NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai & Accredited by NAAC)

K.R. NAGAR, KOVILPATTI – 628 503
www.nec.edu.in

REGULATIONS – 2019

CURRICULUM & SYLLABUS

B. E. – MECHANICAL ENGINEERING

Accredited by NBA

B.E. – MECHANICAL ENGINEERING

CURRICULUM AND SYLLABUS

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

Producing globally competitive Mechanical Engineers with social responsibilities.

MISSION

- Imparting quality education by providing excellent Teaching-learning environment.
- Inculcating qualities of continuous learning, professionalism, team spirit, communication skill and leadership with social responsibilities.
- Promoting leading edge research and development through collaboration with academia and industry.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

After 3 to 5 years of completion of our graduation our,

PEO1: Graduates will have successful profession in Mechanical/Allied Industries or Research/Academics or Business Enterprise.

PEO2: Graduates will be able to broaden their horizons beyond Mechanical Engineering to address the societal and environmental concerns.

PEO3: Graduates will have the attitudes and abilities of leaders to adapt the changing global scenario.

PROGRAMMESPECIFIC OUTCOMES (PSOs)

After successful completion of B.E. Mechanical Engineering Programme, the students should be able to

PSO1: Apply the concepts of Engineering Design to design, analyze and develop the mechanical components and systems using the different analytical/CAD/experimental tools.

PSO2: Apply the concepts of Thermal Engineering to design, analyze and develop the flow and energy systems using the different analytical/experimental/software tools.

PSO3: Apply the concepts of Production, Industrial Engineering and Management for analysis, optimization and development of mechanical systems.

PROGRAMME OUTCOMES (POs)

After the successful completion of Mechanical Engineering Program, the graduates will be able to,

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization in Mechanical Engineering to the solution of complex engineering problems.

PO2: Identify, formulate, research literature, and analyze complex problems in Mechanical Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design solutions for complex Mechanical Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex Mechanical Engineering Problems.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Mechanical Engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **Mechanical Engineering programme** is designed with total number of credits ***166 (125*** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table - I.

Table – 1 CATEGORY OF COURSES

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	07
2.	Basic Science courses	23
3.	Engineering Science courses	32
4.	Professional Core courses	52
5.	Professional Elective courses relevant to chosen specialization / branch	18
6.	Open Elective courses from other technical and /or emerging subject areas	18
7.	Skill Development Courses	16
8.	Mandatory courses	(Non – credit)
	TOTAL	**166**

i. **Humanities and Social Sciences(HSMC)**include English, Communication Skill laboratory and Management courses

ii. **Basic ScienceCourses**(**BSC)** include Chemistry, Physics, Biology and Mathematics

iii. **Engineering Science Courses(ESC)**include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering

iv. **Professional Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

v. **Professional Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.

vii. **Skill Development Courses (SDC)** includethe courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.

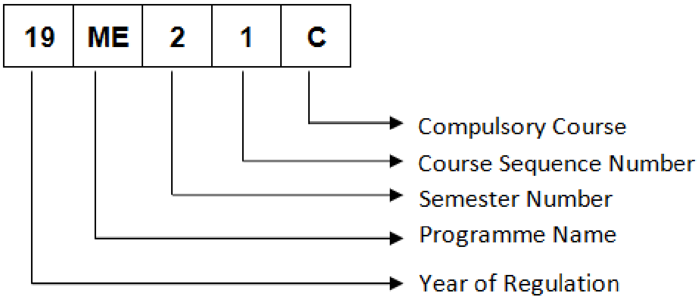
viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

TABLE – 2 QP - QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE



REGULATIONS – 2019 CURRICULUM AND SYLLABUS

SEMESTER – I

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
PRACTICAL COURSES								
6.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	-
7.	ESC	19SH17C	Engineering Practice Laboratory Part A – Mechanical Laboratory Part B – Electrical and Electronics Laboratory	0	0	4	2	-
			TOTAL	**11**	**1**	**11**	**17.5**	

SEMESTER – II

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1	HSMC	19ME21C	Professional English	2	0	0	2	B
2	BSC	19ME22C	Applied Mathematics	3	1	0	4	A
3	BSC	19ME23C	Physics of materials	2	0	0	2	B
4	BSC	19ME24C	Chemistry for Mechanical Engineering	2	0	0	2	B
5	ESC	19ME25C	Engineering Mechanics	3	1	0	4	A
6	ESC	19ME26C	Basic Electrical and Electronics Engineering	3	0	0	3	A
PRACTICAL COURSES								
7.	BSC	19ME27C	Physics and Chemistry Laboratory Part A – Physics Laboratory Part B – Chemistry Laboratory	0	0	3	1.5	-
8.	ESC	19ME28C	Basic Electrical and Electronics Engineering Laboratory	0	0	3	1.5	-
9	ESC	19ME29C	Drafting and Modeling Laboratory	0	0	3	1.5	-
10.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	-
			TOTAL	**16**	**2**	**11**	**23.5**	

SEMESTER – III

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19ME31C	Probability, Statistics and Numerical Methods	3	1	0	4	A
2.	ESC	19ME32C	Computer Programming	3	0	0	3	A
3.	ESC	19ME33C	Thermodynamics	3	1	0	4	A
4.	PCC	19ME34C	Manufacturing Technology-I	2	0	2	3	A
5.	PCC	19ME35C	Kinematics of Machinery	3	1	0	4	A
6.	OEC	E1	Open Elective (Group – I)	3	0	0	3	A
7.	MAC	19MC02C	Constitution of India	3	0	0	0	D
PRACTICAL COURSES								
8.	ESC	19ME36C	Computer Programming Laboratory	0	0	2	1	-
9.	HSMC	19ME37C	Communication Skills Laboratory	0	0	2	1	-
			TOTAL	**20**	**3**	**6**	**23**	

SEMESTER – IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	ESC	19ME41C	Fluid Mechanics and Machinery	3	1	0	4	A
2.	PCC	19ME42C	Strength of Materials	3	1	0	4	A
3.	PCC	19ME43C	Thermal Engineering	3	1	0	4	A
4.	PCC	19ME44C	Manufacturing Technology-II	2	0	0	2	B
5.	ESC	19ME45C	Materials Science and Metallurgy	3	0	0	3	A
6.	MAC	19MC03C	Safety, Health and Environmental Engineering	3	0	0	0	D
PRACTICAL COURSES								
7.	ESC	19ME46C	Fluid Mechanics and MachineryLaboratory	0	0	2	1	-
8.	PCC	19ME47C	Thermal Engineering Laboratory	0	0	2	1	-
9.	PCC	19ME48C	Material Testing Laboratory	0	0	2	1	-
10.	PCC	19ME49C	Manufacturing Technology Laboratory	0	0	2	1	-
			TOTAL	**17**	**3**	**8**	**21**	

SEMESTER – V

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19ME51C	Heat and Mass Transfer	3	1	2	5	A
2.	PCC	19ME52C	Dynamics of Machinery	3	1	0	4	A
3.	PCC	19ME53C	Design of Machine Elements	3	1	0	4	A
4.	PCC	19ME54C	Automation in Manufacturing	3	0	0	3	A
5.	HSMC	19ME55C	Professional Ethics	1	0	0	1	C
6.	OEC	E2	Open Elective (Group – II)	3	0	0	3	-
PRACTICAL COURSES								
7.	PCC	19ME56C	Dynamics Laboratory	0	0	2	1	**-**
8.	PCC	19ME57C	Computer Aided Design and Manufacturing Laboratory	0	0	2	1	**-**
			TOTAL	**16**	**3**	**6**	**22**	

SEMESTER – VI

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19ME61C	Metrology and Measurements	3	0	0	3	A
2.	PCC	19ME62C	Design of Transmission Systems	2	1	0	3	E
3.	PCC	19ME63C	Finite Element Analysis	2	1	0	3	A
4.	HSMC	19ME64C	Project Management	1	0	0	1	C
5.	OEC	E3	Open Elective (Group – III)	2	0	2	3	-
6.	PEC	E4	Elective-I	3	0	0	3	-
7.	PCC	19ME65C	Comprehension	0	0	2	1	-
PRACTICAL COURSES								
8.	PCC	19ME66C	Metrology and Automation Laboratory	0	0	2	1	**-**
9.	PCC	19ME67C	Computer Aided Analysis Laboratory	0	0	2	1	**-**
10.	SDC	19ME68C	Product Development Laboratory	1	0	2	2	**-**
			TOTAL	**14**	**2**	**10**	**21**	

SEMESTER – VII

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19ME71C	Industrial Engineering	2	0	0	2	B
2.	OEC	E5	Open Elective (Group – IV)	3	0	0	3	-
3.	OEC	E6	Open Elective (Group – V)	3	0	0	3	-
4.	PEC	E7	Elective-II	3	0	0	3	-
5.	PEC	E8	Elective-III	3	0	0	3	-
6.	PEC	E9	Elective-IV	3	0	0	3	-
PRACTICAL COURSES								
7.	SDC	19ME72C	Project Phase-I	0	0	6	3	**-**
9.	SDC	19ME73C	Research Paper and Patent Review-Seminar	0	0	2	1	**-**
10.	SDC	19ME74C	Internship / In-plant Training	0	0	4	2	**-**
			TOTAL	**17**	**-**	**12**	**23**	

SEMESTER – VIII

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	OEC	E10	Open Elective (Group – VI)	3	0	0	3	-
2.	OEC	E11	Elective-V	3	0	0	3	-
3.	OEC	E12	Elective-VI	3	0	0	3	-
PRACTICAL COURSE								
4.	SDC	19ME81C	Project Phase-II	0	0	12	6	**-**
			TOTAL	**9**	**-**	**12**	**15**	

TOTAL CREDITS - 166

PROGRAMME ELECTIVE COURSES (PEC)

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THERMAL MODULE								
1.	PEC	19ME01E	Refrigeration and Air Conditioning	3	0	0	3	A
2.	PEC	19ME02E	Design of Heat Exchanger and Pressure Vessel	2	0	2	3	E
3.	PEC	19ME03E	Automobile Engineering	3	0	0	3	A
4.	PEC	19ME04E	Internal Combustion Engines	3	0	0	3	A
5.	PEC	19ME05E	Gas Dynamics and Propulsion Systems	3	0	0	3	A
6.	PEC	19ME06E	Power Plant Engineering	3	0	0	3	A
7.	PEC	19ME07E	Renewable Energy Sources	3	0	0	3	A
8.	PEC	19ME08E	Solar Photovoltaic Energy Conversion	3	0	0	3	A
9.	PEC	19ME09E	Thermal Design and Management of Electronic Equipments	3	0	0	3	A
10.	PEC	19ME10E	Energy Conservation and Waste Heat Recovery	3	0	0	3	A
11.	PEC	19ME11E	Heating Ventilation and Air Conditioning Systems	3	0	0	3	A
12.	PEC	19ME12E	Turbomachines	3	0	0	3	A
13.	PEC	19ME13E	Automotive Electronics	3	0	0	3	A
14.	PEC	19ME14E	Energy Storage Systems	3	0	0	3	A
15.	PEC	19ME15E	Computational Fluid Dynamics	2	0	2	3	E
16.	PEC	19ME16E	Hybrid Electric Vehicles	3	0	0	3	A
DESIGN MODULE								
17.	PEC	19ME17E	Hydraulics and Pneumatics	3	0	0	3	A
18.	PEC	19ME18E	Design of Jigs, Fixtures and Press Tools	3	0	0	3	E
19.	PEC	19ME19E	Mechatronics	3	0	0	3	A
20.	PEC	19ME20E	Industrial Robotics	3	0	0	3	A
21.	PEC	19ME21E	Advanced Modeling Techniques	2	0	2	3	E
22.	PEC	19ME22E	Piping Design Engineering	2	0	2	3	E
23.	PEC	19ME23E	Vibration Control	3	0	0	3	A
24.	PEC	19ME24E	Vehicle Systems Design	3	0	0	3	A
25.	PEC	19ME25E	Industrial Tribology	2	0	2	3	A
26.	PEC	19ME26E	New Product Development	2	0	2	3	A
27.	PEC	19ME27E	Design for Manufacture, Assembly and Environments	3	0	0	3	A
28.	PEC	19ME28E	MEMS Devices – Design and Fabrication	3	0	0	3	A
MANUFACTURING MODULE								

29.	PEC	19ME29E	Applied Nano Technology	3	0	0	3	A
30.	PEC	19ME30E	Composite Materials	3	0	0	3	A
31.	PEC	19ME31E	Unconventional Machining Processes	3	0	0	3	A
32.	PEC	19ME32E	Additive Manufacturing	3	0	0	3	A
33.	PEC	19ME33E	Welding Technology	3	0	0	3	A
34.	PEC	19ME34E	Maintenance Engineering	3	0	0	3	A
35.	PEC	19ME35E	Non-Destructive Evaluation	2	0	2	3	E
36.	PEC	19ME36E	Quality Control of Welded Structures	3	0	0	3	A
37.	PEC	19ME37E	Machine Tool Control	3	0	0	3	A
38.	PEC	19ME38E	Computer Integrated Manufacturing	3	0	0	3	A
INDUSTRIAL ENGINEERING MODULE								
39.	PEC	19ME39E	Total Quality Management	3	0	0	3	A
40.	PEC	19ME40E	Operations Research	3	0	0	3	E
41.	PEC	19ME41E	Implementation of Quality Management System	3	0	0	3	A
42.	PEC	19ME42E	Production and Operations Management	3	0	0	3	A
43.	PEC	19ME43E	Value Analysis and Value Engineering	3	0	0	3	A
44.	PEC	19ME44E	Supply Chain and Logistic Management	3	0	0	3	A
45.	PEC	19ME45E	Statistical Quality Control	3	0	0	3	A
46.	PEC	19ME46E	Process Planning and Cost Estimation	3	0	0	3	A
47.	PEC	19ME47E	Lean Manufacturing	3	0	0	3	A
48.	PEC	19ME48E	Industrial Safety Engineering	3	0	0	3	A
49.	PEC	19ME49E	Production Planning and Control	3	0	0	3	A
50.	PEC	19ME50E	Engineering Economics and Cost Analysis	3	0	0	3	A
51.	PEC	19ME51E	Ecommerce	3	0	0	3	A
52.	PEC	19ME52E	Industry 4.0	3	0	0	3	A

ONE CREDIT ELECTIVE COURSES (PEC)

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THERMAL MODULE								
1.	PEC	19ME01L	Shell and Tube Heat Exchanger Design	1	0	0	1	C
2.	PEC	19ME02L	Energy Audit and Management	1	0	0	1	C
3.	PEC	19ME03L	Pyrolysis and Gasification	1	0	0	1	C
4.	PEC	19ME04L	Grid Tied PV System Design	1	0	0	1	C
5.	PEC	19ME05L	Micro Grid	1	0	0	1	C

6.	PEC	19ME06L	Thermal Energy Storage Systems	1	0	0	1	C
7.	PEC	19ME07L	Solar Cooling Systems	1	0	0	1	C
8.	PEC	19ME08L	Desalination	1	0	0	1	C
9.	PEC	19ME09L	Thermal Characterization of Materials	1	0	0	1	C
10.	PEC	19ME10L	Thermal Analysis of Mechanical Systems Using FEM	1	0	0	1	C
DESIGN MODULE								
11.	PEC	19ME11L	Industrial Drawing Reading with Geometric Dimensioning and Tolerancing	1	0	0	1	C
12.	PEC	19ME12L	Fundamentals of Process Equipment	1	0	0	1	C
13.	PEC	19ME13L	Techniques for Vibration Monitoring and Controls	1	0	0	1	C
14.	PEC	19ME14L	Crashworthiness of Tubular Shells	1	0	0	1	C
15.	PEC	19ME15L	Failure Mode and Effects Analysis	1	0	0	1	C
16.	PEC	19ME16L	Design of Experiments	1	0	0	1	C
17.	PEC	19ME17L	Taguchi Methods	1	0	0	1	C
18.	PEC	19ME18L	Creative and Innovative Methods for Design and Development	1	0	0	1	C
19.	PEC	19ME19L	Creep and Fatigue	1	0	0	1	C
MANUFACTURING MODULE								
20.	PEC	19ME20L	Natural Fiber Composites	1	0	0	1	C
21.	PEC	19ME21L	Functional Materials for Energy Conversion	1	0	0	1	C
22.	PEC	19ME22L	Design for Manufacturability	1	0	0	1	C
23.	PEC	19ME23L	Six Sigma	1	0	0	1	C
24.	PEC	19ME24L	Agile Manufacturing	1	0	0	1	C
25.	PEC	19ME25L	Surface Engineering	1	0	0	1	C
INDUSTRIAL ENGINEERING MODULE								
26.	PEC	19ME26L	Optimization in Scheduling	1	0	0	1	C
27.	PEC	19ME27L	Design a Startup	1	0	0	1	C
ARTIFICIAL INTELLIGENCE								
28.	PEC	19ME28L	Predictive Maintenance	1	0	0	1	C
29.	PEC	19ME29L	Intelligent Manufacturing	1	0	0	1	C
30.	PEC	19ME30L	Artificial Intelligence in Production Management	1	0	0	1	C

Open Elective Course (OEC)

Group – I (Basic science courses)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following courses is compulsory								
1.	OEC	19ME01N	Applied Chemistry	3	0	0	3	A
2.	OEC	19ME02N	Biophysics	3	0	0	3	A
3.	OEC	19ME03N	Calculus and Statistics for Engineers	3	0	0	3	A
4.	OEC	19ME04N	Corrosion Science and Engineering	3	0	0	3	A
5.	OEC	19ME05N	Polymer science and Technology	3	0	0	3	A
6.	OEC	19ME06N	Laser Technology	3	0	0	3	A
7.	OEC	19ME07N	Fundamentals of Nano Science	3	0	0	3	A
8.	OEC	19ME08N	Biology for Mechanical Engineers	3	0	0	3	A
9.	OEC	19ME09N	Introduction to Robotics	3	1	0	4	A

Group – II (Engineering science courses of other discipline)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following courses is compulsory								
1.	OEC	19ME11N	Testing and Calibration of Instruments	3	0	0	3	A
2.	OEC	19ME12N	Digital Electronics for Engineers	3	0	0	3	A
3.	OEC	19ME13N	Instrumentation and Control	3	0	0	3	A
4.	OEC	19ME14N	Microprocessor, Microcontroller and Applications	3	0	0	3	A
5.	OEC	19ME15N	Electrical Drives and Control	3	0	0	3	A
6.	OEC	19ME16N	Foundations of Machine Learning	2	0	2	3	A
7.	OEC	19ME17N	Mechanics of Robots	3	0	0	3	A

Group – III(Computational Skills)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following courses is compulsory								
1.	OEC	19ME21N	Computer Graphics and Virtual Reality	2	0	2	3	A
2.	OEC	19ME22N	Mobile Application Development	2	0	2	3	A
3.	OEC	19ME23N	Object Oriented Programming	2	0	2	3	A
4.	OEC	19ME24N	Programming in Python	2	0	2	3	A

5.	OEC	19ME25N	Fundamentals of Java Programming	2	0	2	3	A
6.	OEC	19ME26N	Programming for Robotics	2	0	2	3	A
7.	OEC	19ME27N	Fundamentals of Artificial Intelligence	2	0	2	3	A
8.	OEC	19ME28N	Modelling and Simulation	2	0	2	3	A
9.	OEC	19ME29N	Essentials of Machine Learning	2	0	2	3	A
10.	OEC	19ME30N	Microprocessor & Embedded Systems	3	0	2	4	A

Group – IV (Management Skills)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following courses is compulsory								
1.	OEC	19ME31N	Entrepreneurship	3	0	0	3	A
2.	OEC	19ME32N	Human Resource Management	3	0	0	3	A
3.	OEC	19ME33N	Industrial Psychology and Organizational Behavior	3	0	0	3	A
4.	OEC	19ME34N	Principles of Management	3	0	0	3	A
5.	OEC	19ME35N	Business Statistics	3	0	0	3	A
6.	OEC	19ME36N	Financial Management	3	0	0	3	A
7.	OEC	19ME37N	Accounting for Engineers	3	0	0	3	A
8.	OEC	19ME38N	Security Analysis and Portfolio Management	3	0	0	3	A

Group – V (Core/Elective courses of other discipline)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following courses is compulsory								
1.	OEC	19ID01E	Product Design and Development	3	0	0	3	A
2.	OEC	19ID02E	Disaster Management	3	0	0	3	A
3.	OEC	19ID03E	Energy Engineering	3	0	0	3	A
4.	OEC	19ID04E	Control of Robotic Systems	3	0	0	3	A
5.	OEC	19ID05E	Product Lifecycle Management	3	0	0	3	A
5.	OEC	-	Other Programme Courses	3	0	0	3	As specified for the chosen course

Group-VI (Trans-disciplinary courses) - Self Study Course

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following courses is compulsory								
1.	OEC	19TD01E	Soft Skills and Interpersonal Communication	0	0	0	3	D
2.	OEC	19TD02E	Impact of social media on society	0	0	0	3	D
3.	OEC	19TD03E	International Business Management	0	0	0	3	D
4.	OEC	19TD04E	Basics of Marketing	0	0	0	3	D
5.	OEC	19TD05E	Indian Economy	0	0	0	3	D
6.	OEC	19TD06E	International Trade	0	0	0	3	D
7.	OEC	19TD07E	Global Challenges and issues	0	0	0	3	D
8.	OEC	19TD08E	Indian Culture and Heritage	0	0	0	3	D
9.	OEC	19TD09E	Indian History	0	0	0	3	D
10.	OEC	19TD10E	Sustainable Development and Practices	0	0	0	3	D
11.	OEC	19TD11E	Women in Indian Society	0	0	0	3	D
12.	OEC	19TD12E	Bio Mechanics in Sports	0	0	0	3	D

19SH11C TECHNICAL ENGLISH L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1:apply the basic language skills to understand various aspects of communication skills (K3)

CO2: express their thoughts with correct usage of language in formal writings (K3)

CO3: understand various language components and develop the pronunciation skill. (K2)

CO4: make effective technical writings and interpret any pictorial representation. (K3)

CO5: frame sentences and write effective reports. (K3)

UNIT I 6

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, Letter to Friend / Parent / Siblings - Greetings and Self Introduction –Situational Phrases - Tense (Present)

UNIT II 6

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) –Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

UNIT III 6

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

UNIT IV 6

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

UNIT V 6

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

Suggested Activity: Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Anderson, Paul V. “Technical Communication: A Reader - Centered Approach”, 9thEdition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. “A Comprehensive Grammar of the English Language”, Longman Inc., Newyork, 2014.

REFERENCES

1. Murphy Raymond, “Basic Grammar Practice on Tense”, Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., “Engineering English”, Orient Blackswan: Hyderabad, 2015.

19SH12C MATHEMATICAL FOUNDATIONS FOR ENGINEERS L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make use of orthogonal transformation. (K3)
CO2: find the evolutes of various curves. (K2)
CO3: maxima and minima of real valued functions. (K3)
CO4: solve ordinary differential equations. (K2)
CO5: solve partial differential equations. (K2)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivative – Total derivative – Euler’s theorem on homogeneous functions – Taylor’s Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange’s multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order ordinary differential equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9th Edition, Dorling Kindersley Private Limited, 2010.

19SH13C ENGINEERING PHYSICS L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)
CO2: understand the principle and propagation of different types of waves (K2)
CO3: choose the appropriate Laser technique for industrial and medical applications (K2)
CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)
CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

UNIT I CRYSTALLOGRAPHY 6

Lattice, Unit cell, Bravais lattice, Lattice planes-Crystal system-Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

UNIT II WAVES 6

Simple harmonic oscillators - Damped harmonic oscillator-Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

UNIT III LASER 6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

UNIT IV FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

UNIT V QUANTUM PHYSICS 6

Black Body Radiation - Matter Waves - Heisenberg's uncertainty principle - Schrodinger's wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 11th Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", 7th Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D. J. Griffiths, "Quantum mechanics", 2nd Edition, Cambridge University Press, 2014.

REFERENCES

1. Renk, Karl.F "Basics of laser physics", 2ndEdition, Springer international publishing, 2017.
2. H. J. Pain,Patricia Rankin "Introduction to vibration and waves", 1st Edition, Wiley, 2015
3. K.S.Mathur, "Fundamentals of Fiber Optics", 1st Edition, Zorba books, 2018.

19SH14C ENGINEERING CHEMISTRY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)
CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)
CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)
CO4: familiar with the various novel organic material used in electronics industry. (K2)
CO5: understand the principle, components and working of various analytical instruments.(K2)

UNIT I WATER TREATMENT 6

Hardness - Estimation of hardness of water –Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

UNIT II SURFACE CHEMISTRY AND CATALYSIS 6

Adsorption – Types - Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – Kinetics of surface reactions-Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications -Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

UNIT III ELECTROCHEMISTRY AND CORROSION 6

Electrode potential-Nernst Equation-reference electrode- glass electrode - measurement of pH –electrochemical series –significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)

Corrosion: Types of corrosion - Factors influencing corrosion –Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

UNIT IV ELECTRONIC MATERIALS 6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials –pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidenefluoride- OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, biosensor - chemical sensors

UNIT V ANALYTICAL TECHNIQUES 6

Spectroscopy:Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., “Engineering Chemistry”, Dhanpat Rai Publishing Company, 16thEdition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand& Company Limited, 20thEdition, 2018.

REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6thEdition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania,Vishal, Principles of Physical Chemistry,Vishal Publishing Co., Punjab, 47thEdition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, “Organic Electronics: Materials, manufacturing and applications”, Wiley - VCH, 2016

19SH15C ENGINEERING GRAPHICS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
2	0	4	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
CO2: construct the orthographic projections of points, straight lines and lamina (K2)
CO3: draw the projections of simple solids in different positions. (K3)
CO4: visualize the sectional views and surface areas of various solids. (K3)

CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids.Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P:60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, "Engineering Drawing", 53rdEdition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2ndEdition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2ndEdition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, "Engineering Drawing", Subhas Publications, 32ndEdition, 2017.

19SH16C	ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY	L T P C
		0 0 3 1.5

(Common to all B.E. / B.Tech. Degree Programmes)

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K2)

CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium.(K2)

CO3: illustrate the electrical properties of materials. (K2)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster’s bridge.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. David Loyal, “ Physics laboratory” 4thEdition, Cengage learning, 2013
2. Sesha Sai Kumar Vemula, “Engineering Physics lab manual” 1stEdition, LAP LAMBERT Academic Publishing, 2017

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: determine various water quality parameters. (K2)

CO 2: quantify different ions by different analytical techniques. (K2)

CO3: determine the rate of corrosion of mild steel plate. (K2)

CO4: verify the freundlich adsorption isotherm. (K2)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron (Fe^{2+}) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.

6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron (Fe^{2+}) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris "Quantitative Chemical Analysis: International Edition", W.H.Freeman, 9th Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford ,P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19SH17C ENGINEERING PRACTICE LABORATORY

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
0	0	4	2

PARTA-MECHANICAL LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: prepare different carpentry joints. (K3)
CO2: prepare pipe connections with different joints for domestic applications. (K3)
CO3: make simple components using sheet metal (K3)
CO4: make components using machining operations (K3)
CO5: explain the types of welding processes (K2)
CO6: discuss the applications of 3D printing and injection moulding processes (K2)

LIST OF EXPERIMENTS

I. CARPENTRY PRACTICES 5

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands on exercise with application

II. PLUMBING PRACTICES 5

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands on exercise with application

III. SHEET METAL PRACTICES 5

1. Forming and Bending
2. Model making: Tray, Conical Funnel etc.

IV. MACHINING PRACTICES 5

1. Simple Turning
2. Drilling Practice
3. Model making: Shaft, stiffener plate, square flange, etc.
4. Demonstration of machining process in Vertical Machining Centre (VMC)

V. METAL JOINING PROCESS 5

1. Demonstration of Gas, Arc and TIG Welding

VI. ADDITIVE MANUFACTURING AND INJECTION MOULDING PROCESSES 5

1. Demonstration of 3D Scanning and Printing
2. Demonstration of Injection Moulding process

P:30; TOTAL: 30 PERIODS

TEXT BOOKS

1. BawaH.S,“WorkshopPractice”,TataMcGrawHillPublishingCompanyLimited,2007

REFERENCES

1. Ramesh Babu V, “Engineering Practices Laboratory Manual”, RevisedEdition,VRB Publishers Private Limited,Chennai,2014.
2. JeyachandranK, Natarajan S.andBalasubramanianS, “APrimeronEngineering PracticesLaboratory”,AnuradhaPublications,2007.
3. Jeyapoovan T, Saravanapandian M. and Pranitha S, “Engineering Practices Lab Manual”, VikasPublishingHousePrivateLimited,2006.
4. RajendraPrasadA andSarma PMMS,“WorkshopPractice”,SreeSaiPublication,2002
5. KannaiahP andNarayana KL,“ManualonWorkshopPractice”,ScitechPublications,1999.

PART B – ELECTRICAL AND ELECTRONICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: perform residential house wiring (K2)
CO2: identify faults in any electrical appliances (K2)
CO3: measure energy and resistance to earth of electrical equipment (K2)
CO4: measure AC signal parameters using CRO (K2)
CO5: apply soldering for electronic circuit formation in PCB (K2)

LIST OF EXPERIMENTS

ELECTRICAL

1. Residential House Wiring using Switches, Fuse, Indicator, Lamp and Energy Meter.
2. Stair Case Wiring Connections
3. Measurement of Energy using Energy Meter for Single Phase System.
4. Measurement of Earth Resistance using Electrical Equipment.
5. Study of Emergency Lamp, Choke, Starter, Fan and Iron Box
6. Coil Rewinding for Transformer and Fan using Rewinding Machine.
7. Connection of protective devices

ELECTRONICS

8. Study of Resistor, capacitor and inductor
9. Study and Operation of Digital Multimeter, Function/Signal Generator and Regulated Power Supply.
10. Measurement of AC signal parameter (Peak-Peak, RMS, Period and Frequency) using CRO and DSO.
11. Soldering Practice
12. Study of logic gates AND, OR, NOT, NAND, NOR and EXOR.
13. Half Wave Rectifier and Full Wave Rectifier.

P: 30; TOTAL: 30PERIODS

REFERENCES

1. Jeyachandran K, Natarajan S and Balasubramanian S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T, Saravanapandian M and Pranitha S, "Engineering Practices Lab Manual", Vikas Publishing House Pvt. Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A and Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.
5. Kannaiah P and Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.

19ME21C PROFESSIONAL ENGLISH L T P C

(Common to all B.E. / B.Tech. Degree Programmes) **2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Integrate and apply the acquired skills in real life situation. (K3)
CO 2: Write effectively in any professional contexts. (K3)
CO 3: Enhance the vital sub-functions of communication in any formal situation. (K3)
CO 4: Participate actively in any informal and formal discussion. (K3)
CO 5: Recall the acquired skills and apply them in their work place. (K2)

UNIT I **6**

Standard Abbreviations - If Conditionals - Presenting articles based on newspaper reading - Listening for specific information - Argumentative essay.

UNIT II **6**

One word substitution - Rearranging the jumbled phrases of sentences – Chart Description - Business Letters for Quotations and Clarification.

UNIT III **6**

Idioms and Phrases - Direct & Indirect Speech - Business Letters for Placing orders and Making Complaints - Process Description.

UNIT IV **6**

Synonyms **-** Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples - Demo) - Proposal Writing.

UNIT V **6**

Error Spotting (Based on Concord, Pronouns, Articles & Adverb Placement) - Job Application Letter & Resume Preparation - Circular and Minutes of the meeting - Reading Comprehension.

Suggested Activity: Career Analysis – Herein the students will be required to submit a report about their dream career / company of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Board of editors. "Fluency in English A Course book for Engineering and Technology",
   Orient Blackswan, Hyderabad, 2016.
2. Bovee, Courtland, L., John V.Thill. "Business Communication Today", 13th Edition, Pearson Education, New Delhi, 2018.

REFERENCES

1. Lester Mark and Larry Beason, "Hand book of English Grammar and Usage", McGraw Hill Education, 1st Edition, 2017.
2. Raman, Meenakshi and Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2014.

19ME22C APPLIED MATHEMATICS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: calculate the Fourier series solution of Wave and Heat equations. (K3)
CO2: evaluate area and volume using double and triple integrals. (K3)
CO3: analyze the concepts related to vector calculus. (K3)
CO4: grasp Analytic functions and their properties. (K2)
CO5: evaluate complex integration over contour. (K3)

UNIT I BOUNDARY VALUE PROBLEMS 12

Fundamentals of Fourier series - Half range sine and cosine series, Parseval's theorem - Fourier series solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two dimensional heat equation.

UNIT II INTEGRAL CALCULUS 12

Evaluation of double and triple integrals- Change of order of integration - Change of variables - Cartesian to polar coordinates- Area and volume - Beta and Gamma integrals - Definite integrals in terms of Beta and Gamma functions.

UNIT III VECTOR CALCULUS 12

Gradient, Divergence and Curl –Directional derivatives – Irrotational and solenoidal vector fields -Vector integration–Line, Surface and Volume Integrals –Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem–Simple applications involving cubes and rectangular parallelopipeds.

UNIT IV ANALYTIC FUNCTIONS 12

Analytic functions - Necessary and Sufficient conditions - Harmonic and orthogonal properties of analytic functions - Harmonic conjugate - Construction of analytic functions - Conformal mapping: w= z+c, cz, 1/z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 12

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's expansions - Singular points - Residues - Residue theorem - application of residue theorem to evaluate real integrals - unit circle and semi-circular contour

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", Khanna Publications, New Delhi, 44th Edition, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition, 2011.

REFERENCES

1. Bali N.P. and Manish Goyal, "Text book of Engineering Mathematics", Laxmi Publications (P) Ltd., 9th Edition, 2017.
2. Ramana B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing company, 6th Edition, New Delhi, 2008.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publishing House Private Limited, 5th Edition, 2016.

19ME23C PHYSICS OF MATERIALS L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the mechanical properties of materials (K2)
CO2: acquire knowledge on thermal properties of materials (K2)
CO3: summarize the physics underlying the magnetic and superconducting behaviour of materials. (K2)
CO4: predict the mechanism by which the electric field interacts with material and their applications.(K2)
CO5: understand the different types of solar energy materials. (K2)

UNIT I MECHANICAL PROPERTIES OF MATERIALS 6

Elasticity-Modulus of Elasticity-Twisting couple on a wire-Torsion pendulum-Theory of bending moment-Young's modulus-Uniform bending method – I-Shaped Girders.

UNIT II THERMAL PROPERTIES OF MATERIALS 6

Modes of heat transfer - Rectilinear flow of heat along a metal bar - Methods of radial flow of heat - Spherical shell method and cylindrical shell method - Thermal conductivity of a poor conductor – Lee's disc method.

UNIT III MAGNETIC MATERIALS AND SUPERCONDUCTING MATERIALS 6

Basic definitions-Dia, Para magnetic materials - Ferromagnetism – Domain theory - Hysteresis – Hard and soft magnetic materials

Superconductivity – Properties - BCS theory - Type I and Type II Superconductors - Applications

UNIT IV DIELECTRIC MATERIALS 6

Dielectric constant – Local field - Clausius Mosotti relation – Types of polarization – Frequency and temperature effects on polarization – Dielectric loss - Dielectric breakdown

UNIT V SOLAR ENERGY MATERIALS 6

Solar collector materials – Glazing materials – Absorber materials - Insulation materials - Reflecting materials – Phase change materials.

Photovoltaic materials – Direct and indirect band-gap materials – Solar grade silicon – Mono and multi crystalline silicon solar cells – CIGS – Dye sensitised solar cells – Organic cells.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. William D.Callister,Jr, David G. Rethwisch "Materials Science and Engineering - An Introduction", John-Wiley and Sons, 10th Edition, 2018
2. Charles Kittel, "Introduction to Solid State Physics", John Wiley and Sons, 8thEdition, Singapore, 2012.

REFERENCES

1. Joe Kachan, "Thermal Properties of Matter" Morgan and Claypool Publishers, 1stEdition, 2018
2. Charles P. Poole Jr. , Horacio A. Farach, Richard J.Creswick,Ruslan Prozorov, "Superconductivity", Elsevier, 3rdEdition, 2018
3. Chetan Singh Solanki, "Solar Photovoltaics, fundamentals, technology and applications", PHI Publication, 3rdEdition, 2015
4. Pelleg, Joshua, "Mechanical Properties of Materials", Springer Netherlands, 1stEdition, 2013
5. K.H.J.Bushchow, "Handbook of Magnetic materials", Elsevier, 1stEdition, 2014

19ME24C CHEMISTRY FOR MECHANICAL ENGINEERING L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply the phase rule to two component systems and know the variousheat treatment processes. (K2)

CO2: familiar with thermodynamic functions and Ellingham diagrams. (K2)

CO3: know different synthetic procedures of biofuels and numerical problems related to combustion. (K2)
CO4: understand the principle and process of various surface coatings. (K2)
CO5: acquire the knowledge about applications of nanocomposites materials. (K2)

UNIT I PHASE RULE AND ALLOYS 6

Gibb's Phase rule-Application - two component system - Lead-silver system, Fe-Carbon alloy system-Heat treatment of steel- Non Ferrous Alloys.

UNIT II FREE ENERGY IN CHEMICAL EQUILIBRIA 6

Thermodynamic functions: entropy and free energy- Estimations of entropy and free energies-Free energy and emf - Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT III FUELS AND COMBUSTION 6

Coal - proximate and ultimate analysis – carbonization.

combustion: calorific value - higher and lower calorific values- theoretical calculation of calorific value-calculation of minimum amount of air for combustion.

Biofuels: Fundamental concepts – production - Biomass feedstock - Bioethanol production - Biodiesel: production from oil seeds, waste oils and algae – Biogas; synthesis -flue gas analysis.

UNIT IV SURFACE COATING 6

Introduction-metallic coating- determination of throwing power-electroplating of chromium-Electroless plating- nickel plating. Paints-constituents - multilayer coating on aluminium - zinc pasivation - anodizing.

UNIT V NANOCOMPOSITES 6

Types of nanocomposites - polymer matrix-synthesis -mechanical alloying, sol-gel, solutions mixing, in-situ polymerization and bioassisted methods – characterization – Applications in mechanical, electrical and optical field.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. P.C. Jain and M. Jain., "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2016.
2. S.S Dara and S.S Umare, A text Book of Engineering Chemistry, S. Chand & Company Ltd, 20th Edition 2018.

REFERENCES

1. A. A. Tracton, "Coating materials and surface coatings" CRC press, Taylor & Francis,4th Edition, 2016.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of physical chemistry– Publishing Co.; 47th Edition, 2017.
3. A. K. Haghi and O.S. Oluwafemi, Composites and Nanocomposites, Taylor and Francis (CRC Press), 3rd Edition, 2015.
4. A.H. Scragg, Biofuels: Production, Application and Development, CAB International, Oxfordshire, 4th Edition, 2017.

19ME25C ENGINEERING MECHANICS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply basic laws of mechanics to solve the problems on statics of particles. (K2)
CO2: draw free body diagram and apply equilibrium principles for two dimensional rigid bodies. (K3)
CO3: determine the centroid and moment of inertia of plane lamina. (K2)
CO4: apply fundamental principles to solve problems in dynamics of particles. (K3)
CO5: summarize the basic principles of friction and general plane motion. (K2)

UNIT I BASICS AND STATICS OF PARTICLES 12

Laws of Mechanics – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force – Vectorial representation of forces.

UNIT II EQUILIBRIUM OF RIGID BODIES12

Free body diagram – Types of supports and their reactions – Moments and Couples – Moment of a force about a point and about an axis, Vectorial representation of moments and couples – Scalar components of a moment – Equilibrium of Rigid bodies in two dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane areas - Parallel and perpendicular axis theorem - radius of gyration.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements - Velocity and acceleration, their relationship – Projectile motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force -Laws of friction -Simple contact friction – Rolling resistance – Belt friction – Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

L: 45; T:15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Hibbeler RC, "Engineering Mechanics: Statics & Dynamics", Pearson India Education Services Private Limited, 13thEdition, 2012.
2. Beer FP, Mazurek DF, Sanghi S, Eisenberg ER, Johnston ER and Cornwell PJ, "Vector Mechanics for Engineers: Statics and Dynamics", Tata Mcgraw Hill Education Private Limited, 10thEdition, 2012.

REFERENCES

1. Rajasekaran S and Sankarasubramanian G, "Fundamentals of Engineering Mechanics", Vikas Publishing House Private Limited, 3rdEdition,2010.

2. Irving H Shames, “Engineering Mechanics – Statics and Dynamics”, Pearson Education Asia Private Limited, 4th Edition,2003.
3. Ashok Gupta, “Interactive Engineering Mechanics–Statics – A Virtual Tutor (CDROM)”, Pearson Education Asia Private Limited, 2002.
4. Palanichamy M.S and Nagam S, “Engineering Mechanics – Statics and Dynamics”, Tata McGraw Hill, 3rd Edition, 2004.

19ME26C BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the concepts of basic electrical circuits (K2)
CO2: describe the working principles of electrical machines and instruments (K2)
CO3: outline the functions of the component of low voltage electrical installations (K2)
CO4: explain the characteristics and applications of semiconductor devices (K2)
CO5: recall the different logic principles used in digital circuits (K2)

UNIT I CONCEPTS OF DC AND AC ELECTRICAL CIRCUITS 9

Electrical Circuit Elements – Ideal and Practical Sources – Electrical Quantities: Voltage, Current, Power and Energy – Ohms Law – Kirchoffs Laws – analysis of simple circuit with DC excitation- AC Circuits Fundamentals – Single Phase Circuits and Three Phase Circuits – Power and Power Factor.

UNIT II ELECTRICAL MACHINES 9

DC Machines: Types – Construction – Working Principles – Need for Starters - Speed control of DC motors.
AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Starting and Speed Control of Induction Motors.
AC Synchronous Generators: Construction – Working Principle.
Transformers: Single Phase and Three Phase Transformers – Auto Transformers - Construction – Working Principle.

UNIT III INSTRUMENTS AND ELECTRICAL INSTALLATION 9

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.
Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Operation, Characteristics and Applications: PN Junction Diode - Rectifiers - Zener Diode – Regulators - Bipolar Junction Transistor –CE Amplifier - FET – Opto-Electronic Devices – LEDs – Photo Diodes.

UNIT V DIGITAL ELECTRONICS 9

Binary Number System – Logic Gates – Boolean Algebra – Adders - Flip Flops– Shift Registers – Counters – ADC and DAC.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. D.P. Kothari and I.J. Kothari, "Basic Electrical and Electronics Engineering", 1st Edition, Tata McGraw Hill, 2014.
2. P.S. Bimbhra, "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.
3. Thomas L. Floyd, "Digital Fundamentals", 10thEdition, Pearson Education Inc, New Delhi, 2009.
4. A.K.Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2004.

REFERENCES

1. D.C. Kulshreshtha, "Basic Electrical Engineering", Revised 1st Edition, Tata McGraw Hill, 2011.
2. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill, 2003.
6. David Bell, "Electronic Devices and Circuits", Prentice Hall Private Limited, 2007.
7. M. Morris Mano, "Digital Design", 4th Edition, Pearson Education, 2007.

19ME27C PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

PART A PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: illustrate the mechanical properties of materials (K2)
CO2: study the magnetic properties of materials (K2)
CO3: demonstrate the properties of optical waves (K2)
CO4: analyze the thermal properties of materials (K2)

LIST OF EXPERIMENTS

1. Determination of young's modulus of a material of a beam by uniform bending method
2. Determination of moment of inertia of the disc and rigidity modulus of the wire using torsion pendulum
3. BH curve - Hysteresis method
4. Determination of wavelength of prominent spectral lines using spectrometer
5. Determination of thermal conductivity of a bad conductor using Lee's disc method

6. Determination of radius of curvature of a plano convex lens using Newton's rings Method
7. V-I Characteristics of solar cell

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. R.K.Shukla, Anchal Srivastava, "Practical Physics", 3rdEdition, New Age Private Limited, 2017
2. David Loyal, " Physics laboratory", Cengage learning, 4thEdition, 2013
3. Sesha Sai Kumar Vemula, "Engineering Physics lab manual" LAP LAMBERT Academic Publishing, 1stEdition, 2017

PART B CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: estimate the amount of ions using various analytical techniques. (K2)
CO2: synthesize biodiesel from waste vegetable oil. (K2)
CO 3:estimate the free acid value of given oil sample. (K2)
CO4: estimate the calcium ion by pH metric methods. (K2)

LIST OF EXPERIMENTS

1. Estimation of Fe(II) by potentiometric method.
2. Estimation of copper in brass by EDTA method.
3. Synthesis of biodiesel.
4. Estimation of the free acid value of biodiesel.
5. Estimation of the iodine value of biodiesel.
6. Estimation of calcium in limestone.
7. Synthesis of silver nano particles.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris, "Quantitative Chemical Analysis: International Edition", 9th Edition, W.H.Freeman, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J.Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8thEdition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19ME28C BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

	L	T	P	C
19ME28C	0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the common components with different rating and use the instruments. (K2)
CO2: analyze the basic electrical circuits (K2)
CO3: infer the characteristics of electrical machines (K2)
CO4: demonstrate the functionality and characteristics of electronics devices. (K2)

LIST OF EXPERIMENTS

1. Basic Safety Precautions, Practical Circuit Elements and Measuring Instruments – Voltmeter, Ammeter, Wattmeter and Energy Meter
2. Verification of Ohms Law and Kirchoff Laws
3. Load test of Single Phase Transformer
4. Load test on DC Shunt Motor
5. Load test on DC Series Motor
6. Load test on Single Phase Induction Motor
7. Load test on Three Phase Induction Motor
8. Experimental Verification of PN Junction diode Characteristics.
9. Experimental Verification of Zener Diode Characteristics and Zener Diode as Voltage Regulator
10. Input and Output Characteristics of BJT in CE Configuration
11. Truth Tables and Functionality of Flip Flops

P: 45; TOTAL: 45 PERIODS

19ME29C DRAFTING AND MODELING LABORATORY

	L	T	P	C
19ME29C	0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Draw different 2D views of given solid model using manual and computer assisted techniques. (K3)
CO2: Perform 2D Drafting of given machine elements using software tools. (K3)
CO3: Draw sectional views of machine elements using computer assisted techniques. (K3)
CO4: Create 3D model of simple machine components using CAD software. (K3)
CO5: Interpret industrial drawing. (K3)

LIST OF EXERCISES

1. Manual and computer assisted 2D drawing of simple solid model.
   Examples: Support Bracket, Machine Block, Shaft Support, Sliding block, Shaft bracket etc.
2. 2D drafting of given machine element.

Examples: Simple Pulley, bolts and nuts, spur and helical gear profiles, clamping units, hooks, couplings, L-clamps etc.

3. Sectional views of machine elements using computer assisted techniques.
   Examples: Machine vice, Support Bracket, Machine Block, Shaft Support, Sliding block, Shaft bracket etc.
4. Modeling of simple machine components using software assisted techniques.
   Examples: Couplings, Linear Bush, Machine Block, Flexible joints, gear profiles, hand wheels, hooks, supporting and clamping units etc.
5. Reading and extracting the basic information such as dimension, machining allowance and tolerance from the given industrial drawing.

P:45; TOTAL: 45 PERIODS

TEXT BOOK

1. Narayana K.L, Kannaiah P, Venkata Reddy K“Machine Drawing”,New Age International Publishers, Delhi,2016.

REFERENCES

1. Venkata Reddy K, “Text Book of Engineering Drawing”, BS Publishers,Hyderabad,2008.
2. Colin H. Simmons, Denis E. Maguire, “Manual of Engineering Drawing”, ButterworthHeinemann, 2012.
3. Scott Onstott, “AutoCAD 2018 and AutoCAD LT 2018”, Wiley Publications, 2017.
4. Kenneth Morling, “Geometric and Engineering Drawing”, Elsevier Publications, 2010.
5. Shah M.B, Rana B.C, “Engineering Drawing”, Pearson Publications, 2009.
6. IS SP 46: Engineering Drawing Practice for Schools & Colleges

19GN01C INNOVATION THROUGH DESIGN THINKING

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)
CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS 15

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS 30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, “Design Thinking: The Handbook”, WS Professional, 2020
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving”, Penguin Random House, 2020

3. D.M. Arvind Mallik, “Design Thinking for Educators”, Notion Press, 2019
4. Michael Lewrick, “The Design Thinking Playbook”, Wiley, 2019
5. Kathryn Christopher, “Design Thinking in Engineering”, Kendall Hunt Publishing Company, 2019
6. Robert Curedale, “Design Thinking Process & Methods” 5th Edition, Design Community College Inc, 2019
7. David Lee, “Design Thinking in the Classroom”, Ulysses Press, 2018
8. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, “The Little Booklet on Design Thinking: An Introduction”, 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, “Design Thinking: New Product Development Essentials”, Wiley-Blackwell, 2016
11. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies - presentation	10 Hours
Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions	20 Hours
Evaluating the students‘ activities through their presentations	

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19ME31C PROBABILITY, STATISTICS AND NUMERICAL METHODS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Grasp basic probability concepts and standard distributions. (K2)
CO2: Perform the ideas related to two dimensional random variables. (K2)
CO3: Calculate the various measures of dispersion. (K3)
CO4: Perform numerical differentiation and integration. (K3)
CO5: Solve differential equations using numerical methods. (K3)

UNIT I RANDOM VARIABLES 12

Random Variables - Discrete and Continuous random variables – Moments –Moments generating functions with properties – Binomial, Poisson, Geometric, Exponential, Gamma and Normal Distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint Distribution – Marginal and Conditional Distribution – Covariance – Correlation and Regression. Transformation of Random variables.

UNIT III STATISTICS 12

Central tendencies - Mean, Median, Mode - Measures of Dispersion –Mean deviation and Quartile deviation–Moments–Skewness –Kurtosis- Correlation and Regression.

UNIT IV NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS, NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Solution of Algebraic and transcendental linear equations - Newton - Raphson Method- Solution of simultaneous equations – Gauss Elimination method – Gauss Seidel method – Interpolation – Newton's forward and backward formulae - Numerical Differentiation – Newton's forward difference and backward difference formula – Numerical integration - Single and double integration using Trapezoidal and Simpson's rules.

UNIT V NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS 12

Taylor's Series Method - Euler's Method – Runge Kutta fourth order Method – Predictor - corrector Methods - Milne's Method - Solution of one-dimensional heat equation by explicit and implicit methods - Two dimensional Laplace and Poisson equations – Liebman's Iteration Process.

L:45; T:15; TOTAL:60 PERIODS

TEXT BOOKS

1. Oliver C. Ibe, "Fundamentals of Applied Probability and Random processes", Elsevier, 1st Indian Reprint, 2007.
2. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", 4th Edition, Tata McGraw-Hill Publishers, New Delhi, 2002.
3. Grewal.B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publications,Delhi, 2017.

REFERENCES

1. Miller.S.L and Childers, S.L, "Probability and Random Processes with applications to Signal Processing and Communications", Elsevier Inc., 1st Indian Reprint 2007.
2. Richard Arnold Johnson, Irwin Miller, John E Freund, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education Private Limited, 2013.
3. Robert V.Hogg, Joseph W.Mckean, Allen Thornton Craig, "Introduction to Mathematical Statistics", 6th Edition, Pearson Education Private Limited, 2005.
4. K.Shankar Rao, "Numerical Methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India,2008.
5. M.K.Jain, S.R.K.Iyengar&R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International Private Limited Publishers, 2012.

19ME32C	COMPUTER PROGRAMMING	L T P C
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Apply the basic concepts to solve simple problems. (K3)
CO2: Use array and make decisions based on the problem and solve it by selection of appropriate technique (K2)
CO3: Analyze the difficulties of problems using functions. (K3)
CO4: Analyze and apply different sorting and searching techniques to solve the problem.(K3)

UNIT I INTRODUCTION 9

Introduction: Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, Applications. Programming environment, Data Storage and Communication with Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

UNIT II DECISION MAKING AND LOOPING 9

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way Decision Making. Array: Reading, Writing, Processing, Sorting, Evaluating Polynomial. Sum and Difference, Trace, Transpose of Matrices.

UNIT III FUNCTIONS 9

String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV SORTING TECHNIQUES 9

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications.

UNIT V SEARCHINGTECHNIQUES 9

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Ashok.N.Kamthane, Computer Programming and IT, Pearson Education India, 2016
2. Anita Goel, Ajay Mittal,"Computer Fundamentals and Programming in C (RMK)", Pearson Education India, 2016
3. R.G. Chaudhari, Training Techniques of Creative problem Solving, Notion Press, 2018.

REFERENCES

1. Maureen Sprankle and Jim Hubbard, Problem Solving and Programming Concepts‖, 9thEdition, Prentice Hall, 2012.
2. Teodor Rus, Computer-Based Problem-Solving Process, The university of Iowa, USA, 2015.

19ME33C **THERMODYNAMICS** **L T P C**
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the thermodynamic systems and apply first law of thermodynamics to analyze the systems. (K3)
CO2: Discuss second law of thermodynamics and its corollaries, and analyze the feasibility of a process based on first and second law of thermodynamics. (K3)
CO3: Evaluate the change in properties of ideal and real gases subjected to thermodynamics processes using equation /table/ chart. (K2)
CO4: Calculate the change in properties of steam subjected to thermodynamics processes using equation/table/chart. (K2)
CO5: Determine the change in properties of atmospheric air subjected to psychrometric processes using equation/chart. (K2)

UNIT I BASIC CONCEPT AND FIRST LAW OF THERMODYNAMICS 12

Thermodynamic system - concepts - Zeroth law of thermodynamics - Heat and work transfer - First law of thermodynamics in flow and non-flow processes.

UNIT II SECOND LAW OF THERMODYNAMICS 12

Thermal energy reservoir-heat engines and heat pumps - Kelvin and Clausius statements-Reversible and irreversible processes - Carnot cycle and theorem - Clausius inequality - Concept of Entropy - Increase of entropy principle.

UNIT III IDEAL AND REAL GASES AND THERMODYNAMICRELATIONS 12

Gas mixtures - properties of ideal and real gases - equation of state – Avogadro’s Law - Vander Waal’s equation of state - compressibility factor - compressibility chart – Dalton’s law of partial pressure - Exact differentials - T-D relations – Maxwell’s relations - Clausius Clapeyron equations - Joule Thomson coefficient.

UNIT IV PROPERTIES OF PURE SUBSTANCE 12

Pure substances - Phase change - Property diagrams - Property tables - thermodynamic properties of steam - Calculations of work done and heat transfer in non-flow and flow processes.

UNIT V PSYCHROMETRY 12

Psychrometry and psychrometric charts - property calculations of air vapour mixtures – Simple Psychrometric processes - Evaporative cooling.

Note: (Use of steam tables and psychrometric chart are permitted in the End Semester Examination)

L: 45; T:15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Yunus A Cengel and Michael A Boles, “Thermodynamics - An Engineering Approach”, 8thEdition, Tata McGraw-Hill Education, 2015.
2. Nag P.K, “Engineering Thermodynamics”, 6thEdition, the McGraw-Hill Book Company, 2017.

REFERENCES

1. Sonntag, Borgnakke and Van Wylen, “Fundamentals of Thermodynamics”, 7thEdition, Wiley India Private Limited, 2009.
2. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of Engineering Thermodynamics: 8thEdition, John Wiley & Sons, 2015
3. Rajput RK, “A Textbook of Engineering Thermodynamics”, 4thEdition, Laxmi Publications Private Limited, 2015.
4. NPTEL Videos: http://nptel.ac.in/video.php?subjectId=112105123.

19ME34C	MANUFACTURING TECHNOLOGY– I	L T P C
		2 0 2 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Elucidate and select appropriate casting method for a productand design the gating and riser systems (K3)

CO 2: Identify and select suitable metal joining process for fabrication and prepare weld joints in laboratory (K3)

CO 3: Discuss and practice the metal forming processes and calculate the load requirement in forming processes (K3)

CO 4: Explain the various stages in component preparation through powder metallurgy technique (K2)

CO 5: Discuss various polymer processing methods and applications (K2)

UNIT I METAL CASTING PROCESSES 12

Sand casting- Moulding sand: types, properties and testing methods- Patterns: materials and allowances – Core making process –Heat transfer and solidification in casting-Riser and gating design– Working principle of Special casting processes-Recent developments in casting– Casting defects. Preparation of mould using green sand and split pattern in laboratory.

UNIT II METAL JOINING PROCESSES 12

Fusion and solidstate welding processes –Brazing, soldering and adhesive bonding processes–Recent developments in welding-Weld defects. Practicing with TIG welding for making simple weld joints in laboratory.

UNIT III METAL FORMING PROCESSES 12

Hot working and cold working of metals – forging, rolling, drawing and extrusion processes- principles and applications- Sheet metal forming processes- principles and applications-Load estimation for bulk (forging, rolling, extrusion, drawing) and sheet(shearing, deep drawing, bending) metal forming processes-Recent developments in forming. Preparation of simple objects through hot forging and simple sheet metal parts in laboratory.

UNIT IV POWDER METALLURGY 12

Metallic Powder preparation: Mechanical, Physical and chemical methods- Powder treatment and handling. Powder compaction: Pressure and Pressure less compaction methods. Sintering: Solid state, Liquid state and activated sintering processes. Secondary operations on part prepared through powder metallurgy. Recent developments and Industrial applications.

UNIT V PROCESSESING OF PLASTICS 12

Types of plastics- plastic processing techniques: Blow moulding, Injection moulding (screw and plunger type machines), Rotational moulding, Transfer moulding and compression moulding- Recycling and Eco-friendlyProcessing-Recent developments and Industrial applications.

L:30; P:30; TOTAL: 60 PERIODS

TEXT BOOKS

1. HajraChoudhury, "Elements of Workshop Technology, Vol.I Manufacturing Processes", Media Promotors Private Limited, Mumbai, 15thReprint, 2016.
2. S.Gowri, P.Hariharan and A.SureshBabu, "Manufacturing Technology 1", Pearson Education, 2017.

REFERENCES

1. B.S. MagendranParashar&R.K.Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N.Rao, "Manufacturing Technology", 2ndEdition, Tata McGraw-Hill Publishing Limited, 2015.
3. P.C. Sharma, "A Text book of Production Technology", 11thEdition, S.Chand and Company, 2013.
4. Begman, "Manufacturing Process", 8th Edition, John Wiley & Sons, 2018.
5. SeropeKalpajian, Steven R.Schmid, "Manufacturing Engineering and Technology", PearsonEducation, Inc. 2018 (2nd Indian Reprint).
6. Beddoes.J and Bibby M.J, "Principles of Metal Manufacturing Processes", Elsevier, 2016.
7. Rajput R.K, "A text book of Manufacturing Technology", Lakshmi Publications, 2016.
8. Larry Jeffus, "Welding and Metal Fabrication", Cengage Learning, 2012.

19ME35C KINEMATICS OF MACHINERY

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the simple mechanisms with suitable examples. (K2)
CO2: Determine velocity and acceleration of any point on a link in simple mechanisms. (K2)
CO3: Draw different cam profile for various follower motions. (K2)
CO4: Describe laws of gearing, types of gears, terminologies of spur gears and gear trains. (K2)
CO5: Discuss the concept of friction in drives and brakes. (K2)

UNIT I BASICS OF MECHANISM 12

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism and Machine – Degrees of Freedom – Mobility – Kutzbach criterion (Gruebler's equation) – Grashoff's law- Kinematic inversions of four-bar chain and single slider crank chain – Mechanical Advantage-Transmission angle. Description of common mechanisms – Offset slider mechanism as quick return mechanisms, pantograph, straight line generators (Peaucellier and Watt mechanisms).

UNIT II KINEMATIC ANALYSIS 12

Analysis of velocity and acceleration in simple mechanisms – Graphical Methods for relative velocity and acceleration polygons –Coriolis acceleration.

UNIT III KINEMATICS OF CAMS 12

Introduction – Terminology, Classifications, Types of follower motion – Uniform velocity Motion,Simple Harmonic Motion, Uniform Acceleration and Retardation Motion and Cycloidal Motion. Graphical layouts of cam profile – Knife edge follower, Roller and flat faced follower.

UNIT IV GEARS 12

Types of Gears – Spur gear terminology and definitions – Law of toothed gearing – Involute and cycloidal gear profiles- Interchangeability – Interference and undercutting. Gear trains – Simple, compound and Epicyclic gear trains–speed calculation.

UNIT V FRICTION DRIVES 12

Dry friction, Friction in screw threads – Friction clutch - types –single plate, Multi plate and cone clutch. –Block brakes, band brakes. Conditions for self-locking and self energizing.

L:45; T:15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Rattan SS, "Theory of Machines", Tata McGraw – Hill Publishers, New Delhi, 2017.
2. Robert L Norton, "Design of Machinery", 5thEdition, McGraw-Hill Higher Education, 2013.

REFERENCES

1. Uicker JJ, Pennock GR andShigley JE, "Theory of Machines and Mechanisms", 5thEdition, Oxford University Press, 2017.
2. Ambekar AG, "Mechanism and Machine Theory", 1stEdition, Prentice Hall of India, New Delhi, 2011.
3. Thomas Bevan, "Theory of Machines", 3rdEdition, CBS Publishers and Distributors, 2009.
4. Ramamurti V, "Mechanism and Machine Theory", 2ndEdition, Narosa Publishing House,Reprint 2019.
5. Cleghorn W.L., Mechanisms of Machines, Oxford University Press, 2nd Edition, 2014.

19MC02C CONSTITUTION OF INDIA

	L	T	P	C
	3	0	0	0

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the salient features of the Indian Constitution. (K2)
CO2: discuss the structure and functions of parliament. (K2)
CO3: elaborate the structure and functions of state legislature. (K2)
CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
CO5: discuss the foreign policy of India. (K2)

UNIT I INDIAN CONSTITUTION 9

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM 9

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM 9

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT IV THE JUDICIARY 9

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS 9

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Basu D.D,” Introduction to Indian Constitution”, Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, “Indian Government and Politics”, Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, “Introduction to the Constitution of India”, Vikas Publishing House, NewDelhi, 2011.
2. Kashyap S, “Our Constitution”, National Book Trust, New Delhi, 2010.
3. Shukla V N, “Constitution of India”, Eastern Book Company Ltd., New Delhi, 2011.

19ME36E COMPUTER PROGRAMMING LABORATORY L T P C

0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Solve simple and Complex problems (K3)
CO 2: Solve sorting and searching problems. (K3)

LIST OF EXPERIMENTS

1. Solve problems such as temperature conversion, student grading, interest calculation, the roots of a quadratic equation
2. Design a simple arithmetic calculator. (Use switch statement)
3. Perform the following operations:
    a. Generate Pascal‘s triangle.
    b. Construct a Pyramid of numbers.
4. Generation of first ‘n’ terms of the Fibonacci sequence and prime sequence.
5. Find the 2‘s complement of a binary number.
6. Perform the following operations:
    a. Matrix addition.
    b. Transpose of a matrix.
    c. Matrix multiplication by checking compatibility
7. Perform the following operations on a string:
    a. Insert a sub-string into main string at a given position.
    b. Delete n characters from a given position in a string.
    c. Check whether the given string is palindrome or not.
    d. Replace a character of string either from beginning or ending or at a specified location.
    e. Write a C program to determine if the given string is a palindrome or not
8. Perform the following operations: (Use recursive functions)
    a. Find the factorial of a given integer.
    b. Find the GCD (Greatest Common Divisor) of two given integers.
    c. Solve the Towers of Hanoi problem.
9. Write C programs that implement the following sorting methods to sort a given list of integers in ascending order: i) Bubble sort ii) Selection Sort iii) Insertion sort iv) Merge sort
10. Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers: i) Linear search ii) Binary search

Software Requirement: Turbo C / Python

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Ashok.N.Kamthane, Computer Programming and IT, Pearson Education India, 2016
2. Anita Goel, Ajay Mittal, “Computer Fundamentals and Programming in C (RMK)”, Pearson Education India, 2016
3. R.G. Chaudhari, Training Techniques of Creative problem Solving, Notion Press, 2018.

19ME37C COMMUNICATION SKILLS LABORATORY L T P C 0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Listen and respond effectively to interact at different situations fluently (K2, S3)
CO2: Excel appropriately in professional contexts. (K3, S4)
CO3: Acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3, S4)

UNIT I **10**

Lab session: Listening and responding to audio files
Practice session: Mini Presentation related to Business English & Picture description.

UNIT II **10**

Lab session: Role Play – News Reader
Practice session: Resume Preparation

UNIT III **10**

Lab session: Listening to audio files related to soft skills.
Practice session: Practicing Power point presentation, Group discussion

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Dutt P. Kiranmai and Rajeevan Geeta, “Basic Communication Skills”, Foundation Books, 2013.
2. Comfort, Jeremy, et al. “Speaking Effectively, Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge: Reprint 2011.
3. Rizvi.M.Ashraf, “Effective Technical Communication”, The MC-Graw Hill Education Private Limited, Companies, New Delhi, 2010.

19ME41C FLUID MECHANICS AND MACHINERY L T P C 3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the fundamentals of fluid properties and solve fluid dynamics problems using Bernoulli’s equation. (K2)
CO2: Apply dimensional analysis to simple problems. (K2)
CO3: Determine flow rates, pressure changes, minor and major head losses for laminar and turbulent flows through pipes. (K2)
CO4: Apply principles of fluid mechanics to the operation, design and selection of hydraulics turbines. (K2)
CO5: Apply principles of fluid mechanics to the operation, design and selection of pumps. (K2)

UNIT I INTRODUCTION TO FLUID AND FLUID DYNAMICS 12

Properties of fluids - Flow characteristics: concepts of system and control volume- Application of control volume to continuity equation - Bernoulli's equation – applications.

UNIT II DIMENSIONAL AND MODEL ANALYSIS 12

Dimension and units - dimensionless parameters - Buckingham’s π theorem - Models and similitude - Applications of dimensionless parameters, scaling factors and law.

UNIT III FLOW THROUGH CIRCULAR CONDUITS 12

Boundary layer concepts - Laminar flow though circular conduits and circular annuli - Darcy-Weisbach's equation - Flow through pipes in series and in parallel, friction factor – Moody diagram- Losses in pipes.

UNIT IV HYDRAULIC TURBINES 12

Hydro turbines: definition and classifications - working principles - velocity triangles - work done - specific speed - efficiencies - performance curves.

UNIT V HYDRAULIC PUMPS 12

Pump: Classification and working principles - Centrifugal pump velocity triangles, specific speed, efficiency and performance curves - Reciprocating pump: slip, discharge, work done - cavitation.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Bansal RK, “Fluid Mechanics and Hydraulics Machines”, 10th Edition, Laxmi publications (P) Ltd, New Delhi, 2018.
2. White FM, “Fluid Mechanics”, 8th Edition, Tata McGraw-Hill, New Delhi, 2016

REFERENCES

1. Yunus A. Cengel and John M. Cimbala, “Fluid Mechanics”, 3rd Edition, McGraw-Hill Ltd, New Delhi, 2014
2. Streeter VL and Wylie EB, “Fluid Mechanics”, 9th Edition, McGraw-Hill Ltd, New Delhi, 2010.
3. Modi PN and Seth SM, “Hydraulics and Fluid Mechanics Including Hydraulics Machines”, 20th Edition, Standard Book House, 2015.
4. Kumar KL, “Engineering Fluid Mechanics”, 15th Edition, Eurasia Publishing House Private Limited, New Delhi, 2006.
5. Shiv Kumar, “Fluid Mechanics & Fluid Machines: Basic Concepts & Principles”, 2nd Edition, Ane Books Pvt. Ltd., New Delhi, 2011
6. https://nptel.ac.in/courses/112105171/

19ME42C STRENGTH OF MATERIALS L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Determine various stresses on simple load carrying members subjected to axial, shear and thermal loads. (K2)

CO2: Apply Mohr's circle to resolve stresses on inclined planes and determine stresses in thin cylinders. (K2)
CO3: Construct shear force and bending moment diagrams for beams. (K2)
CO4: Estimate slope and deflection of beams and columns. (K2)
CO5: Determine the twist and shear stresses of shaft and springs under torsional load (K2)

UNIT I SIMPLE STRESSES 12

Axial and shear stresses and strains – Elasticity, Hook's law – Lateral strain – Poisson's ratio – Volumetric strain – Elastic constants – Thermal stress – Stress in composite bars, Factor of safety.

UNIT II COMBINED STRESSES AND BIAXIAL STRESSES 12

Principal stresses and Planes. Plane of maximum shear – Mohr's circle for plane stresses. Thin cylindrical and spherical shells subjected to internal pressure, Thick cylinders – Lame's equation.

UNIT III SHEAR FORCE AND BENDING MOMENT IN BEAMS 12

Classification of beams, Shear force and Bending Moment diagrams for cantilever, simply supported beams -point loads, UDL and UVL. Bending stresses.

UNIT IV DEFLECTION OF BEAMS AND COLUMNS 12

Slope and deflection of cantilever and simply supported beams - Macaulay, Moment area and Conjugate methods - Columns and struts –Euler's and Rankine's formulae.

UNIT V TORSION 12

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stress and defection in open coil helical spring.

L: 45 T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Timoshenko SP, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 2004.
2. Popov EP, "Engineering Mechanics of Solids", 2nd Edition, Prentice-Hall of India, New Delhi, 2002.

REFERENCES

1. Hibbeler RC, "Mechanics of Materials", 8th Edition, Prentice Hall, 2011.
2. Ramamurtham S, "Strength of Materials", 14th Edition, Dhanpat Rai Publications, 2011.
3. Nash WA, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co., New York, 1995.
4. Kazimi SMA, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
5. Ryder GH, "Strength of Materials", 3rd Edition, Macmillan India Limited, 2002.
6. Beer FP and Johnston R," Mechanics of Materials", 3rd Edition, McGraw-Hill Book Co., 2002.
7. Bansal RK, "Strength of Materials", Laxmi Publications, New Delhi, 2012.

8. Norman E Dowling, "Mechanical behavior of Materials – Engineering methods for Deformation, Fracture and Failure", 4th Edition, Pearson Publications, England, 2013.
9. Prashant Kumar, "Elements of Fracture Mechanics" McGraw Hill, New Delhi, 2009.

19ME43C THERMAL ENGINEERING

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Explain different gas power cycles with their application in IC engines and Gas turbines. (K2)
- CO2: Explain steam power cycle and modify the cycle to improve the overall efficiency. (K2)
- CO3: Describe and carry out the performance study on steam nozzles and turbines. (K2)
- CO4: Calculate the performance of VCR and Air conditioning system. (K2)
- CO5: Calculate the performance Air compressors. (K2)

UNIT I GAS POWER CYCLES 12

Otto, Diesel, Dual and Brayton cycles - I.C Engines – basics - Valve Timing and Port timing diagrams - Performance and Heat Balance of I.C. Engines.

UNIT II STEAM POWER CYCLE 12

Simple, Actual Rankine Cycle and components –Modified cycles- - Reheat, Regeneration and Combined cycles– Recent developments.

UNIT III STEAM NOZZLES AND TURBINES 12

Steam Nozzles - Effect of friction, critical pressure ratio, supersaturated flow - Steam Turbines-types - compounding, degree of reaction, velocity diagram, speed regulations, Condition for maximum efficiency – Latest developments.

UNIT IV REFRIGERATION AND AIR CONDITIONING SYSTEMS 12

VCR cycle - super heat, sub cooling - Performance calculations-Reversed Brayton cycle - VAR cycle - Ammonia - Water, Lithium bromide -water systems - Air Conditioning - Types - Cooling load calculations - Cooling towers – concept and types - Latest developments.

UNIT V AIR COMPRESSOR 12

Classification - working principle - reciprocating air compressors - work of compression and efficiency - with and without clearance - Multistage air compressor with Intercooling.

L: 45; T: 15; TOTAL: 60 PERIODS

*Note: (Use of steam tables, Refrigeration tables and psychrometric chart are permitted in the End Semester Examination)

TEXT BOOKS

1. Mahesh M Rathore, "Thermal Engineering ", Tata McGraw-Hill, New Delhi, 2010.
2. Rajput R.K, "Thermal Engineering", 10thEdition, Laxmi Publications, Limited, 2018.

REFERENCES

1. S.M Yahya, "Turbines, Compressors and Fans", 4thEdition, Tata McGraw-Hill Education, 2010
2. Yunus A Cengel and Michael a Boles, "Thermodynamics - An Engineering Approach", 8thEdition, Tata McGraw-Hill Education, 2015.
3. Manohar Prasad "Refrigeration and Air Conditioning", 3rdEdition, New Age International Publishers, 2015.
4. Ganesan V, "Internal Combustion Engines", 4th Edition, Tata McGraw-Hill, 2012.
5. IS 10001:1981, Performance of IC Engines.
6. IS: 1391-2002 Part II, Performance test of RAC.
7. http://nptel.ac.in/courses/112105128/11.

19ME44C MANUFACTURING TECHNOLOGY– II

L T P C
2 00 3

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

CO 1: Describe the theories of metal cutting and calculate cutting tool life, machining time and cutting forces in metal machining. (K2)
CO 2: Identify accessories and tools required to perform a particular operation in centre and semi-automatic lathes. (K2)
CO 3: Describe the constructional and operational features of various special purpose machine tools. (K2)
CO 4: Discuss the process of grinding and other surface finishing operations (K2)
CO 5: Discuss the need and process of additive manufacturing. (K2)

UNIT I THEORY OF METAL CUTTING 6

Material removal processes, types of machine tools – theory of metal cutting: cutting tool materials, tool wear and life, economics of machining, cutting fluids and cutting force measurement techniques.

UNIT II CENTRE LATHE AND SEMI-AUTOMATIC LATHES 6

Centre lathe- cutting tool geometry- taper turning and thread cutting methods. Capstan and turret lathes. Recent developments in general purpose machine tools.

UNIT III SPECIAL PURPOSE MACHINE TOOLS 6

Shaping, milling, planning and drilling operations- Indexing calculations in milling machine. Gear manufacturing processes. Recent developments in special purpose machine tools.

UNIT IV SURFACE FINISHING PROCESSES 6

Grinding wheel and various types of grinding processes, electrochemical grinding, honing, lapping and buffing processes. Recent developments in super finishing.

UNIT V ADDITIVE MANUFACTURING 6

Need and Development of AM systems - Classification of AM processes - Benefits - Applications.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. HajraChoudry, “Elements of Work Shop Technology – Vol. II”, Media Promoters, 2016
2. Milton C.Shaw, “Metal Cutting Principles”, Oxford University Press, 4th Edition, 2016.

REFERENCES

1. Rao, P.N. “Manufacturing Technology”, Metal Cutting and Machine Tools Volume 2, Tata Mc-Graw –Hill, New Delhi, 3rd Edition, 2013.
2. P.C.Sharma, “A Text Book of Production Engineering”, S.Chand and Company Limited, 11thEdition, 2015.
3. Rajput R.K, “A Text book of Manufacturing Technology”, Laxmi Publications, 2017.
4. Philip F.Ostwald and Jairo Munoz, “Manufacturing Processes and systems”, John Wiley and Sons, 11thEdition, 2016.
5. MikellP.Groover, “Fundamentals of Modern Manufacturing, Materials, Processes and Systems”, John Wiley and Sons, 5th Edition, 2015.

19ME45C MATERIALS SCIENCE AND METALLURGY

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Describe the structure and properties of materials referring suitable phase diagrams. (K2)
- CO2:Select appropriate heat-treatment techniques to impart desired properties in materials /alloys. (K2)
- CO3: Describe the different types of ferrous and non -ferrous materials and their applications. (K2)
- CO4: Select suitable plastics, ceramics and composites for specific engineering applications. (K2)
- CO5: Explain different damage mechanisms and testing of metals (K2)

UNIT I ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys–Solid solutions, substitutional and interstitial–phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron–Iron carbide phase diagram. Classification of Steel and cast Iron - microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition–Full annealing, stress relief, recrystallisation and spheroidising–normalising, hardening and Tempering of steel. Isothermal transformation diagrams–cooling curves superimposed on I.T. Diagram -Continuous Cooling Transformation (CCT) diagram-Austempering, Martempering –hardening methods-case hardening, carburizing, Nitriding, cyaniding, carbonitriding–Flame and Induction hardening–Vacuum and Plasma hardening - Thermo-mechanical treatments-elementary ideas on sintering.

UNIT III FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti& W) -α and β stabilizers – stainless and tool steels–HSLA, Maraging steels–Cast Iron-Grey, white, malleable, spheroidal–alloy cast irons, Copper and copper alloys–Brass, Bronze and Cupronickel–Aluminum and its alloys - Al-Cu–precipitation strengthening treatment– Titanium alloys, Mg-alloys, Ni-based super alloys –Properties and Applications.

UNIT IV NON-METALLIC MATERIALS 9

Polymers–types of polymer, commodity and engineering polymers–Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers–Urea and Phenol formaldehydes)-Engineering Ceramics–Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON–Composites-Classifications-Metal Matrix and FRP-Applications of Composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

Mechanismsofplasticdeformation, slip and twinning–Types of fracture–Testing of materials under tension, compression and shear loads–Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Micro and Nano-hardness tests, Impact test Izod and Charpy, fatigue and creep failure mechanisms.

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Avner, S.H.“Introduction to Physical Metallurgy”, McGraw Hill Education; 2nd Edition, July 2017
2. Williams D Callister, “Material Science and Engineering” Wiley India Private Limited, Revised Indian Edition, 2014

REFERENCES

1. Raghavan.V, “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd., Edition: 2015
2. Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint 2002.
3. Upadhyay. G.S.and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd., New Delhi, 2006.
4. U.C.Jindal: Material Science and Metallurgy, "Engineering Materials and Metallurgy", 1st Edition, Dorling Kindersley, 2012.

19MC03C SAFETY, HEALTH AND ENVIRONMENTAL ENGINEERING

L	T	P	C
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COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: Explain the principles of safety management in industries. (K2)
CO2: Discuss the techniques to identify and prevent the occupational diseases. (K2)
CO3: Summarize the sources and consequences of global warming. (K2)
CO4: Identify the potential sources and effects of air and water pollution. (K2)
CO5: Discuss the concepts of measurement of emissions and emission measurement

devices. (K2)

UNIT I SAFETY CONCEPTS AND TECHNIQUES 9

History of Safety movement –Evolution of modern safety concept- general concepts of management – planning for safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety-budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.

UNIT II OCCUPATIONAL HEALTH 9

Concept and spectrum of health - functional units and activities of occupational health services, pre- employment and post-employment medical examinations - occupational elated diseases,levels of prevention of diseases, notifiable occupational diseases their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests.

UNIT III GLOBAL WARMING 9

Last 30 years in global warming – greenhouse effect – greenhouse gases – Climate change – impacts of climate change: Fresh water resources, Costal areas, Sea level rise, agriculture and food supply, eco systems, human health. Global warming forecasting, Energy solutions to global warming

UNIT IV AIR AND WATER POLLUTION 9

Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials - automobile pollution-hazards of air pollution.Classification ofwater pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal

UNIT V ENVIRONMENTAL MEASUREMENT AND CONTROL 9

Sampling and analysis – dust monitor – gas analyzer, particle size analyzer – pH meter – gas chromatograph – atomic absorption spectrometer.Gravitational settling chambers - cyclone separators – scrubbers - electrostatic precipitator – Flue Gas desulphurization.

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, 1973
2. Rao, C.S, “Environmental Pollution Engineering, Wiley Eastern Limited, New Delhi, 1992.
3. Heinrich H.W. “Industrial Accident Prevention” Mc-Graw-Hill Company, New York, 1980.

REFERENCES

1. Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010.
2. Rao, C.S, “Environmental Pollution Engineering, Wiley Eastern Limited, New Delhi, 1992.
3. Varma and Braner, “Air pollution equipment”, Springer Publishers, 2nd Edition.

19ME46C FLUID MECHANICS AND MACHINERY LABORATORY L T P C

0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Apply Bernoulli's equations to determine the coefficient of discharge in flow measuring devices. (K3)

CO2: Determine head losses in various flow sections for viscous flows through pipes with simple case study. (K3)

CO3: Evaluate the performance of different types of turbines and pumps and to solve simple case study problems. (K3)

UNIT I FLUID MECHANICS 10

Bernoulli's Equation - Venturimeter - Orificemeter - Rotameter - Viscous flow through Pipes and pipe fittings.

UNIT II PERFORMANCE OF TURBINES 10

Pelton Wheel turbine - Francis Turbine - Kaplan Turbine - Performance curves.

UNIT III PERFORMANCE OF PUMPS 10

Centrifugal Pump - Reciprocating Pump - Gear oil Pump - Performance curves.

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Streeter VL and Wylie EB, "Fluid Mechanics", 9thEdition, McGraw-Hill Ltd, New Delhi, 2010.
2. Bansal RK, "Fluid Mechanics and Hydraulics Machines", 10thEdition, Laxmi publications (P) Ltd, New Delhi, 2018.
3. http://fm-nitk.vlabs.ac.in/#
4. https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html?domain=Civil%20Engineering
5. http://mfts-iitg.vlabs.ac.in/

19ME47C THERMAL ENGINEERING LABORATORY L T P C

0 0 2 1

COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

CO1: Examine and compare the properties of different types of oils using various apparatus. (K2)

CO2: Design and conduct experiments on internal combustion engines to investigate and compare the performances. (K3)

CO3: Evaluate the performance of compressors, refrigeration and air conditioning systems (K2)

UNIT I CHARACTERIZATION OF OIL/FUEL 10

Viscosity measurement- redwood viscometer, Saybolt viscometer

UNIT II PERFORMANCE TESTS ON ENGINES 10

Performance and heat balance test - Morse test - Retardation test - Optimum load Determination

UNIT III PERFORMANCE TESTS ON THERMAL SYSTEMS 10

Compressors - Rotary - Reciprocating; Refrigeration and Air conditioning systems - Performance Tests

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Mahesh M Rathore, “Thermal Engineering “, Tata McGraw-Hill, New Delhi, 2010.
2. Rajput RK,“Thermal Engineering”, 10th Edition, Laxmi Publications, Ltd., 2018.
3. Ganesan V, “Internal Combustion Engines”, 4thEdition, Tata McGraw-Hill, 2012.
4. S.M Yahya, “Turbines, Compressors and Fans, 4/e”, 4th Edition, Tata McGraw-Hill Education, 2010
5. IS 10001:1981, Performance of IC engines.
6. IS: 1391-2002 Part II, Performance test of RAC.
7. http://vlabs.iitkgp.ernet.in/rtvlas/#

19ME48C MATERIAL TESTING LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Study the ASTM Standards for Mechanical and Wear testing of Materials
CO2: Evaluate mechanical properties experimentally for materials subjected to direct, shear and bending. (K3)
CO3: Compare hardness and impact resistance of the materials before and after heat treatment. (K4)
CO4: Perform metallurgical characterization of materials. (K3)
CO5: Analyze the strength and stiffness of helical springs. (K3)
CO6: Conduct wear test and examine the wear resistance of the material (K3)

UNIT I MECHANICAL PROPERTIES OF MATERIALS 14

ASTM and BIS Standards for Mechanical and Wear test of the materials - Mechanical properties - elastic constants, yield strength, ultimate tensile strength (UTS), S-N curve, hardness, shear strength, impact strength and torsional strength.

UNIT II STRENGTHENING MECHANISMS 4

Heat treatment - Effect of hardening and tempering - Improvement in hardness and impact resistance of steels.

UNIT III MICROSCOPY 4

Microstructural analysis - Optical microscopy.

UNIT IV SPRINGS 4

Mechanical properties - Stiffness, modulus of rigidity, maximum strain energy.

UNIT V WEAR TEST 4

Study of Wear Parameters – Pin-On-Disc Wear test – depth of wear and Coefficient of friction.

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Timoshenko SP, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 2004.
2. Popov EP, "Engineering Mechanics of Solids", 2nd Edition, Prentice-Hall of India, New Delhi, 2002.
3. Bharath Bhushan. "Introduction to Tribology", 2nd Edition, Wiley India, 2013

19ME49C MANUFACTURING TECHNOLOGY LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

- CO1. Perform operations to create simple components using Lathe. (K3)
- CO2. Estimate cutting forces in a single point cutting tool. (K3)
- CO3. Perform shaping, slotting and milling operations. (K3)
- CO4. Generate gear profile using milling and hobbing machines. (K3)
- CO5. Perform surface finishing operations on simple parts. (K3)
- CO6. Make simple components using 3D printer. (K3)

UNIT I CENTRE LATHE AND SEMI AUTOMATIC LATHE 8

Thread cutting with centre lathe and simple machining practices in capstan lathe. Cutting force measurement using cutting tool dynamometer.

UNIT II SPECIAL PURPOSE MACHINE TOOLS 8

Shaping, milling and slot cutting operations.

UNIT III GEAR MANUFACTURING AND ABRASIVE PROCESSES 8

Gear milling, gear hobbing and simple grinding operations.

UNIT IV ADDITIVE MANUFACTURING 6

Additive manufacturing – Making of simple components - FDM technology.

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. II Machine tools", Media Promotors Private Limited, Mumbai, 15th Reprint, 2016.
2. SeropeKalpajian, Steven R.Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2018 (2nd Indian Reprint).
3. B.S. Magendran Parashar &R.K.Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2003.
4. P.N.Rao, "Manufacturing Technology", 2nd Edition, Tata McGraw-Hill Publishing

Limited, 2015.
5. P.C. Sharma, “A Text book of Production Technology”, 11th Edition, S.Chand and Company, 2013.
6. Begman, “Manufacturing Process”, 8th Edition, John Wiley & Sons, 2018.
7. Beddoes.J and Bibby M.J, “Principles of Metal Manufacturing Processes”, Elsevier, 2016.
8. Rajput R.K, “A text book of Manufacturing Technology”, Lakshmi Publications, 2016.
9. Larry Jeffus, “Welding and Metal Fabrication”, Cengage Learning, 2012.

19ME51C HEAT AND MASS TRANSFER

L T P C
3 1 2 5

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

CO1:Solve problems involving conduction heat transfer with simple geometries through theoretical and experimental methods. (K3)
CO2: Apply the principles of free and forced convection heat transfer using empirical correlations and simple experiments. (K3)
CO3: Design a simple heat exchanger and evaluate its performance. (K3)
CO4: Apply the basic concepts of radiation heat transfer to thermal systems. (K3)
CO5:Apply the principles of diffusion and convective mass transfer for simple applications. (K3)

UNIT I CONDUCTION 18

General differential equation of heat conduction in various coordinate systems - One dimensional heat conduction for steady and unsteady state conditions - Extended surfaces - Case studies.

Experiments on determination of thermal conductivity of materials

UNIT IICONVECTION 18

Basic concepts - Boundary layer concept - Forced convection - External and internal flow - Free convection -External flow - Dimensional analysis - Applications.

Experiments on convective heat transfer: Forced convection & Natural convection inside a tube

UNIT IIIPHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS18

Nusselt theory of condensation - Pool and flow boiling - Heat exchangers - Types and working principle - Simple heat exchanger design - Fouling factors - Introduction to compact heat exchanger - Case studies.

Experiments on performance of heat exchangers: Parallel and Counter flow

UNIT IVRADIATION 18

Laws of radiation - Black body radiation - Grey body radiation - Shape factor algebra - Electrical analogy - Radiation shields - Introduction to gas radiation - Solar radiation - Concept and applications.

Experimental verification of Stefan Boltzman constant, Determination of emissivity of grey *surface*

UNIT VMASS TRANSFER 18

Basic concepts - Diffusion mass transfer - Steady state molecular diffusion - Convective mass transfer - Application of mass transfer: Cooling tower - Performance characteristics.

L:45 T:15 P:30; TOTAL:90 PERIODS

Note: (Use of HMT data book and steam tables are permitted in the end semester examination)

TEXT BOOKS

1. YunusCengel and Afshin Ghajar, "Heat and Mass Transfer: Fundamentals and Applications", McGraw-Hill Education, 2019, 6th Edition.
2. Frank P Incropera and David P DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 2018, 8thEdition.

REFERENCES

1. Nag PK, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2011, 3rdEdition.
2. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer", New Age International, 2017, 5thEdition.
3. Holman JP, "Heat and Mass Transfer", McGraw-Hill Education, 2011, 10thEdition.
4. Ozisik MN, "Heat Transfer", McGraw-Hill Book Co., 1994.
5. Kothandaraman CP, "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 2019.
6. NPTEL Lecture notes: https://nptel.ac.in/courses/112/108/112108149/
7. NPTEL videos: https://nptel.ac.in/courses/112/101/112101097/

19ME52C	DYNAMICS OF MACHINERY	L	T	P	C
		3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Analyze dynamic forces in the reciprocating engine, and predict mass and radius of gyration of flywheel using turning moment diagram. (K3)

CO2: Balance reciprocating and rotating masses in IC engines and identify whether the rotating system is balanced. (K3)

CO3: Predict the natural frequency of longitudinal and torsional vibration, and identify the critical speed of transverse vibration(K3)

CO4: Determine the amplitude of the forced vibration and force transmissibility. (K3)

CO5: Determine the characteristics of the mechanical governors, and analyze the effect of gyroscopic couple on automobiles, ships and aero plane. (K3)

UNIT I DYNAMIC FORCE ANALYSIS AND FLYWHEEL 12

Introduction - Inertia force and inertia torque - D Alembert's principle - Dynamic force analysis in reciprocating engines - Gas forces - Inertia effect of connecting rod - Bearing loads - Crankshaft torque - Turning moment diagrams - Fly wheels - Flywheels of punching presses

UNIT II BALANCING OF MASSES 12

Static and dynamic balancing - Balancing of rotating masses - Balancing of single cylinder engine - Balancing of Multi-cylinder inline, V- engines - Partial balancing of reciprocating masses.

UNIT III FREE VIBRATION 12

Basic features of vibratory systems - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - Natural frequency - Types of damping - Damped free vibration - Whirling of shafts -Torsional systems; Natural frequency of two and three rotor systems.

UNIT IV FORCED VIBRATION 12

Response of one-degree of freedom systems to periodic forcing - Harmonic disturbances - Disturbance caused by unbalance - Support motion - Transmissibility - Vibration isolation - Vibration measurement.

UNIT V MECHANISM FOR CONTROL: GOVERNORS AND GYROSCOPE 12

Governors - Types - Centrifugal governors - Watt, Porter and Proell - Spring loaded governors - Hartnell and Hartung governors - Characteristics - Effect of friction - Controlling force curves.

Gyroscopes - Gyroscopic forces and torques - Gyroscopic stabilization - Gyroscopic effects in automobiles, ships and airplanes

L:45; T:15; TOTAL:60 PERIODS

TEXT BOOKS

1. Rattan SS, “Theory of Machines”, 4th Edition, Tata Mc Graw Hill, New Delhi, 2017.
2. Thomas Bevan, “Theory of Machines”, 3rd Edition, Pearson India, 2009.

REFERENCES

1. Uicker JJ, Pennock GR and Shigley JE “Theory of Machines and Mechanisms”, 4thEdition, Oxford University Press, New Delhi, 2014.
2. Ballaney P L, “Theory of Machines and Mechanisms”, Khanna Publishers, New Delhi, 2005.
3. Ambedkar AG,” Mechanism and Machine Theory”, PHI Learning, New Delhi, 2009.
4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.

19ME53C	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the fundamental scientific principles of mechanical design and their use in design analysis. (K2)

CO2: Design and analyze the shafts and couplings carrying various elements with geometrical features**.** (K3)

CO3: Design a suitable spring based on the requirements. (K3)

CO4: Design a suitable joint for a given application. (K3)

CO5: Design and select a sliding and rolling contact bearing based on the application. (K3)

UNIT I FUNDAMENTALS OF MACHINE DESIGN 12

Design considerations - Limits, fits and standardization - Selection of materials - Simple stress and strain relationship, types of stresses - combined stresses - Fatigue life - Factor of safety - theories of failure - Design based on strength and stiffness - Stress concentration - Design for variable loading.

UNIT II DESIGN OF SHAFTS AND COUPLINGS 12

Shafts and axles - Design of solid and hollow shafts based on strength, rigidity and critical speed - Keys and splines - Rigid and flexible couplings.

UNIT III DESIGN OF SPRINGS 12

Types of springs, design of helical and concentric springs - Surge in springs, Design of laminated springs - Spiral springs - Belleville spring

UNIT IV DESIGN OF JOINTS 12

Threaded fasteners - Bolted joints - Simple and eccentrically loaded bolted joints - Welded joints & symbols - Butt, fillet and parallel transverse fillet welds - Welded joints subjected to bending, torsional and eccentric loads - Riveted Joints - Design of knuckle and cotter joints.

UNIT V DESIGN OF BEARINGS 12

Theory of lubrication - Design of hydrodynamic bearings. Static and dynamic load capacity - probability of survival - Selection of rolling element bearing.

L:45; T:15; TOTAL:60 PERIODS

Note: (Use of P S G Design Data Book is permitted in the End Semester Examination)

TEXT BOOKS

1. Norton, R.L., Machine Design: An Integrated Approach, 2ndEdition, Pearson Education, 2013
2. Budynas, R.G. and Nisbett, J.K., Shigley‘s Mechanical Engineering Design, 9thEdition, Tata McGraw Hill Education, 2013.

REFERENCES

1. Bhandari V B, Design of Machine Elements, Tata McGraw Hill Education (India) Private Limited, New Delhi, 3rdEdition, 2010.
2. Schmid, S.R., Hamrock, B.J. and Jacobson B.O., Fundamentals of Machine Elements, 3rdEdition, CRC Press, 2014.
3. Kamlesh Purohit and Sharma CS, “Design of Machine Elements”, Prentice-Hall of

India Private Limited, New Delhi, 3rd Edition, 2005.

4. Wentzell Timothy H, “Machine Design; Machine Design, Delmar Cengage learning”, U.S.A, 1st Edition, 2003.

19ME54C	**AUTOMATION IN MANUFACTURING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the importance of automation in the of field of manufacturing (K2)
CO2: Understand fundamentals of CAD, CAM, and CNC controls. (K2)
CO3: Discuss Mechanical & Electro mechanical Systems, Pneumatics and Hydraulics based low-cost automations. (K2)
CO4: Discuss the product modeling, simulation and process routes. (K2)
CO5: Discuss the different configurations, programming techniques and applications of robots (K2)

UNIT I INTRODUCTION TO AUTOMATION 9

Introduction: Why automation, current trends, CAD, CAM, CIM; Rigid automation: Part handling, machine tools. Flexible automation: Computer control of machine tools and machining centers, NC and NC part programming, CNC - Adaptive control, Automated material handling - Assembly - Flexible fixture - Industry 4.0.

UNIT II FUNDAMENTALS OF CAD AND CAM 9

Computer aided design: Fundamentals of CAD - Hardware in CAD - Computer graphics software and data base - Geometric modeling for downstream applications and analysis methods - Computer Aided Manufacturing: CNC technology, PLC, Micro-controllers, CNC adaptive control.

UNIT III LOW-COST AUTOMATION 9

Low-cost automation: Mechanical & Electro mechanical systems, Pneumatics and Hydraulics - Illustrative examples and case studies

UNIT IV MODELLING AND SIMULATION 9

Introduction to modeling and simulation: Product design, process route modeling - Optimization techniques - Case studies & industrial applications.

UNIT V INDUSTRIAL ROBOTICS 9

Introduction - Robot - laws of robot - Robot anatomy - Degrees of freedom, configurations - Work envelope - Specifications. Introduction to robot programming methods - Overview of programming languages - Robot applications in manufacturing, material transfer and machine loading/unloading, welding and painting, assembly operations, inspection, mobile robots - Flexible automation versus robotic technology.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mikell P. Groover, Automation, Production Systems, and Computer-integrated Manufacturing, Pearson Education India; 4th Edition, 2016.

2. Ibrahim Zeid, CAD/CAM: Theory & Practice, 2ndEdition, Tata McGraw-Hill Education, 2006.

REFERENCES

1. M. P. Groover, Principles of Modern Manufacturing, 5thEdition, Wiley, 2014.
2. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, A press, 2017.
3. SeropeKalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology, 7thEdition, Pearson, 2013.
4. Groover, Industrial Robotics - Technology, Programming and Applications (Special Indian Edition), Tata McGraw-Hill Education, 2012

19ME55C	PROFESSIONAL ETHICS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Recognize the core human values and theories related to ethical behavior (K2)
CO2: Analyze the engineering ethical breach from case studies (K2)

UNIT I ETHICAL THEORIES AND HUMAN VALUES 8

Moral dilemmas and moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and controversy - Vigil mechanism - Whistle blowing - Protected disclosures - Engineering as experimentation - Negligence - Codes of ethics - Personal ethics and human values - Governing Regulation.

UNIT II CASE STUDIES ON ETHICAL INFRINGEMENT 7

The challenger case study - The three-mile island and recent case studies. Intellectual Property Rights (IPR).

L:15; TOTAL:15 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 2017.
2. Govindarajan.M, Natarajan S and Senthil Kumar VS, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D and Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint)
2. Charles E Harris, Michael S Protchard and Michael J Rabins, “Engineering Ethics - Concepts and Cases”, Wadsworth Thompson Learning, United States, 2018 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2016.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.

19ME56C	**DYNAMICS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Calculate the mass moment of inertia of connecting rod and flywheel. (K3)

CO2: Balance rotating and reciprocating masses, and analyze the vibration before and after the balancing. (K4)

CO3: Predict and validate the natural frequency of the longitudinal, transverse and torsional vibratory systems, and investigate the vibration in the rotating machinery. (K4)

CO4. Determine the amplitude of forced vibrations. (K4)

CO5: Carry out performance study on governors, and analyze the effect of gyroscopic couple on motorized gyroscope model. (K4)

UNIT I MOMENT OF INERTIA 6

Moment of inertia - Flywheel and connecting rod - Dynamically equivalent system

UNIT II BALANCING OF MASSES 8

Balancing - Rotating masses and reciprocating masses

UNIT III VIBRATION MEASUREMENT AND ANALYSIS 8

Natural frequency - Time and Frequency domain analysis

UNIT IV CONTROL MECHANISMS 8

Governors - Sensitivity and effort - Gyroscope - Gyroscopic couple, Cam - Cam profile andJump phenomenon.

P:30; TOTAL:30 PERIODS

REFERENCES

1. Rattan SS, “Theory of Machines”, 4th Edition, Tata Mc Graw Hill, New Delhi, 2017.
2. Thomas Bevan, “Theory of Machines”, 3rd Edition, Pearson India, 2009.
3. Uicker JJ, Pennock GR and Shigley JE “Theory of Machines and Mechanisms”, 4thEdition, Oxford University Press, New Delhi, 2014.
4. Ballaney P L, “Theory of Machines and Mechanisms”, Khanna Publishers, New Delhi, 2005.
5. Ambedkar AG,” Mechanism and Machine Theory”, PHI Learning, New Delhi, 2009

19ME57C	COMPUTER AIDED DESIGN AND MANUFACTURING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1:Develop Part modeling, Assembly and detailing of practical engineering components. (K3)

CO2: Develop a Part model of existing physical component. (K3)

CO3: Develop a prototype using 3D printing. (K3)

CO4: Generate Cutter Location data using CAM software. (K3)

CO5: Perform simple operations in CNC Lathe and Milling machines. (K3)

UNIT I COMPUTER AIDED DESIGN 6

Part Modeling, Assembly and Detailing of Screw Jack, Flange Coupling, Knuckle Joint, Plummer Block

UNIT II REVERSE ENGINEERING 8

3D Modeling of physical components - Connecting Rod, Spur Gear, Piston - Image conversion using 3D scanner.

UNIT III ADDITIVE MANUFACTURING 8

Design and development of new product using Fusion Deposition Modeling.

UNIT IV COMPUTER AIDED MANUFACTURING 8

Numerical Control (NC) code generation using CAM software for milling and turning operations.

P:30; TOTAL:30 PERIODS

REFERENCES

1. Ibrahim Zeid, CAD/CAM: Theory & Practice, 2ndEdition, Tata McGraw - Hill Education, 2006.
2. Donald Hearn, “Computer Graphics”- Pearson Education Ltd, 2ndEdition, 2008.
3. Vinesh Raja, Kiran J. Fernandes, Reverse Engineering: An Industrial Perspective, Springer Science & Business Media - 2007.
4. Otto, Kevin; Wood, Kristin, Product Design: Techniques in Reverse Engineering and New Product Development 1stEdition, Pearson, 2010.
5. G. Boothroyd, P. Dewhurst and W. A. Knight, Product Design for Manufacture and Assembly, 3rdEdition, CRC Press, 2010.

19ME61C	**METROLOGY AND MEASUREMENTS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon the completion of this course the students will be able to

- CO1: Describe the concepts of measurements (K2)
- CO2: Outline the principles of linear and angular measurement tools (K2)
- CO3: Demonstrate the form measurement techniques (K2)
- CO4: Explain the procedure for conducting computer aided inspection (K2)
- CO5: Discuss various measuring techniques of power, flow and temperature (K2)

UNIT I BASICS OF METROLOGY 9

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – Their effect on precision and accuracy – Errors; Errors in measurements – Uncertainty in measurements – Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 9

Linear measuring instruments – Evolution – Types – Classification – Limit gauges – Gauge design – Terminology – Procedure – Concepts of interchange ability and selective assembly –Angular measuring instruments – Types – Bevel protractor, clinometers, angle gauges, spirit levels, sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY 9

Basic concept of lasers - Advantages of lasers – Laser interferometers – Types – DC and AC laser interferometers – Applications – Straightness – Alignment. Basic concepts of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of machine vision system – Element – Applications.

UNIT IV FORM MEASUREMENT 9

Principles and methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 9

Measurement of force, torque, power - Mechanical, pneumatic, hydraulic and electrical type - Flow measurement: Venturi meter, orifice meter, rotameter, pitot tube – Temperature: Bi-metallic strip, thermocouples, electrical resistance thermometer – Reliability and calibration –Reproducibility and repeatability.

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2018.
2. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2009.

REFERENCES

1. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2014.
2. Raghavendra, Krishnamurthy "Engineering Metrology & Measurements", Oxford Univ. Press, 2013.
3. Donald Peckman, "Industrial Instrumentation", Wiley Eastern, 2004.
4. Alan S. Morris, "The essence of Measurement", Prentice Hall of India 1996.
5. Charles Reginald Shotbolt, "Metrology for Engineers", 5thEdition, Cengage Learning EMEA, 1990.

19ME62C	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		2	1	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design and select a flexible drive system for a given application. (K3)
CO2: Design and select a gear drive to transmit power between two parallel shafts.(K3)
CO3: Design and select a gear drive to transmit power between two non-parallel shafts. (K3)
CO4: Select a suitable ray diagram and construct the kinematic arrangement of gears to design multi speed gear box. (K3)
CO5: Select and design brakes, clutches and Power screws for appropriate applications. (K3)

UNIT I DESIGN OF FLEXIBLE TRANSMISSION SYSTEMS 9

Design of flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wireropes and pulleys – Design of transmission chains and sprockets.

UNIT II SPUR AND HELICAL GEARS 9

Speed ratios and number of teeth - Force analysis - Tooth stresses – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane - Equivalent number of teeth - Forces for helical gears.

UNIT III BEVEL AND WORM GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth.Estimating the dimensions of pair of straight bevel gears. Worm Gear: Terminology, Thermal capacity, materials - forces and stresses, efficiency, estimating the size of the worm gear pair.

UNIT IV GEAR BOXES 9

Gear box - Geometric progression, standard step ratio, Ray diagram, kinematics layout – Design of sliding mesh gear box - Constant mesh gear box.

UNIT V FRICTION DRIVES 9

Clutches - Introduction, Principle of operation of friction clutches, Clutch materials, friction lining materials, Types of clutches - Single plate clutches, Multi-plate clutches, Axial clutches, Cone clutches, Centrifugal clutches – Shoe or block brakes (single & double), internal and external shoe brakes, self-locking and self-energizing of brakes, simple and differential band brakes - Design of power screw - Square threads - Force analysis (for screw jack, lathe, etc.,)

L:30; T:15; TOTAL: 45 PERIODS

TEXT BOOKS

1. Robert L Norton, “Machine Deign” Pearson Education, 5thEdition, 2018
2. Bhandari V, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 4thEdition, 2016.

REFERENCES

1. Gitin M Maitra, Prasad L, “Handbook of Gear Design”, Tata Mcgraw-Hill, 2011.
2. Prabhu T J, “Design of Transmission Systems”, Private Publication, 5thEdition, 2018.
3. Richard Budynas, Keith Nisbett, “Mechanical Engineering Design”, Mc-Graw Hill, 2011.
4. Spotts M F, Shoup T E, Hornberger L E, “Design of Machine Elements”, Prentice Hall of India, 8thEdition, 2007.
5. William Orthwein, “Machine Component Design”, Vol. I and II, Jaico Publishing house, New Edition, 2006.
6. IS 6938: Design of rope drum and chain hoists for hydraulic gates-Code of practice
7. IS 15146:2002 ISO 155:1998, Belt Drives- Pulleys-Limiting Values Adjustment of Centers.

19ME63C FINITE ELEMENT ANALYSIS

L	T	P	C
2	1	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss fundamental concepts of FEA and to solve mechanical engineering problems using suitable approximation method. (K3)
CO2: Solve structural problems using one dimensional element. (K3)
CO3: Select suitable two-dimensional elements to solve structural problems under plane stress and plane strain conditions. (K3)
CO4: Apply the concept of axisymmetric and dynamic analysis. (K3)
CO5: Formulate Isoparametric elements and model the problems in FEA (K3)

UNIT I FEA BASICS AND APPROXIMATION METHODS 9

Basic concepts of FEA - Engineering analysis - General procedure for FEA - Elasticity equations - Weighted residual method - Rayleigh Ritz method - Weak formulation method - Application to structural and heat transfer problems.

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS 9

Introduction - Finite element modeling, Coordinates - linear bar element, Truss and Beam

Elements - Interpolation function, Derivation of characteristic matrices. - Problems on structural and heat transfer analysis - Quadratic Bar element (Derivations only).

UNIT III TWO-DIMENSIONAL FINITE ELEMENT ANALYSIS 9

Dimensionality of a problem - Constant strain triangular element - Shape function, strain displacement, Stress calculations, temperature effects - Plane problems of elasticity - Problems in plane stress and plane strain - Application to solid mechanics and heat transfer problems.

UNIT IV AXISYMMETRIC ELEMENTS AND DYNAMIC ANALYSIS 9

Modeling techniques - use of symmetry, modeling of offsets, supports and joints. Axisymmetric formulation, Applications to cylinders under internal pressure and rotating disc- Types of dynamic analysis, general dynamic equation of motion, lumped and consistent mass matrices of bar and beam elements - Eigen value problem, Evaluation of eigenvalues and eigenvectors.

UNIT V ISOPARAMETRIC ELEMENT FORMULATION 9

Four noded rectangular element - Shape function, Strains and stresses - Need for Isoparametric formulation - four noded quadrilateral element - Numerical Integration, Application to structural problems – Usage of CAE software for different applications.

L:30; T:15; TOTAL: 45 PERIODS

TEXT BOOKS

1. Rao, S.S., The Finite Element Method in Engineering, 5thEd., Elsevier Butterworth Heinemann, 2011.
2. Seshu P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2013.

REFERENCES

1. Bathe, K.-J., Finite Element Procedures, PHI Learning, New Delhi, 2010.
2. David V Hutton, “Fundamentals of Finite Element Analysis”, Tata McGraw-Hill Edition, 2017.
3. Cook, Robert D, Plesha, Michael E and Witt Robert J “Concepts and Applications of Finite Element Analysis”, Wiley Student Edition, 2012.
4. Reddy J N, “An Introduction to the Finite Element Method”, McGraw-Hill International Editions, 2009.

19ME64C PROJECT MANAGEMENT

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the concept of project management. (K2)
CO2: Apply the project monitoring techniques. (K2)

UNIT I PROJECT FORMULATION AND APPRAISAL 8

Introduction to project management – Project life cycle - Project selection and formulation –Investment decision analysis - Project appraisal – Break-even Analysis-Risk Analysis.

UNIT II PROJECT MONITORING AND CONTROL 7

Network techniques – CPM & PERT - project management teams and coordination - Monitoring and post implementation, evaluation of the project.

L:15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Gobalakrishnan P and Ramamoorthy VE, "Textbook of Project Management", Macmillan Publications, 2014.
2. Maylor, "Project Management", 3rdEdition, Pearson, 2010.

REFERENCES

1. Gido, "Effective project management", 5thEdition, Cengage Learning, 2012.
2. Gray and Larson, "Project Management: The Managerial Process", 4thEdition, TMH, 2013.
3. Choudhury S, "Project Management", 1stEdition, Tata Mc Graw Hill Publishing Co., 2008.

19ME65C	COMPREHENSION	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Recollect the knowledge acquired during the earlier semesters. (K2)

CO2: Apply fundamental principle of mechanical engineering concepts to solve real life problems. (K3)

CO3: Present technical topics and discuss about them. (K2)

CO4: Analyze and interpret experimental data with relevance. (K4)

UNIT I REVIEW OF TECHNICAL KNOWLEDGE 6

Review of various courses learned in the previous semesters by conducting objective type tests.

UNIT II PRESENTATION 6

A group of students present on any technical topic of their interest.

UNIT III ANALYSIS OF EXPERIMENTAL DATA 6

Analyzing and interpreting the results of experiments conducted in the earlier semester laboratory courses.

UNIT IV IDENTIFYING REAL LIFE PROBLEMS AND PROPOSING SOLUTIONS 6

Real life industrial problems which they may face in their work place will be analyzed and solutions will be formulated. At least one such problem will be identified and solved by each group of students.

UNIT V REPORT WRITING 6

A thirty-page summary report should be submitted by each group of students for evaluation. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.

L:30; TOTAL: 30 PERIODS

19ME66C	METROLOGY AND AUTOMATION LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon the completion of this course the students will be able to

CO1: Calibrate vernier, micrometer, slip gauges for inspection. (K3)
CO2: Measure the linear, angular, form and mechanical measurements. (K3)
CO3: Demonstrate the functioning of various pneumatic systems. (K4)

UNIT I LINEAR AND ANGULAR MEASUREMENT 10

Calibration and use of measuring instruments –Vernier caliper, micrometer, Vernier height gauge –using gauge blocks - Measurement of linear dimensions using Comparators - Measurement of angles using bevel protractor and sine bar

UNIT II FORM MEASUREMENT 10

Screw thread dimensions - Measurement of gear tooth parameters using gear tooth vernier caliper and profile projector - Measurement of straightness using Autocollimator - Measurement of temperature, Displacement and strain.

UNIT III PNEUMATIC CIRCUITS 10

Study of hydraulic, pneumatic and electro-pneumatic circuits - Operation of single and double acting pneumatic cylinder - Operation of double acting cylinder with quick exhaust valve - Operation of double acting cylinder in a cycle using limit switch and memory valve.

P:30; TOTAL:30 PERIODS

REFERENCES

1. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2014.
2. Raghavendra, Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.
3. Donald Peckman, “Industrial Instrumentation”, Wiley Eastern, 2004.
4. Alan S. Morris,“The essence of Measurement”, Prentice Hall of India 1996.
5. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th Edition, Cengage Learning EMEA, 1990.

19ME67C	COMPUTER AIDED ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Analyze bar, beam and truss structure to determine deflection and stresses. (K3)
CO2: Conduct structural analysis on simple components. (K3)
CO3: Perform modal and harmonic analysis for structures. (K3)
CO4: Perform conductive and convective heat transfer analysis. (K3)

UNIT I ONE DIMENSIONAL STRUCTURAL ANALYSIS 8

Structural analysis of bars, beams and trusses.

UNIT II TWO- AND THREE-DIMENSIONAL STRUCTURAL ANALYSIS 8

Stress analysis of shaft, gear with hole, Stress analysis of pressure vessel and L bracket.

UNIT III VIBRATION ANALYSIS 7

Dynamic analysis of bar and beam for natural frequency and mode shape. Vibration analysis of 2D plate, Harmonic vibration analysis of simple beam.

UNIT IV THERMAL ANALYSIS 7

Thermal analysis- 1D and 2D with conduction and convection, Transient heat transfer analysis – Thermal stress analysis.

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Saeed Moaveni, “Finite Element Analysis (Theory and application with ANSYS software)”, 4th Edition, Pearson Education Limited, 2015.
2. Paleti Srinivas, Krishna Chaitanya Sambana and Rajesh Kumar Datti, “Finite Element analysis Using ANSYS® 11.0”, PHI Learning Pvt. Ltd., 2010.
3. Nakasone Y, Yoshimoto S and Stolarski TA, “Engineering Analysis with ANSYS software”, Elsevier Butterworth-Heinemann, 2006.
4. Erdogan Madenci, Ibrahim Guven, “The Finite Element method and Applications in Engineering using ANSYS®”, Springer Publisher, 2006.

19ME68C	**PRODUCT DEVELOPMENT LABORATORY**	**L**	**T**	**P**	**C**
		1	**0**	**2**	**2**

Upon completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)

CO2: verify the functionality of the concept through prototyping (K4)

UNIT I Need identification, target specifications and Concept Selection 20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

UNIT II Prototyping and Demonstration 25

Prototyping: Low-fidelity and High-fidelity prototyping – Cost estimation – Product demonstration - documentation.

L:15;P: 30; TOTAL: 45 PERIODS

REFERENCE BOOKS

1. Michael G Luchs, Scott Swan, Abbie Griffin, “Design Thinking: New Product Development Essentials from the PDMA”, Willey, 2015
2. Christian Muller-Roterberg, “Design Thinking”, Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata Mc Graw Hill Education, 4th Edition, 2011.
4. George E Dieter, Linda C Schmidt, “Engineering Design”, Mc-Graw Hill International Edition, 5thEdition, 2013.
5. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2013.

MENTOR ACTIVITIES

- Forming multidisciplinary/interdisciplinary batches among the students
- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students’ activities through demonstration and presentations

End semester Assessments can be made through:

- Product demonstration and presentation

Other points:

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four
- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

19ME71C	INDUSTRIAL ENGINEERING	L	T	P	C
		2	0	0	2

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: understand the various production planning methodologies and layout design(K2)
- CO2: carryout process planning and control to increase theproductivity. (K2)
- CO3: suggest the effective work studyand ergonomics for better productivity. (K2)
- CO4: handle the inventory management and suitable material handling equipment. (K2)
- CO5: understand the concept of value engineering and plant maintenance. (K2)

UNIT I PRODUCTION SYSTEM 6

Industrial Engineering- Concept, History and development, Applications, Roles of Industrial engineer- Production management, Industrial engineering versus production management, operations management- Production System Analysis, input output model, Productivity, Factors affecting productivity- Plant layout, Criteria for good layout, Types of layout, Flow pattern,Work station design.

UNIT II PROCESS PLANNING AND PRODUCTION CONTROL 6

Introduction to process planning - Definition, Procedure, Process selection, Machine capacity, process sheet, process analysis. Group technology –classification and coding system. Production planning, loading, scheduling. Production control-dispatching, routing - progress controlbar, curve, Ganttchart, routeand schedule chart.

UNIT III WORK STUDYAND ERGONOMICS 6

Workstudy-Definition, Need, Advantages, method study and work measurement, Process chart symbols, outline process chart, flowprocesschart,multiple activity chart, flow diagram, string diagram, operation analysis, principles of motion economy, Therbligs, SIMO chart,stopwatchprocedure,micro&macromotionstudy,ergonomics-applications ofergonomic principlesinthe shopfloorwork benchesseatingarrangement, Industrialphysiology.

UNIT IV INVENTORY MANAGEMENT 6

Inventory control, classification, management, objectives,functions. Economic order quantity, Economic batch quantity, inventory models, ABC analysis, Material Requirement Planning (MRP I), Manufacturing Resource Planning (MRP II), Operating cycle, KANBAN technique, lean manufacturing, Supply chain management-Material Handling Functions, Principles, Engineering and economic factors, Material handling equipment selection, maintenance,types.

UNIT V SYSTEM ANALYSIS AND MAINTENANCE 6

System concept-system analysis, systems engineering, techniques and applications. Value analysis - Aim, technique, procedure, advantages, value engineering, value control, types of values. Plant maintenance - objectives, importance, maintenance engineer duties, functions and responsibilities. Types- breakdown, scheduled, preventive and predictive- Plant maintenance schedule, Condition monitoring.

L:30; TOTAL:30 PERIODS

TEXT BOOKS

1. MartandT.Telsang, Industrial Engineering and Production Management, S Chand Publishers, 2018.
2. Ravi Shankar, Industrial Engineering and Management, GalgotiaPublications Pvt. Ltd., New Delhi, 2012.

REFERENCES

1. Jan Dul, Bernard Weerdmeester, Ergonomics for Beginners: A quick Reference Guide, CRC Press, TaylorandFrancis group, 2008.
2. Lee J.Krajewski, Larry P. Ritzman, Foundations of Operations Management, Addison Wesley, 2015.
3. PanneerselvamR., Production and operations management, Heritage Publishers, 2012.
4. Khanna O.P., Industrial Engineering and management, DhanpatRai Publications, 2012.

19ME72C	PROJECT WORK - I	L	T	P	C
		0	0	6	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify an innovate or creative idea / concept / solution to a problem (K3)
CO2: perform the detailed literature survey related to concept / idea (K2)
CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modeling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

P:90; TOTAL:90 PERIODS

19ME73C	RESEARCH PAPER AND PATENT REVIEW – SEMINARL	T	P	C
	0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the emerging technology / research development in the engineering Field(K2)
CO2: acquaint with the concepts published in reputed journals on their area of interest(K2)

CO3: examine patents and procedures available in the data base.(K3)
CO4: effectively communicate the contents to the target audience and handle the questions with confidence(K3)
CO5: Check for patent plagiarism(K2)

The students will make a technical presentation on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

P:30; TOTAL:30 PERIODS

19ME74C INTERNSHIP / IN-PLANT TRAINING

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO1: acquire the knowledge of different industrial / organizational activities (K2)
CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department
2. A report should be submitted after the successful completion of internship / in-plant training.

P: 60; TOTAL: 60 PERIODS

19ME81C PROJECT WORK - II

L	T	P	C
0	0	12	6

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO1: design and develop the working model (K3)
CO2: work independently to complete the project along with team members (K2)
CO3: demonstrate the results and documents the report (K4)

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

P:180; TOTAL:180 PERIODS

B.E. – MECHANICAL ENGINEERING

OPEN ELECTIVE COURSES

Group – I (Basic Science Courses)

19ME01N	APPLIED CHEMISTRY	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: gain knowledge on various purification and refining process in metallurgy (K1)
- CO2: select proper engineering materials for desired engineering application (K2)
- CO3: design an energy storage device by applying the basic concepts of batteries(K1)
- CO4: synthesize the polymers used in day-to-day life (K1)
- CO5: acquire knowledge on principle and applications of thermal analytical techniques. (K2)

UNIT I METALLURGY 9

Introduction - Various processes involved in extraction of metals – purification of metals – applications of redox reactions to extraction of elements from their ores: Ellingham diagrams. Secondary refining processes including AOD, VAD, VOD, VAR and ESR

UNIT II ENGINEERING MATERIALS 9

Refractories: classification and properties; Refractoriness, porosity, Dimensional stability – Lubricants: mechanism of lubrication – properties of lubricants – solid lubricants; Diamond and graphite – Abrasives: classification and uses.

UNIT III ENERGY RESOURCES AND STORAGE DEVICES 9

Nuclear energy fission and fusion reaction – nuclear reactor – solar energy conversion-solar cells wind energy – fuel cells. Hydrogen and oxygen fuel cell batteries alkaline batteries lead acid. Nickel cadmium and lithium batteries.

UNIT IV POLYMERS 9

Polymers: Types of Polymerization. Thermoplastics & thermosetting polymers. Preparation, properties and applications of the Polyethylene, Teflon, PVC, Nylon, Phenol formaldehyde & Urea Formaldehyde, Elastomers: Natural rubber, Vulcanization of rubber & Synthetic rubber.

UNIT V THERMOANALYTICAL METHODS 9

Thermo analytical methods - principle involved in differential thermal analysis - characteristics of TGA, DSC and DTA - thermo grams – factors affecting TGA and DTA curves - discussion of various components of the instrument with block diagrams - Applications of DT.

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Dara S.S. and Umare S.S., “A text book of Engineering Chemistry”, S.Chand and Company Limited, New Delhi, 2013.
3. Chawla.S, “A text book of Engineering Chemistry”, 16thEdition, Dhanpat Rai

Publishing Company, New Delhi, Reprint 2015.

REFERENCES

1. Lee, J. D., Concise Inorganic Chemistry, 5thEdition, Wiley-India, 2010
2. B.K. Sharma – “Industrial Chemistry”, 1st Ed., Goel Publication, Meerut. 1983
3. V.R.Gowarikar, N.V. Viswanathan, Polymer science, Wiley Eastern Limited, New Delhi 1986.
4. Skoog D.A., James H. F. and Crouch S.R., “Instrumental Analysis”, Cengage Learning India Private Limited, New Delhi, 2011.
5. F.W.Billmeyer, A Text book of Polymer Chemistry, John Wiley & sons, Singapore, 1994.

19ME02N	BIOPHYSICS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: infer the basics of biophysics. (K2)
CO 2: interpret the structural aspects of proteins. (K2)
CO 3: interpret the structural aspects of nucleic acids. (K2)
CO 4: describe the significance of conformational aspects of Carbohydrates. (K2)
CO 5: summarize the different techniques in the investigation of biomolecules. (K2)

UNIT I BASICS OF BIOPHYSICS 9

Molecular alphabets of life (Amino acids, nucleic acid bases, saccharides and lipids) – Roles of biomolecules in biological functions – Geometry of biomolecules – Conformation and Configuration – Various bonds involved in structural stabilization of biomolecules.

UNIT II PROTEINS 9

Structure and properties of Amino acids - Structure and Conformations of proteins - Allowed conformations for a pair of linked peptide units – Ramachandran contact criteria and Ramachandran map – globular and fibrous proteins – Protein databases.

UNIT III NUCLEIC ACIDS 9

Base pairs - Nucleotides – Double helical structure of DNA, Watson and Crick model - base pairing and base stacking, Interactions stabilizing the structure of DNA – DNA polymorphism - A, B and Z forms – Structural elucidation of DNA.

UNIT IV CARBOHYDRATES 9

Monosaccharides, Disaccharides and Oligosaccharides – Structural and conformational aspects of some basic sugars. – Glycosidic torsional angles – Conformational map for typical disaccharides – Some significant polysaccharides and its applications - Carbohydrates as integral part of biological systems.

UNIT V BIOPHYSICAL METHODS 9

Basics of X-ray diffraction, X-ray Protein Crystallography, X-ray fibre diffraction. Structural investigation of Biomolecules by theoretical methods - Molecular Mechanics and Molecular Dynamics – Concepts- Visualization and graphical tools for different representation of Biomolecules.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Jack A.Tuszynski& Michal Kurzynski, “Introduction to Molecular Biophysics”, 1stEdition, CRC press, 2003.
2. Reginald H. Garrett & Charles M. Grisham, “Biochemistry”, 6thEdition, Cengage Learning Publishers, 2016.
3. Nathan R .Zaccai, Igor N .Serdyuk& Joseph Zaccai, “Methods in Molecular Biophysics”, 2ndEdition, Cambridge University Press, 2017.

REFERENCES

1. VasanthaPattabhi& Gautham N, “Biophysics”, 2ndEdition, Narosa Publishing House, 2011.
2. P. Narayanan, “Essentials of Biophysics”, 1stEdition, Anshan Publishers, 2010.
3. David Whitford, “Proteins: Structure and Function”, 1stEdition, John Wiley & Sons, 2013.
4. Jan Drenth, “Principles of Protein X-Ray Crystallography”, 2ndEdition, Springer, 2013.

19ME03N CALCULUS AND STATISTICS FOR ENGINEERS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Interpret the convergence of sequence and series (K2)
CO 2: Solve Bessel’s and Legendre’s equation (K2)
CO 3: Extremize the functional. (K3)
CO 4: Apply the concept of testing of hypothesis for small and large samples (K3)
CO 5: Apply the basic concepts of classifications of design of experiments (K3)

UNIT I SEQUENCES AND SERIES 9

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions

UNIT II POWER SERIES SOLUTIONS FOR DIFFERENTIAL EQUATIONS 9

Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties – Generating functions.

UNIT III CALCULUS OF VARIANTIONS 9

Concept of variation and its properties - Euler’s equation - Functional dependent on first and higher order derivatives - Functional dependent on functions of several independent variables - Variational problems with moving boundaries - Ritz method.

UNIT IV TESTING OF HYPOTHESIS 9

Sampling distributions - Tests for single mean, Proportion, Difference of means (for large samples) – Tests for single variance and equality of variances – t-test, F-Test and Chi-square test for goodness of fit – Independence of attributes.

UNIT V DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Srimanta Pal Subodh C. Bhunia " Engineering Mathematics" 1st Edition, Oxford Uuniversity press ,India , 2015
2. Grewal.B.S."Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.
3. Gupta, A.S., "Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi,2004
4. Arnold O. Allen, "Probability, Statistic and Queueing Theory with Computer Science Applications", 2nd Edition, Elsevier a division of Reed Elsevier India Private limited, New Delhi, 2012
5. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Johnson. R.A, Miller.I and Freund.J, Miller and Freund's Probability and Statistics for Engineers. Pearson Education, Asia, 8thsEdition, 2015.
2. Gary W. Oehlert, A First Course in Design and Analysis of Experiments, 1stEdition, W.H.Freeman and Company, 2010
3. Richard A. Johnson, Irwin Miller, John Freund, "Miller & Freund's Probability and Statistics for Engineers", Pearson Education Limited, Global Edition, 9thEdition, 2017.

19ME04N CORROSION SCIENCE AND ENGINEERING

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the thermodynamic and kinetic concept of corrosion. (K2)
CO2: describe the various forms of corrosion. (K2)
CO3: recognize the various corrosion testing techniques. (K2)
CO4: explain the various corrosion control methods. (K2)
CO5: describe the corrosion and its control methods of various industrial components (K2)

UNIT I THERMODYNAMICS AND KINETICS OF CORROSION 9

Need and importance - Causes - Corrosion of various metals and alloys in mineral acids, seawater, fresh water and high - purity water. Pourbaix diagrams, Electrode Kinetics Exchange Current Density, Activation Polarization, Concentration Polarization, Combined Polarization, Mixed-Potential theory, Mixed Electrodes, Passivity, Mechanisms of the Growth and Breakdown of Passive Films.

UNIT II FORMS OF CORROSION 9

Uniform attack, Galvanic, Crevice, pitting, Intergranular, Erosion corrosion, Stress induced Corrosion– Bacterial corrosion – Marine corrosion - High temperature corrosion-Mechanism.

UNIT III CORROSION TESTING 9

Introduction - Weight loss method - Electrochemical methods - Warren test - NACE and slow strain rate test methods - Evaluating Pitting, crevice, galvanic, intergranular, exfoliation and stress corrosion.

UNIT IV CORROSION PROTECTION METHODS 9

Alloys - Anodic protection, Cathodic Protection, Inhibitors, Coatings: Organic coating, Metallic coating, Anodizing, phosphating, Chromate coating and control of Bacterial corrosion.

UNIT V CORROSION OF INDUSTRIAL COMPONENTS 9

Importance of corrosion prevention in various industries: The direct and indirect effects of corrosion - Corrosion and its control in Power industries, automotive industry, Chemical processing industries, marine industries and petroleum production and refining Industries

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., “Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2013.
2. Dara S.S. and Umare S.S., “A text book of Engineering Chemistry”, S.Chand and Company Limited, New Delhi, 2013.
3. Chawla.S, “A text book of Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2015.

REFERENCES

1. S. Sastri, E. Ghali, and M. Elboujdaini, Corrosion Prevention and Protection, Practical Solutions, Wiley, Chichester, England, 2007.
2. R. Winston Revie and Herbert H. UHLIG, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, 4th Edition-March 2008, John Wiley & Sons, Inc., publication ISBN: 978-0-471-73279-2,
3. BrankoN.Popov , Corrosion Engineering Principles and Solved Problems ISBN-13; 978-0-444-62722-3 Elsevier-2015
4. Zhaki Ahamed, Principles of Corrosion Engineering and corrosion control, First Edition 2008, Elsevier, ISBN-13-978-0-7506-5924-6
5. Mars G.Fontana, Corrosion Engineering, Third Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi. ISBN-13;978-0-07-060744-6
6. Volkan Cicek Corrosion Engineering Scrivener Publishing LLV and John Wiley & Sons, Inc., publication 2014 ISBN-978-1-118-72089-9

7. Philip A.Schweitzer, P.E. Corrosion Engineering Hand Book,Marcel Dekker, Inc., New York,1996, ISBN -0-8247-9709-4

19ME05N	**POLYMER SCIENCE AND TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the basic concept of polymer, the importance of polymers in various fields,and differentiate the different types of polymers based on its function. (K2)
CO2: Acquire the knowledge to impart special properties to the polymer by modifying the structural features of polymers. (K2)
CO3: Identify the various polymer processing techniques which relate directly to the material(s) used in its construction (K2)
CO4: familiar with the various analytical methods to determine the physical and chemical properties of polymers. (K2)
CO5: familiar with the applications polymers in various fields. (K2)

UNIT I INTRODUCTION 9

Introduction-Monomers, functionality, degree of polymerizations-classification of polymers- glass transition-melting transition-criteria for rubberiness-polymerization methods: addition and condensation; metallocene polymers and other newer techniques of polymerization- copolymerization, monomer reactivity ratios and its significance-kinetics-different copolymers: random, alternating, azeotropic copolymerization, block and graft copolymers- techniques for copolymerization-bulk, solution, suspension, emulsion.

UNIT II STRUCTURE PROPERTY RELATIONSHIP 9

General structural features of polymers: Effects of atoms -types of bonds-bond dissociation energy-functional groups on properties of polymers. Polymer chain flexibility: concept-various factors for deciding flexibility- properties of polymers affected by flexibility - Intermolecular orders: Amorphous-crystalline and oriented forms of polymers-crystallinity in polymers-factors affecting crystallinity-properties affected by the crystallinity of polymers.

UNIT III POLYMER PROCESSING TECHNIQUES 9

Type of reactors: batch reactors-tubular flow reactors- stirred tank reactors. Processing Techniques: Basic of processing techniques -One-dimensional process (Coating and Adhesives)-Compression molding-transfer molding-injection molding-blow molding-reaction injection molding-extrusion-pultrusion-calendaring-rotational molding-thermoforming-rubber processing in two-roll mill-internal mixer.

UNIT IV MOLECULAR CHARACTERIZATION OF POLYMERS 9

Mechanical-static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.

Analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA) and microscopic (optical and electronic) techniques.

UNIT V APPLICATION OF POLYMERS 9

Technical applications: thermoplastics (PVC, PVA)-thermostats (PF, UF), and elastomers (SBR, GR-N)-silicones. Application of polymers in space, ocean, electronics, medical, agriculture, automobile, sports, and building construction. Special Polymers: Fire retardant polymers- Biodegradable polymers-electroluminescent polymers.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Premamoy Ghosh, Polymer Science and Technology: Plastics, Rubber, Blends and Composites, McGraw Hill Education; 3rd Edition, 2017.
2. Richard A Petherick, Polymer Science and Technology for Engineers and Scientists, Whittles Publishing, 2010.

REFERENCES

1. Anil Kumar, Rakesh K. Gupta, Fundamentals of Polymer Engineering, Revised and Expanded, CRC Press,2003
2. Fred W. Billmayer, Textbook of Polymer Science, John & Wiley inc., 1984
3. Alfred Rudin, Philip Choi, The Elements of Polymer Science and Engineering, 3rd Edition, Academic press publications, Elsevier, 2013.

19ME06N LASER TECHNOLOGY

	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the basic concepts of lasers. (K2)
CO2: learn the surface treatment process by laserK2)
CO3: describe the cutting, welding and drilling processes using laser (K2)
CO4: explain the micro machining processes by laser (K2)
CO5: gain knowledge about holography and medical applications of lasers (K2)

UNIT I BASIC PRINCIPLE OF LASER AND ITS TYPES 9

Characteristics of laser -Spontaneous and Stimulated Emission process and Einstein’s coefficients-Population inversion-Pumping-meta-stable state- wave length chart types of laser- three & four level lasers, Continuous Wave Lasers, Pulsed lasers, Q-switch lasers Solid state lasers: Nd-YAG laser-Liquid lasers: Dye laser, Gas laser: Argon ion laser-Krypton ion laser

UNIT II LASER SURFACE TREATMENT 9

Introduction –forms of laser surface treatment-laser transformation hardening - advantages - laser surface melting - laser alloying - laser cladding-co-axial powder feeding lateral powder feeding-laser texturing-case examples

UNIT III LASER WELDING CUTTING AND DRILLING 9

Laser welding -process arrangement - mechanisms - applications –modes of welding-conduction limited welding-key hole welding-heat flow theory - one dimensional heat flow - Laser cutting –process characteristics-theoretical models of cutting - practical performance applications –process variation- drilling –single pulse drilling-percussion drilling-trepanning applications.

UNIT IV MICROMACHINING AND LASER SAFETY 9

Fiber Laser and UV Laser based marking - micromachining solutions - laser shock loading - basics - applications - laser safety - danger - safety limits - eye and skin - class four safety arrangements - electric hazards - fume hazards.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical Science: Medical lasers, Laser diagnostic, Laser in ophthalmology, Laser for general surgery, Laser in dermatology, laser in dentistry- laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. William M. Steen, “Laser Material Processing”, Springer Verlag, 2003
2. K.Thyagarajan, AjoyK.Ghatak, “Lasers, Theory and Applications”, Plenum Press, 1981.

REFERENCES

1. Svelto, “Principles of lasers” 5thEdition, Springer International publishing, 2010
2. Paulo Ribeiro, Maria Raposo, “Optics, Photonics and Laser Technology”, Springer International publishing, 1stEdition, 2018
3. Uday Shanker Dixit, Shrikrishna N. Joshi, J. Paulo Davim, “Application of Lasers in Manufacturing” Springer Singapore, 1st Edition, 2019
4. Stephan Wieneke and Christoph Gerhard, “Lasers in Medical Diagnosis and Therapy Basics, applications and future prospects” IOP Publishing Ltd, 2018
5. AK Katiyar, CK Pandey and Manisha Bajpai, “Fundamentals of Laser Systems and Applications”, Wiley, 2017.

19ME07N	**FUNDAMENTALS OF NANO SCIENCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the fundamentals of nanoscience (K2)
CO2: recognize the different methods of synthesizing nanomaterials (K2)
CO3: identify the exact characterization technique to analyze different properties (K2)
CO4: describe the different properties of nanomaterials(K2)

CO5: explain the various applications of nanomaterials in different fields (K2)

UNIT I BASIC CONCEPTS OF NANOSCIENCE 9

Introduction of nanomaterials - History of nanomaterials - Size effect of Nanomaterials: Size, shape, density, melting point, wet ability and specific surface area - Surface to Volume Ratio – Energy at the Nanoscale - Quantum Confinement Effects –Nanosized metals, alloys, semiconductors, ceramics – classification based on the dimensionality: nanoparticles, semiconducting nanoparticles, nanowires, nanoclusters, nanotubes, quantum wells, metal based nanostructures, nanocomposites, carbon nanotubes

UNIT II SYNTHESIS OF NANOMATERIALS 9

Bottom-up, Top-down Approach - Inert gas condensation, Plasma arc technique, Ion sputtering, Laser ablation, Ball Milling, Molecular beam epitaxy (MBE), Chemical vapour deposition (CVD) method, Ultrasonication, Chemical precipitation and co-precipitation, Sol-Gel synthesis; Microemulsions synthesis, Hydrothermal, Solvothermal synthesis methods, Microwave assisted synthesis.

UNIT III CHARACTERIZATION TECHNIQUES 9

X-ray diffraction (XRD), SEM, EDAX, AFM, TEM, Elemental mapping, FTIR, UV-Visiblespectrophotometer, Laser Raman Spectroscopy, Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermo gravimetric Analysis (TGA), X-ray Photoelectron Spectroscopy (XPS), Electrochemcial Characterization measurements, Nanoindentation.

UNIT IV PROPERTIES OF NANOSTRUCTURED MATERIALS 9

Mechanical behaviour: Modes of Deformation - Elastic and Plastic Deformation - Mechanical Stiffness - tensile strength- Fracture - Toughness - Superplasticity - Hardness -Micro-hardness - wear resistance and corrosion resistance behaviour - Hall-Petch Relation - Fundamentals of Nanomechanics and Nanotribology - Thermal properties: Thermal conductivity, thermal expansion and thermal expansion coefficient - Electrical properties: Electrical conductivity, band gap tuning, band gap determination - Magnetic properties: Magnetic hysteresis - Superparamagnetism - Optical properties of nanostructures.

UNIT V APPLICATIONS OF NANOMATERIALS 9

Functional graphene- carbon nanotube and polymer composite applications in defence and aerospace. Nanomaterials for solar Cells- Nanoscale catalysts for energy and automobile industries. Rechargeable batteries based on nanomaterials- Nanomaterials for electrodes and wearable electronics- Nano based coating and paints.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Nanostructures & Nanomaterials: Synthesis, Properties &Applications, G. Cao, Imperial College Press, 2004.
2. Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep, CRC Press, 2009

REFERENCES

1. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, C.N.R. Rao, A. Muller, A. K. Cheetham (Eds), Wiley-VCH Verlag, 2004.
2. Impedance spectroscopy: Theory, Experiment and applications, E. Barsoukov, J. R. McDonald, John Wiley & Sons Ltd, 2000.
3. Nanostructures and nanomaterials: Synthesis, properties and applications, G. Cao, Imperial College Press, 2006.

19ME08N	**BIOLOGY FOR MECHANICAL ENGINEERS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: describe the concepts of mechano biology. (K2)
CO2: acquire the knowledge on biomechanics (K2)
CO3: understanding the fabrication process of various Bioenergy sources (K2)
CO4: illustrate the various bio engineering process (K2)
CO5: know the various biomaterials and its applications produce (K2)

UNIT I MECHANOBIOLOGY 9

Introduction - Need to study - Mechanobiology of Stem Cell-Mechanobiology of Diseases-Mechanical Forces & DNA damage-Techniques in Mechanobiology

UNIT II BIOMECHANICS 9

Introduction - Fluidics in living systems - Pressure driven flows - Surface tension driven flows – Mechanics of joints – Structure – types – Biomechanical analysis of elbow, shoulder, spine and knee

UNIT III BIO-INSPIRED ENGINEERING 9

Introduction to biologically-inspired designs (BID for Biomedical and Non-biomedical applications): Human-organs-on-chips; Bio-optics; Nanostructures for Drug Delivery; Artificial neural networks; Biosensors: role in medical diagnostics; Bio-filters; Bio-robotics; 3D Bio-printing

UNIT IV BIO MATERIALS 9

Introduction – requirements – biocompatibility materials – Alloys - Titanium alloys, Stainless steel, Co-Cr-Mo alloys, Magnesium alloys - Ceramics – Properties – Applications of Joints: Skeletal joints, skeletal muscles, the elbow shoulder, Spinal column, hip, knee and ankle.

UNIT V BIOENERGY 9

Introduction – Microbial fuel cell – beneath fuel cell- Characterization -Biomass resources - Biogas production- Bioenergy distribution and end use for a sustainable future

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Y.Nelson, L.David, Lehninger Principles of Biochemistry, 7th Edition, International Edition. New York: W. H. Freeman, Macmillan Learning, 2017.
2. S.ThyagaRajan., N.Selvamurugan. M.P.Rajesh. R.A.Nazeer, W.Richard, S.Thilagaraj, Barathi, and Jaganathan.M.K, "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012.
3. Bioenergy: Principles and Applications by Yebo Li and Samir Kumar Khanal,1st Edition, 2016
4. Gefen, Amit, Cellular and biomolecular mechanics and mechanobiology, Springer, 2010

REFERENCES

1. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 7th Edition, W. H. Freeman & Co, 2012.
2. Jonathan Black, "Biological Performance of Materials: Fundamentals of Biocompatibility" Fourth Edition: CRC Taylor & Francis Group, London, 2006.
3. Judy D. Wall and Caroline S. Harwood, Bioenergy, 1st Edition, 2008
4. Christopher. R. Jacobs,Introduction to Cell mechanics and Mechanobiology, Garland Science, 1st Edition, 2012

19ME09N	**INTRODUCTION TO ROBOTICS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the fundamentals of robot's configurations for the design (K2).
CO2: Identify a suitable gripper and sensor system of the robot (K3).
CO3: Select suitable on drive systems for various actuations of robot (K3).
CO4: Develop robot programs for the specific applications (K3).
CO5: Design the Unmanned Aerial Vehicle with fixed wing, multi-copter and flapping wing (K3).

UNIT I INTRODUCTION TO ROBOTICS 12

Introduction - Automation – Robotics - Brief History, Basic Concepts of Robotics such as Definition, Three laws, Elements of Robotic Systems, i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems based on various parameters such as work volume, type of drive, etc., Associated parameters, i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Industrial applications of the robot.

UNIT II GRIPPERS AND SENSORS FOR ROBOTICS 12

Grippers for Robotics - Types of Grippers, guidelines for the robotic gripper, Force analysis for various basic gripper systems. ***Sensors for Robots*** - Need for sensors- Types of Sensors used in Robotics, Classification and Selections of sensors, applications of sensors. The vision system of a robot.

UNIT III DRIVES AND CONTROL FOR ROBOTICS 12

Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. ***Control Systems***: Types of Controllers, Introduction to closed-loop control.

UNIT IV PROGRAMMING AND LANGUAGES FOR ROBOTICS 12

Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, ***Programming Languages***: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc., - case studies.

UNIT V UNMANNED AERIAL VEHICLE 12

Unmanned Aerial Vehicle (UAV) - Taxonomy –Need –definition- applications- Remote sensing, Aerial mapping, Disaster response, Surveillance Search and rescue, Transportation Payload delivery.

Development strategy of Fixed wing UAVs - Multi-copter UAV- Flapping wing UAV- Swarm Robot - case study.

L:45; T:15; TOTAL:60 PERIODS

TEXT BOOKS

1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education, 2014.
2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press, 2006.
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, 2019.

REFERENCES

1. R. K. Mittal, I. J. Nagrath, Robotics and Control, Tata McGraw Hill Publishing CoLtd, New Delhi, 2003.
2. S. B. Niku, Introduction to Robotics – Analysis, Contro, Applications, 3rd edition, John Wiley & Sons Ltd., 2020.
3. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer, 1997.
4. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, Industrial Robotics 2nd edition, SIE, McGraw Hill Education (India) Pvt Ltd, 2012.
5. R.D.Klafter, Thomas A.Chmielewski, and MechaelNegin, Robotic Engineering – An Integrated Approach, EEE, Prentice Hall India, Pearson Education Inc, 2009.

Group – II (Engineering Science Courses of other discipline)

19ME11N	TESTING AND CALIBRATION OF INSTRUMENTS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain key terms related to testing and calibration. (K2)
CO2: illustrate the test measurement instrumentation system. (K2)
CO3: explain the testing procedures for industrial instruments. (K2)
CO4: summarize the procedures related to calibration requirements. (K2)
CO5: explain the calibration services of different laboratories. (K2)

UNIT I INTRODUCTION TO TESTING AND CALIBRATION 9

The Signal Flow of Electronic Instruments, The Instrument Block Diagram, Measurement Systems, Types of instruments, Traceability, Calibration Types, Calibration Requirements, Calibration Methodology, Instrument Specifications and Calibration Tests, Calibration Standard Requirements.

UNIT II INSTRUMENTATION AND DATA ANALYSIS 9

Test Measurement Instrumentation, Process Instrumentation, Test Objective - Requirements and limitations, Test Data - Format and Analysis.

UNIT III TESTING OF INSTRUMENTS 9

Voltage-Voltmeter, Current - Ammeter and Resistance - Ohmmeter, Temperature - Thermocouple, Pressure - Primary pressure sensing elements-Diaphragm, Bourdon tube**. Flow – Pitot tube, Anemometer.**

UNIT IV CALIBRATION REQUIREMENTS 9

Calibration procedure, calibration procedure content, calibration datasheet, Instrument Specification Forms, Project Specifications, Manufacturer’s Specifications, Calibration Intervals, Safety Considerations, Calibration Status Labels.

UNIT V CALIBRATION STANDARDS 9

National Measurement Standard Laboratories, Commercial Calibration Services, **Standards in different National Laboratories and Bureaus**, calibration management and maintenance.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mike Cable, “Calibration - A technician’s guide”, ISA, 2005.
2. Vaisala Oyj, “Calibration Book”, Calibration book project team, 2006.

REFERENCES

1. Clyde F.Coombs Jr, “Electronic Instrument Handbook”, Tata McH, 3rd Edition, 2008.
2. M/s. Beamex OYED, Fram in Vaasa, Finland, 2nd Edition, 2012.
3. Tony R. Kuphaldt, “Lesson in Industrial Instrumentation”, 2017.

19ME12N	DIGITAL ELECTRONICS FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the binary number system and codes. (K2)
CO2: simplify the Boolean expression using K map reduction techniques. (K3)
CO3: analyse and design combinational circuits. (K3)
CO4: analyse and design basic sequential circuits. (K2)
CO5: design and implement digital logic using memories. (K2)

UNIT I BINARY SYSTEMS 9

Introduction of Digital Computers and Digital Systems, Binary numbers, Base Conversion (BINARY, DECIMAL, HEX, OCTAL), R's Complement, (R-1)'s Complement, Binary Codes.

UNIT II BINARY LOGIC AND BOOLEAN ALGEBRA 9

Basic Binary logic, Basic and Universal logic gates, Boolean theorems and algebra, Postulates, De-Morgan's Theorems, SOP and POS forms, Canonical form, Boolean Function Implementation. Simplification using Boolean algebra, Karnaugh map - 2 – Variable, 3 – Variable, 4 – variable using Don't care condition.

UNIT III COMBINATIONAL CIRCUITS 9

Basic Combinational circuit, Design procedure of combinational logic, Adder - Half Adder, Full Adder, Subtractor, Half Subtractor-Full Subtractor, Code Conversion-BCD – Excess-3 conversion, Decoder, Encoder, Multiplexer, Demultiplexers.

UNIT IV SEQUENTIAL CIRCUITS 9

Sequential Circuits – Latches and types of Flip Flops, Shift Registers types and universal shift register – Counters -up counter, down counter and up down counter, Johnson counter, ring counter, ripple counter.

UNIT V MEMORY AND PROGRAMMABLE LOGIC DEVICES 9

Memories: RAM – SRAM, DRAM and ROM – Programmable Logic Array - Programmable Array Logic.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Morris Mano M. and Michael D. Ciletti, Digital Design, 5th Edition, Pearson Education, 2013.
2. Charles H. Roth Jr, Fundamentals of Logic Design, 5th Edition, Jaico Publishing House, Mumbai, 2003.

REFERENCES

1. John F. Wakerly, Digital Design Principles and Practices, 4th Edition, Pearson Education, 2007.
2. Kharate G. K., Digital Electronics, Oxford University Press, 2010.
3. R.P.Jain, "Modern Digital Electronics", TMH, 2nd Edition, 2013.

19ME13N	INSTRUMENTATION AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the principles of measurements and its standard (K2)
CO2: describe the working principle of level, flow, and temperature measurement techniques (K2)
CO3: describe the working principle of force, speed and vibrational measurement techniques (K2)
CO4: develop a mathematical model for a mechanical system (K3)
CO5: design the control strategy for electro-mechanical system (K3)

UNIT I CONCEPTS OF MEASUREMENT SYSTEM 9

Measurement Fundamentals: The process of measurement- calibration, significance, generalized measuring system, Characteristics of measuring instruments: Static characteristics - Precision, Accuracy, Sensitivity, Repeatability, Reproducibility, Linearity, Errors- Systematic and Random, Uncertainty of Measurement,

Measurement Standards: National, Reference, Secondary, and Working Standards, interchangeability, Bias, Calibration, calibration of machine tools Traceability, Confidence level.

UNIT II LEVEL, FLOW AND TEMPERATURE MEASUREMENT 9

Measurement of Level: Direct methods - Indirect methods - Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators – Bubbler level indicators.

Flow measurement: Turbine Meters, Electromagnetic Flowmeters, Rotameter, Magnetic, Ultrasonic, Turbine flowmeter, Hot - wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Temperature: Bimetallic strip, liquid in glass thermometer, Resistance Temperature Detectors (RTD), Thermistor, Thermocouples, Pyrometers.

UNIT III FORCE, SPEED AND VIBRATION MEASUREMENT 9

Measurement of Force: Strain gauge factor, mechanical strain gauge, electrical strain gauge, platform balance, load cell - Temperature compensation techniques, use of strain gauges for measuring torque, strain gauge rosettes.

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non - contact type Stroboscope.

Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments – Vibrometer and accelerometer principle- piezo electric accelerometer.

UNIT IV MODELING AND RESPONSE OF MECHANICAL SYSTEM 9

Mathematical modelling of electrical, mechanical, and electromechanical system, spur and gear mechanism – servomechanism - time response of first order and second order mechanical system.

UNIT V CONTROL SYSTEM PRINCIPLE 9

Basic elements of control systems – open loop and closed loop control – elements of closed loop control system - concept of stability, Introduction to ratio, split range, feedforward, and cruise control. Overview of P, PI and PID controllers.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Beckwith T G and Buck N L, “Mechanical Measurements”, 6th Edition, Pearson Education, 2013.
2. Ogata Katsuhiko, “Modern Control Engineering”, Prentice Hall International, 5thEdition, New Delhi, 2010

REFERENCES

1. Jain RK, “Mechanical and Industrial Measurements”, Khanna Publishers, Delhi, 1999
2. Rangan, Mani and Sharma, “Instrumentation”, Tata McGraw Hill Publishers, New Delhi, 2004
3. Alan S Morris, “Measurement and Instrumentation Principles”, Butterworth, 2006.
4. Sawhney A.K, “A Course in Mechanical Measurements and Instrumentation”, 12thEdition, Dhanpat Rai & Co., 2001.
5. Nagrath I J, Gopal M, “Control Systems Engineering”, 6th Edition, New Age International Pvt. Ltd., New Delhi, 2018.

19ME14N	MICROPROCESSOR, MICROCONTROLLER AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the architecture and functional blocks of 8085 processor. (K2)
CO2: develop simple programs with 8085 processor. (K3)
CO3: explain the architecture and functional blocks of the 8051 microcontroller. (K2)
CO4: interface the peripherals with 8085 and 8051. (K3)
CO5: develop simple applications by programming with 8051 microcontroller. (K2)

UNIT I 8085 PROCESSOR 9

Hardware Architecture, Pinouts – Functional Building Blocks of Processor – Memoryorganization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Hardware Architecture, Pinouts – Functional Building Blocks of Processor – Memoryorganization – I/O ports and data transfer concepts– Timing Diagram – Interrupts-DataTransfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming
concepts with 8085.

UNIT III 8051 MICRO CONTROLLER 9

Voltage-Voltmeter, Current - Ammeter and Resistance - Ohmmeter, Temperature -

Thermocouple, Pressure - Primary pressure sensing elements-Diaphragm, Bourdon tube.

UNIT IV PERIPHERAL INTERFACING 9

Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254, 8279, – A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Simple programming exercises- key board and display interface –Control of servo motor stepper, motor control- Application to automation systems.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. R.S. Gaonkar, Microprocessor Architecture Programming and Application, with 8085, Wiley Eastern Ltd., New Delhi, 2013.
2. Sunil Mathur &Jeebananda Panda, Microprocessor and Microcontrollers, PHI Learning Pvt. Ltd, 2016.

REFERENCES

1. Krishna Kant, Microprocessor and Microcontrollers, Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. B.RAM, Computer Fundamentals Architecture and Organization New Age International Private Limited, Fifth Edition, 2017.
3. Soumitra Kumar Mandal, Microprocessor and Microcontroller Architecture, Programming and Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
4. Ajay V.Deshmukh, Microcontroller Theory &Applications, McGraw Hill Edu, 2016.
5. Douglas V.Hall, Microprocessor and Interfacing, McGraw Hill Edu, 2016.

19ME15N	**ELECTRICAL DRIVES AND CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the basic concepts of different types of electrical machines and their performance. (K2)

CO2: Recall the characteristics and different methods of starting D.C motors and induction motors. (K2)

CO3: Explain the operation of conventional and solid-state DC drives. (K2)

CO4: Discuss the concepts of conventional and solid-state AC drives. (K2)

CO5: Describe the working principles of stepper motor and servo motor drives. (K2)

UNIT I INTRODUCTION 9

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions – Industrial drives- types, group drive, individual drive, multi motor drive - Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS AND STARTING METHODS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – Types of D.C Motor starters – Three phase squirrel cage and slip ring induction motor starters.

UNIT III D.C. DRIVES (qualitative treatment only) 9

Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system - Using controlled rectifiers and DC choppers – applications.

UNIT IV A.C. DRIVES (qualitative treatment only) 9

Induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – using inverters and AC voltage regulators – applications.

UNIT V STEPPER MOTOR AND SERVO MOTOR DRIVES 9

(Qualitative treatment only)

PMDC, Stepper motor- construction and working principle and applications – Servo motor – types: brushless servo motor, permanent magnet servo motor construction and applications, stepper motor drive: single stepping and half stepping. Servo drives.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. G. K. Dubey, “Fundamentals of Electrical Drives”, 2ndEdition, Narosa Publishing house, New Delhi, 2019 Reprint.
2. Nagrath.I.J. &Kothari.D.P, “Electrical Machines”, Tata McGraw-Hill, New Delhi, 2006.

REFERENCES

1. Pillai.S.K “A first course on Electric drives”, Wiley Eastern Limited, 2012.
2. M.D.Singh, K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2008.
3. VedamSubrahmaniam, “Electric Drives (concepts and applications)”, Tata McGraw-Hill, 2011.

19ME16N FOUNDATIONS OF MACHINE LEARNING

L	T	P	C
2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the basics and application of Machine learning (K2)
CO2: Explain data analyzing techniques (K2)
CO3: Apply data exploration and data preparation techniques (K3)
CO4: Apply data visualization techniques (K3)
CO5: Apply regression for solving practical problems (K3)

UNIT I INTRODUCTION 12

Types of machine learning: Supervised learning- Unsupervised Learning - Reinforcement Learning- Applications of Machine Learning

UNIT II DATA ANALYSIS 12

Quality and Transformation- Getting to Know the Data: Normal Distribution-Identifying Data Quality Issues: Missing Values, Irregular cardinality, Outliers-Handling Data Quality Issues: Handling Missing Values, Handling Outliers

UNIT III DATA EXPLORATION AND DATA PREPARATION 12

Visualising Relationships Between Features, Measuring Covariance and Correlation, Measure of Distribution (Skewness and Kurtosis) -Data Preparation: Normalisation-binning-sampling

UNIT IV DESCRIPTIVE STATISTICS AND DATA VISUALIZATION 12

Descriptive Statistics for Continuous Features: Central Tendency, Variation- Descriptive Statistics for Categorical Features- Populations and Samples- Data Visualization: Bar Plots, Histograms, Box Plots, Bubble charts, Tree map, Heat map, Motion charts

UNIT V REGRESSION 12

Regression –Gradient descent- Linear Regression –Multivariate Regression regularized regression – Evaluating and Validating Models –Cross-Validation

L:30; P:30 TOTAL:60 PERIODS

TEXT BOOK

1. John D Kelleher, Brain Mac Namee and Aoife D’Arcy, “Fundamentals of Machine Learning for Predictive Data Analytics”, MIT Press, 2015

REFERENCES

1. Marc Peter Deisenroth, Aldo Faisal, Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge university Press, 2020.
2. Bruce Ratner, “Statistical and Machine-Learning Data Mining”, CRC press, 2017.
3. Peters Morgan, “Data Analysis from Scratch with Python”, AI Sciences, 2016

19ME17N MECHANICS OF ROBOTS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Apply fundamental mathematical model for the mechanics of robotics. (K3)

CO2: Derive mathematical expression for the manipulator positioning and motions(K3)

CO3: Analyze basics of motion programming as per kinematics. (K3)

CO4: Formulate mathematical expression for robot dynamics. (K3)

CO5: Develop the robot programs to control the movements of robot manipulate. (K3)

UNIT I MATHEMATICS FOR MECHANICS OF ROBOTICS 9

Spatial Descriptions: positions, orientations, and frame, mappings: changing description from frame to frame, Operators: translations, rotations and transformations, transformation arithmetic, compound Transformations, inverting a transform, transform equations, Euler Angles, Fixed Angles, Euler Parameters.

UNIT II ROBOT KINEMATICS 9

Manipulator Kinematics, Link Description, Link to reference frame connections, Denavit-Hartenberg Approach, D-H Parameters, Position Representations, Homogeneous Transformation Matrix, Forward Kinematics. Inverse Kinematics, Geometric and analytical approach.

UNIT III STATICS AND ROBOT LINKAGE 9

Velocities & Statics: Cross Product Operator for kinematics, Jacobians - Direct Differentiation, Basic Jacobian, Jacobian Jv/Jw, Jacobian in a Frame, Jacobian in Frame, Kinematic Singularity, Kinematics redundancy, Force balance equation, Forces, Velocity/Force Duality, Virtual Work, Force ellipsoid, Jacobian, Kinematic Singularity, Kinematics redundancy, Mechanical Design of robot linkages

UNIT IV ROBOT DYNAMICS 9

Introduction to Dynamics, Velocity Kinematics, Acceleration of rigid body, mass distribution, Newton’s equation, Euler’s equation, Iterative Newton –Euler’s dynamic formulation, closed dynamic, Lagrangian formulation of manipulator dynamics, dynamic simulation, computational consideration.

UNIT V ROBOT PROGRAMMING 9

Manipulators with Two, Three Degrees of Freedom (In 2-Dimensional), Four Degrees of Freedom (In 3-Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education, 2014.
2. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, 2019.

REFERENCES

1. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press, 2006.
2. M. Spong, M. Vidyasagar, S. Hutchinson, Robot Modeling and Control, Wiley & Sons, 2005.
3. J. J. Craig, “Introduction to Robotics: Mechanics and Control”, 3rd edition, Addison Wesley2003.

Group – III (Computational Skills)

19ME21N	COMPUTER GRAPHICS AND VIRTUAL REALITY	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply different view of projections on objects (K3)
CO 2: apply 2D and 3D transformations (K3)
CO 3: apply lighting and shading effects on objects (K2)
CO 4: explore 3D interaction techniques (K2)
CO 5: work on virtual reality tools (K3)

UNIT I INTRODUCTION TO COMPUTER GRAPHICS 12

Graphics system and models: Applications of Computer Graphics, Graphics System, Physical and Synthetic Images, Imaging Systems, Graphics Architectures – Primitives and Attributes, Color, Control functions, Adding Interaction. Viewing: Positioning of the Camera, Parallel Projections, Perspective Projections, OpenGL Projection Matrices.

UNIT II GEOMETRIC OBJECTS AND TRANSFORMATIONS 12

Scalars, Points and Vectors, Three-Dimensional Primitives, Coordinate Systems and Frames, Frames in OpenGL, Matrix and Vector Classes, Modeling a Colored Cube, Affine Transformations – Translation, Rotation and Scaling, Transformations in Homogeneous Coordinates, Concatenation of Transformations, Transformation Matrices in OpenGL, Interfaces to Three-Dimensional Applications, Quaternion- 2D transformations: Translation, Scaling, Rotation, and Shearing – 3D transformations: Translation, Scaling, and Rotation.

UNIT III FRAGMENTATION, LIGHTING AND SHADING 12

Vertices to Fragments: Basic Implementation Strategies, Four Major Tasks, Clipping– Line Clipping, Polygon Clipping, Clipping of Other Primitives, Clipping in Three Dimensions, Polygon Rasterization, Hidden-Surface Removal, Antialiasing, Display Considerations. Lighting and Shading: Light and Matter, Light Sources, Polygonal Shading, Specifying Lighting Parameters, Global Illumination.

UNIT IV 3D INTERACTION TECHNIQUES 12

3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines – 3D Travel Tasks, Travel Techniques. Design Guidelines – System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Multimodal System Control Techniques, Design Guidelines – Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques.

UNIT V ADVANCES IN 3D USER INTERFACES 12

3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces – Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, 3D Interaction Techniques- 3D UI Design and Development-3D UI Evaluation and Other Issues.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Edward Angel, "Interactive Computer Graphics: A Top-Down Approach Using OpenGL", 7th Edition, Addison-Wesley, 2015.
2. Hearn Baker Carithers, "Computer Graphics with Open GL", 4th Edition, Pearson Education Limited 2014.
3. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

REFERENCES

1. Abdulmotaleb El Saddik , Mauricio Orozco, Mohamad Eid, Jongeun Cha, "Haptics Technologies: Bringing Touch to Multimedia", Springer; 2011.
2. https://booksite.elsevier.com/samplechapters/9780123749437/01~Front_Matter.pdf
3. http://cmp.felk.cvut.cz/cmp/courses/XE33PVR/WS20072008/Lectures/Technical/intro-print.pdf
4. https://virsabi.com/everything-about-haptic-technology
5. Virtual Reality for Enhanced Computer Vision (http://staff.fhhagenberg.at/burger/publications/pdf/ifip-portugal94.pdf)

19ME22N	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Work in the mobile application development framework and understand the life cycle of mobile application (K2).
CO2: understand the Android platform and its components (K2)
CO3: work on mobile application tools to create simple applications (K3)
CO4: understand Android views, view Groups and layouts. (K2)
CO5:Understand about intents and services in android application development (K2).

UNIT I INTRODUCTION 12

Mobile Applications - Characteristics and Benefits - Application Model - Infrastructure and Managing Resources - Mobile Software Engineering - Frameworks and Tools - Mobile devices Profiles.

UNIT II INTRODUCING ANDROID 12

The Android platform - Understanding the Android market - The layers of Android - Four kinds of Android components - Understanding the AndroidManifest.xml file - Mapping applications to processes.

UNIT III TOOLS 12

Android Platform - Eclipse Emulator - Android Application Architecture - Event based programming - iOS Platform - UI tool kit interfaces - Event handling and Graphics services - Layer Animation.

UNIT IV ANDROID STUDIO DEVELOPMENT ENVIRONMENT 12

Setting up an Android Studio Development Environment - Creating an Example Android App in Android Studio - Creating an Android Virtual Device (AVD) in Android Studio - The Basics of the Android Studio Code Editor - Saving and Restoring the State of an Android Activity - Understanding Android Views, View Groups and Layouts.

UNIT V APPLICATION DEVELOPMENT 12

Intents and Services - Storing and Retrieving data - Communication via the Web - Notification and Alarms - Graphics and Multimedia - Location based services - Packaging and Deployment - Security and Hacking.

L:30; P:30; TOTAL:60 PERIODS

REFERENCES

1. W. Frank Ableson, Robisen, Chris King, C. Enrique Ortiz, “Android in Action” Third Edition - Manning Shelter Island, 2012.
2. ZigurdMednieks, Laird Dornin, G.BlakeMeike and Masumi Nakamura, “Programming Android”, O Reilly, 2011.
3. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley, 2010.
4. Alasdair Allan, “iPhone Programming”, O‟Reilly, 2010.
5. Wei-Meng Lee, “Beginning iPhone SDK Progrmming with Objective-C”, Wrox Wiley, 2010.
6. Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley, 2009.

19ME23N	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the differences of structured and object-oriented programming features. (K3)

CO2: develop programs using overloading and appropriate constructors. (K3)

CO3: develop the applications using appropriate inheritance and polymorphism mechanisms (K3)

CO4: use advance features like templates and exception to make programs supporting reusability and sophistication. (K3)

CO5: Implement rich data handling through files and STL. (K3)

UNIT I BASIC CONCEPTS 12

Introduction to OOPs - Applications of OOP - Structure of C++ - Program - C++ Basics: Keywords - Constants - Data Types - Dynamic Initialization of Variables - Reference Variables - Operators in C++ - C++ Class Overview: Class Definition Objects - Class Members - Access Control - Scope Resolution operator - Friend Functions - static class members.

UNIT II CONSTRUCTORS AND OVERLOADING 12

Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors - Function Overloading - Operator overloading, Rules for Operator overloading - overloading of binary and unary operators.

UNIT III INHERITANCE AND POLYMORPHISM 12

Introduction to inheritance - Defining Derived Classes - Single Inheritance - Multiple Inheritance - Multi-Level Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes - Abstract Classes - Constructors in Derived Classes - Introduction to pointers - Pointers to Objects - Virtual Functions - Pure Virtual Functions - Virtual Destructors.

UNIT IV TEMPLATES AND EXCEPTION HANDLING 12

Introduction - Class Templates - Class Templates with Multiple Parameters - Function Templates, Function Templates with Multiple Parameters - Member Function Templates - Basics of Exception Handling, Types of exceptions - Exception Handing Mechanism - Throwing and Catching Mechanism.

UNIT V FILE HANDLING AND STL 12

Files in C++: File handling in C++ - File I/O - Formatted and Unformatted I/O - STL.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Herbert Schildt, “C++: The Complete Reference”, 5th Edition, Tata McGraw - Hill Publishers, 2014.
2. Paul Deitel, Harvey Deitel, “C++ How to Program”, 8th Edition, Prentice Hall Publisher, 2016.
3. Trivedi, Bhushan “Programming with ANSI C++”, 2nd Edition, Oxford University Press - NASW Press, 2013.

REFERENCES

1. Ira Pohl, “Object Oriented Programming using C++”, 2nd Edition, Pearson Education, Reprint 2004.
2. S. B. Lippman, Josee Lajoie, Barbara E. Moo, “C++ Primer”, 4th Edition, Pearson Education, 2012.
3. Bjarne Stroustrup, “The C++ Programming language”, 4th Edition, Pearson Education, 2013.

19ME24N	PROGRAMMING IN PYTHON	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: develop simple Python programs. (K3)

CO2: structure simple Python programs for solving problems and decompose a Python program into functions. (K3)
CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)
CO4: understand file management concepts and develop packages in Python Programs. (K3)
CO5: design and Develop GUI Programming. (K5)

UNIT I DATA, EXPRESSIONS, STATEMENTS 12

Python interpreter and interactive mode - values and data types: Variables - expressions - statements - Operators - precedence of operators - Input and Output - comments - Errors: Syntax Errors - Runtime errors - Logical Errors.

UNIT II CONTROL FLOW, FUNCTIONS 12

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) - chained conditional (if-elif-else) - Iteration: state - while - for - break - continue - pass - Fruitful functions: Function argument and its types - return values - parameters - local and global scope - function composition - recursion.

UNIT III LISTS, TUPLES, DICTIONARIES 12

Strings: string slices - immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop - mutability - aliasing - cloning lists - list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods.

UNIT IV FILES, MODULES, INTERPRETERS & PACKAGES 12

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions - modules - Computer Numerical Controller (CNC) implementation using python - CNC G codes to stepper Motor - Python control of Linux CNC for prototyping machine- packages - Name space.

UNIT V GRAPHICAL USER INTERFACE PROGRAMMING 12

Event driven programming - TkInter introduction - Introducing callbacks - User input - Simple case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, O'Reilly Media, Inc., 2016.
2. Brian Heinold, “A Practical Introduction to Python Programming”, Mount St. Mary’s University, 2012.
3. Richard L. Halterman, “Learning to Program with Python”, 2019, E-book.
4. Mark Pilgrim, “Dive into Python”, Apress, 2012.

REFERENCES

1. Timothy A.Budd, “Exploring Python”,, Mc-Graw Hill Education (India) Limited, 2015.
2. PaulGries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3.6”, Pragmatic Programmers, LLC, 2018.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd, 2016.
4. http://ce.sharif.edu/courses/96-97/2/ce153-6/resources/root/Learn-to-Program-with-Python.pdf.

19ME25N	FUNDAMENTALS OF JAVA PROGRAMMING	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply object-oriented concepts to solve real world problems (K3)
CO 2: explain the principles of packages and strings in java. (K2)
CO 3: develop multi-thread applications with exception handling (K3)
CO 4: create user interfaces for java application and applets using GUI (K3)
CO 5: build real time applications with JDBC and Collections (K3)

UNIT I JAVA BASICS 12

OOPS Concepts-Java Programming Constructs - Objects and Classes - Methods - Constructors - Access Specifiers - Data Types - Variables - Operators - Control Statements - Arrays - Inheritance - Method Overriding - Abstract Class - Interfaces.

UNIT II PACKAGES AND STRING 12

Packages - Importing Packages - Access Protection -Wrapper Classes - String Handling - Character extraction - string comparison - Methods for Modifying and Searching String.

UNIT III EXCEPTION HANDLING AND THREADS 12

Exception Handling: Try, Catch, Finally Blocks - Throw - Throws - Class Throwable-Multithreaded Programming: Creating Threads - Creating Multiple Threads - Thread Priorities - Synchronization - Inter Thread Communication - Suspending, Resuming and Stopping of Threads.

UNIT IV APPLETS AND EVENT HANDLING 12

Applet Basics - Applet Architecture - Applet Class and Methods - Passing parameters to Applets - Event Handling - Delegation Event Model - Event Classes - Event Listener Interfaces - Adapter Classes.

UNIT V JDBC AND COLLECTIONS 12

The Design of JDBC - The Structured Query Language - JDBC Configuration - Executing SQL - Collections: Wrapper classes - Collection framework.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Hortsmann& Cornell, "CORE JAVA 2 Advanced Features - VOL-II", Pearson Education, 10thEdition, 2017.
2. Deitel H M and Deitel P I, "Java - How to Program", Pearson Education, New Delhi, 11thEdition, 2017.
3. Herbert Schildt, Java: The Complete Reference, 11thEdition, 2018.

REFERENCES

1. Anita Seth, B.L.Juneja, "JAVA one step ahead", Oxford University Press Publication,Second Edition,2018.
2. Sachin Malhotra and Saurabh Choudhary, "Programming in Java", Oxford University, New Delhi, 2018.
3. Herbert Schildt, "Java: A Beginner's Guide", Tata McGraw Hill, 2007.

19ME26N	PROGRAMMING FOR ROBOTICS	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: interpret the basic concepts of Robot programming. (K2)
CO 2: enrich the robot programming through VAL. (K3)
CO 3: develop robot with movement and motion instructions. (K3)
CO4: understand the importance of operating and data processing. (K3)
CO 5: explore the interfacing tools and testing of robot. (K3)

UNIT I INTRODUCTION TO ROBOT PROGRAMMING 12

Introduction - Types - Flex Pendant - Lead through programming, Coordinate systems of Robot, Robot controller - major components, functions - Wrist Mechanism - Interpolation - Interlock commands Operating mode of robot, Jogging - Types, Robot specifications - Motion commands, end effectors and sensors commands.

UNIT II ROBOT PROGRAMMING LANGUAGES 12

Robot Languages - Classifications, Structures, Variable Assembly Language (VAL) - VAL language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program - WAIT, SIGNAL and DELAY command for communications using simple applications.

UNIT III RAPID LANGUAGE 12

RAPID language basic commands - Motion Instructions-Pick and place operation using

Industrial robot - manual mode, automatic mode, subroutine command-based programming. Move master command language-Introduction, syntax, simple problems.

UNIT IV AML LANGUAGE 12

ARC Macro Language (AML): AML Language - General description, elements and functions, Statements, constants and variables - Program control statements - Operating systems, Motion, Sensor commands - Data processing.

UNIT V PRACTICAL STUDY OF VIRTUAL ROBOT 12

Robot cycle time analysis - Multiple robot and machine Interference - Process Chart - Simple Problems - Virtual robotics, Robot studio online software - Introduction, Jogging, components, work planning, program modules, input and output signals - Singularities - Collision Detection - Repeatability measurement of robot - Robot economics.

L:30; P:30; TOTAL:60 PERIODS

REFERENCES

1. S.R.Deb, “Robotics technology and flexible automation”, Tata McGraw Hill publishing company limited, 2010.
2. Mikell. P. Groover, “Industrial Robotics Technology, Programming and Applications”, McGraw Hill Co, 2008.
3. RobotIcs Lab manual, 2007.
4. Klafter. R. D, Chmielewski. T. A. and Noggin’s., “Robot Engineering: An Integrated Approach”, Prentice Hall of India Pvt. Ltd., 2011.
5. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 2008.
6. Craig. J. J. “Introduction to Robotics mechanics and control”, Addison-Wesley, 2018.

19ME27N FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Understand intelligent agents for search and games (K2)
- CO2: Solve AI problems through programming with Python. (K3)
- CO3: Learning optimization and inference algorithms for model learning. (K2)
- CO4: Design and develop programs for an agent to learn and act in a structured environment. (K3)
- CO5: Design some of the applications that use Artificial Intelligence (K3)

UNIT I INTRODUCTION 12

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Basic terminologies of tree and graph structures, State space representation, Search graph and Search tree.

UNIT II SEARCH ALGORITHMS 12

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

UNIT III PROBABILISTIC REASONING 12

Probability, conditional probability, Bayes Rule, Bayesian Networks - representation, construction and inference, temporal model, hidden Markov model.

UNIT IV MARKOV DESIGN PROCESS 12

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT V LEARNING 12

Supervised and Unsupervised learning, Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning - Q learning.

L:30; P:30; TOTAL:60 PERIODS

LIST OF PRACTICALS (Should be given as Assignments)

1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3. Write a programme to construct a Bayesian network from given data.
4. Write a programme to infer from the Bayesian network.
5. Write a programme to run value and policy iteration in a grid world.
6. Write a programme to do reinforcement learning in a grid world.
7. Mini Project work

TEXT BOOK

1. S.Russel, P.Norvig, "Artificial Intelligence - A Modern Approach", 3rd Edition, Pearson Education, 2015.

REFERENCES

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", 3rd Edition Tata McGraw-Hill Education Pvt. Ltd, 2008.
2. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, 2018.
3. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

19ME28N MODELLING AND SIMULATION

L	T	P	C
2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the basics of simulation and modelling. (K2)
CO2: generate random numbers and random variates using different techniques. (K3)
CO3: develop simulation model using heuristic methods. (K3)

CO4: identify the relevant input and output analyzer, verification and validation models and simulation software. (K3)
CO5: simulate the models for the purpose of optimum control by using software. (K3)

UNIT I INTRODUCTION 12

Introduction to Simulation: Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System.

UNIT II RANDOM NUMBERS GENERATION 12

General Principles: Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. Random Numbers: Properties, Generations methods, Tests for Random Number - Frequency test, Runs test, Autocorrelation test.

UNIT III SIMULATION MODEL USING HEURISTIC METHODS 12

Random Variate Generation: Inverse Transform Technique - Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods - Erlang distribution.

UNIT IV SIMULATION MODELS USING INPUT AND OUTPUT ANALYZER 12

Analysis of Simulation Data Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model - Model Building, Verification, Calibration and Validation of Models.

UNIT V FUZZY AND GA 12

Modeling Based on Expert Knowledge - Fuzzy sets, Membership functions, Fuzzy Inference systems, Expert Knowledge and Fuzzy Models, Design of Fuzzy Controllers. Simulation of Engineering Systems: Monte-Carlo simulation. Genetic Algorithm - operations - elitism.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOK

1. Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation", 2nd Edition. Academic press 2000.

REFERENCES

1. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, Discrete Event system Simulation, Pearson Education, Asia, 4th Edition, 2007, ISBN: 81-203-2832-9.
2. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978, ISBN: 81-203-0140-4.
3. Ogata K "Modern control Engineering" 3rd Edition. Prentice hall of India 2001.
4. Jang J.S.R. sun C.T and Mizutani E, "Neuro-Fuzzy and soft Computing ", 3rd Edition, Prentice Hall of India 2002.

5. Shannon, R. E., “System Simulation: The Art and Science”, Prentice Hall Inc. 1990.
6. Pratab.R , "Getting started with MATLAB" Oxford university Press, 2009.
7. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions -Industrial Engineering series, 4th Edition, ISBN: 0-07-100803-9.
8. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004, ISBN: 0-87692-028-8.

19ME29N	ESSENTIALS OF MACHINE LEARNING	L	T	P	C
		2	0	2	3

Course Outcomes

Upon completion of this course, the students will be able to

CO 1: Explain the features of Machine learning technique (K2)
CO 2: Apply the Artificial Neural Network for solving practical problems (K3)
CO 3: Provide solution for clustering problems in real-world applications.(K3)
CO 4: Apply Support Vector Machines and Decision Tree for solving practical problems (K3)
CO 5: Apply Naive Bayes Classifier and K-Nearest Neighbors for solving practical problems (K3)

UNIT I INTRODUCTION 12

Machine Learning Process-Terminologies: Weight Space, Curse of Dimensionality, Overfitting, Training, Testing, Validation Sets-Performance Measures: Confusion Matrix, Measurement Precision- Model selection Validation Techniques- Feature Reduction/Dimensionality reduction- Principal components analysis.

UNIT II ARTIFICIAL NEURAL NETWORK (ANN) 12

ANN basics-Feed-forward Network – Training Algorithms- Transfer functions - Network Training – BackPropagation-Testing and Validation.

UNIT III CLUSTERING 12

Distance measures- Different clustering methods (Distance, Density, Hierarchical)- Iterative distance-based clustering - Dealing with continuous, categorical values in K-Means-Constructing a hierarchical cluster - K-Medoids.

UNIT IV SUPPORT VECTOR MACHINES AND DECISION TREE 12

Support Vector Machines: Linear learning machines and Kernel space, Making Kernels and working in feature space - SVM for classification and regression problems.
Decision Trees: C4.5- Ensemble’s methods: Random forest.

UNIT V NAIVE BAYES CLASSIFIER AND K-NEAREST NEIGHBORS 12

Naive Bayes Classifier: Model Assumptions, Probability estimation- Required data processing- M-estimates, Feature selection: Mutual information - Classifier - K-Nearest Neighbors: Computational geometry; Voronoi Diagrams; Delaunay Triangulations - K-Nearest Neighbor algorithm.

L:30; P:30 TOTAL:60 PERIODS

REFERENCES

1. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
2. Chris Albon “Machine Learning with Python Cookbook”, O’Reilly Media, 2018
3. Wei-Meng Lee, “Python Machine Learning”, John Wiley & Sons, 2019.
4. John Paul Mueller, and Luca Massaron, “Machine Learning”, John Wiley & Sons, 2016
5. Andreas C. Müller and Sarah Guido, “Introduction to Machine Learning with Python- A Guide for Data Scientists”, O’Reilly publications, First Edition, 2016.

19ME30N	MICROPROCESSOR AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	1	4

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: configure the embedded systems for a specific application.(K3)
CO2: select the robotic control-hardware based on specific need (K3)
CO3: utilize the embedded processor architecture for robot control system(K3)
CO4: apply the concept of CAN protocol communication (K3)
CO5: develop codes for interfacing the various input and outputs devices through embedded programming. (K3)

UNIT I INTRODUCTION 12

Definition: Embedded system, Intelligent System, Expert system, software architecture, hardware architecture –Block diagram of embedded systems- Trends in Embedded Industry- Basic Embedded System Models - Embedded System development cycle- Challenges for Embedded System Design - Embedded System design flow selection considering any three different Applications.

UNIT II ROBOTIC CONTROL-HARDWARE 12

Robot anatomy: links, Joints and end effectors - Position sensors: Potentiometer, LVDT, Halleffect sensors-Interfacing of Quadrature encoder with controller-Torque sensor and its interfacing scheme-Proximity sensor (Ultrasonic) and its interfacing scheme-Range finder (light based) and its interfacing scheme

UNIT III ARM -32 BIT MICROCONTROLLER 12

ARM processor family variants- Architecture of ARM Cortex M3 –functional block diagram of LPC1768 - General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3- Internal logic blocks with associated registers- Debug Architecture. Embedded Firmware Design Approaches.

UNIT IV CONTROLLER AREA NETWORK (CAN) 12

History and foundation of CAN, CAN Applications, Main characteristics of CAN, CAN in OSI Reference Model, CAN Data Link Layer, Principles of data exchange in CAN, Arbitration, Data Frame, Remote Frame, Error detection and management in CAN, CAN physical Layer, Bit encoding, Bit timing and synchronization, Relationship between data rate and bus length, Single wire and twin wire media, CAN repeaters, Medium-to-medium gateway, Protocol handlers, Micro-controllers and line drivers, Time Triggered CAN (TTCAN), CAN based applications development

UNIT V EMBEDDED SYSTEM INTERFACING PROGRAMS PRACTICE: 12

1. PWM – LED Interfacing
2. Switches – BuzzerInterfacing
3. Motor Interface: servo motor and steppermotor
4. LCD DisplayInterfacing
5. Distance Measurement using HCSR 04Sensor.
6. Temperature measurement using DHT11sensor
7. Pressure measurement using BMP280sensor
8. Analog sensor interfacing using LM35D andADC080
9. Onboard web server for ExternalCommunication
10. CANCommunication

L:45; P:15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, Newness, 2008.
2. James K Peckol, “Embedded Systems – A contemporary Design Tool”, John Wiley Edition, 2008.
3. K. V. Shibu, Introduction to Embedded Systems, McGraw Hill Publications, 2009.

REFERENCES

1. Gilbert Held. “Inter- and Intra-Vehicle Communications, CRC Press2007
2. Marco Di Natale, “Understanding and using controller area network communication protocol”, Springer2008
3. Saeed B. Niku, “Introduction to robotics: Analysis, Control and Applications”, Wiley student edition, 2009.

Group – IV (Management Skills)

19ME31N	ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the types, characteristics of entrepreneurship and its role in economic development. (K2)
CO2: Discuss the theories of achievement motivation and the principles of entrepreneurship development program. (K2)
CO3: Select the appropriate form of business ownership in setting up an enterprise. (K2)
CO4: Demonstrate the fundamental concepts of finance and accounting to enterprise. (K2)
CO5: Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise. (K2)

UNIT I INTRODUCTION 9

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth – Economic, Non-Economic, Government Actions.

UNIT II MOTIVATION 9

Entrepreneurial Motivation: Theories and Factors, Achievement Motivation –Entrepreneurial Competencies – Entrepreneurship Development Programs – Need, Objectives – Business Game, Thematic Apperception Test, Self Rating, Stress management.

UNIT III BUSINESS 9

Small Enterprises – Definition, Characteristics, Project Identification and selection – Project Formulation: Significance, content, formulation of project report – Project Appraisal: Concept and method – Ownership Structures: Selection & Pattern.

UNIT IV FINANCE AND ACCOUNTING 9

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management: Significance, Assessment, Factors, Sources, Management.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business: Concept, Signals, Symptoms, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in Small Scale Enterprise – Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry: Need, Depreciation, Rehabilitation, Investment.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. S.S.Khanka, “Entrepreneurial Development” S.Chand& Co. Ltd. Ram Nagar New Delhi, revised edition, 2013.

2. Kuratko & Hodgetts, "Entrepreneurship – Theory, process and practices", Thomson learning 9th Edition, 2014
3. Vasant Desai, "The Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 6th Edition, 2018.

REFERENCES

1. Charantimath, P. M., Entrepreneurship Development and Small Business Enterprises, Pearson, 2nd Edition, 2013.
2. Hisrich R D and Peters M P, "Entrepreneurship" 8th Edition Tata McGraw-Hill, 2013.
3. Rajeev Roy, "Entrepreneurship", Oxford University Press, 2nd Edition, 2011.

19ME32N	HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the importance human resource management perspective (K2)
CO2: Outline the current theory and practice of recruitment and selection. (K2)
CO3: Describe appropriate implementation, monitoring and assessment procedures of training (K2)
CO4: Discuss the significance of employee benefits to both employers and employees (K2)
CO5: Explain the importance of the performance management system in enhancing employee performance (K2)

UNIT I PERCEPTIVE IN HUMAN RESOURCE MANAGEMENT 9

Evolution of human resource management – the importance of the human factor – objectives of human resource management – role of human resource manager – human resource policies – computer applications in human resource management.

UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT 9

Importance of Human Resource Planning – Forecasting human resource requirement – Skill matrix - matching supply and demand - Internal and External sources- Organizational Attraction-. Recruitment, Selection, Induction and Socialization- Theories, Methods and Process.

UNIT III TRAINING AND DEVELOPMENT 9

Types of training methods purpose benefits resistance - Executive development programmes – common practices - benefits – self-development – knowledge management.

UNIT IV EMPLOYEE ENGAGEMENT 9

Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Mentoring - Development of mentor – Protégé relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behavior: Theories, Models.

UNIT V PERFORMANCE EVALUATION AND CONTROL 9

Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal method.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Gary Dessler & Biju Varkkey, “Human Resource Management”, Pearson Publications, New Delhi, 2012.
2. Rao VSP., “Human Resources Management Text and Cases”, Excel Books, 2010.
3. Aswathappa K, “Human Resource and Personnel Management – Text and Cases”, Tata McGraw Hill, 2011.

REFERENCES

1. L.M.Prasad, “Personnel Management and Industrial Relations”, Sultan Chand & Sons, New Delhi, 3rd Edition, 2014.
2. Mamoria.C.B& Rao V.S.P, “Personnel Management and Industrial Relations”, Himalaya Publishing House, Mumbai, 20th Edition, 2014
3. VSP.Rao, Human Resource Management Text &Cases, Excel Books, Mumbai, 3rd Edition, 2011.
4. Tripathi.P.C, Personnel Management and Industrial Relations, Sultan Chand & Sons, New Delhi, 20th Edition, 2013.

19ME33N INDUSTRIAL PSYCHOLOGY AND ORGANISATIONAL BEHAVIOUR

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate the importance of psychology in a working environment (K2)
CO2: Describe the applicability of concept of behaviour in the management of employees (K2)
CO3: Identify different personality attributes and evaluate motivational strategies used in a variety of organizational settings. (K2)
CO4: Discuss the appropriateness of various leadership styles and conflict management strategies used in organizations. (K2)
CO5: Explain the organizational change and culture affect working relationships within organizations. (K2)

UNIT I INTRODUCTION TO PSYCHOLOGY 9

Psychology as a Science - Area of Applications – Study of Individual - Individual Differences-Study of Behaviour - Stimulus Response Behaviour - Heredity and Environment - Human Mind Cognition - Character - Thinking – Attention – Memory – Emotion.

UNIT II PERSONALITY AND VALUES 9

Definition of personality, determinants of personality, major personality attributes influence organizational behaviour – Perception – Leaning – Attitude – Value – Motivation - Theories of motivation.

UNIT III GROUP & GROUP DYNAMICS 9

Concept, importance, classification of groups, reason for group formation, group cohesiveness - Team work - Creating an effective team – Communication - Organizational conflict - Resolution of conflict – Leadership.

UNIT IV INTRODUCTION TO ORGANISATIONAL BEHAVIOUR 9

Definition – Development - Fundamental Concept - Nature of People Nature of Organization – Organizational Behaviour System – Models - Autocratic Model - Hybrid Model - Concept of Organizational Culture.

UNIT V ORGANIZATIONAL CHANGE AND DEVELOPMENT 9

Organizational effectiveness - criteria of effectiveness - Organizational Change - Process of planned Change - Organizational development Concept - Need of organizational development - difference between organizations development & management development.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Stephen P.Robbin & Seema Sanghi, “Organizational Behaviour”, Pearson publications, 18th Edition, 2018.
2. L.M. Prasad, “Organizational Behaviour”, S. Chand & son, 5th Edition, 2014.
3. Cecily D.Cooper & Don Hellriegel, “Mastering Organizational Behaviour”, Flat world publisher, 14th Edition, 2017.

REFERENCES

1. Fred Luthans, “Organizational Behaviour: An Evidence - Based Approach” Mc Graw Hill International Edition, 12th Edition, 2017.
2. Ricky W. Griffin and Gregory Moorhead, “Organizational Behaviour – Managing people and organization”, Cengage India Private Limited, 11th Edition, 2017.

19ME34N	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: discuss the development of management thoughts and different types of Business Organization. (K2)

CO2: Demonstrate the process of planning and decision making in an industrial situation. (K2)

CO3: Illustrate the suitable selection process for a particular job description. (K2)

CO4: Relate the importance of different motivational techniques and leadership skills in the organization. (K2)

CO5: Summarise the various controlling techniques and tools in the organization. (K2)

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Harold Koontz & Heinz Weihrich, “Essentials of Management – An International Perspective”, Tata Mcgraw Hill, 10th Edition, 2016.
2. Andrew J. Dubrin, “Essentials of Management”, Thomson South western, 9th Edition, 2011.
3. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017.

REFERENCES

1. Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall of India”, 8th Edition, 2012.
2. Charles W.L Hill, Steven L McShane, “Principles of Management”, Mcgraw Hill Education, Special Indian Edition, 2017.

19ME35N	**BUSINESS STATISTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the key concepts and terminologies used in business statistical analysis (K2)

CO2: Summarise the concept of statistical distributions and its applications in business context (K2)

CO3: Interpret the use of hypothesis in decision making (K2)

CO4: Demonstrate the use and application of non-parametric test in decision making (K2)

CO5: Explain the uses and application of correlation in business context (K2)

UNIT I INTRODUCTION 9

Basic definitions and rules for probability, conditional probability independence of events, Baye‘s theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION 9

Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS 9

Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA one and two way.

UNIT IV NON-PARAMETRIC TESTS 9

Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test.

UNIT V CORRELATION AND REGRESSION 9

Correlation – Coefficient of Determination – Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Richard I. Levin, David S. Rubin, Masood H.Siddiqui, Sanjay Rastogi, “Statistics for Management”, Pearson Education, 8th Edition, 2017.
2. Prem. S. Mann, “Introductory Statistics”, Wiley Publications, 9th Edition, 2015.
3. T N Srivastava and Shailaja Rego, “Statistics for Management”, Tata McGraw Hill, 3rd Edition 2017.

REFERENCES

1. Ken Black, “Applied Business Statistics”, Wiley India Edition, 7th Edition, 2012.
2. David R. Anderson, Dennis J. Sweeney, Thomas A.Williams, Jeffrey D.Camm, James J.Cochran, “Statistics for Business and Economics”, Thomson (South – Western) Asia, Singapore, 13th Edition, 2016.
3. N. D. Vohra, “Business Statistics”, Tata McGraw Hill, 2017.

19ME36N	**FINANCIAL MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Identify the concepts of financial decision of an organisation (K2)
CO2: Explain the role of financial manager in investment decision making (K2)
CO3: Describe the concept of various budgets and its applications in financial planning (K2)
CO4: Interpret the estimation of working capital and its management (K2)
CO5: Summarise the application of break-even analysis in decision making process (K2)

UNIT I FOUNDATIONS OF FINANCE 9

Introduction to finance- Financial Management – Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions – Time value of money – features and valuation of shares and bonds – Concept of risk and return – single asset and of a portfolio.

UNIT II INVESTMENT DECISIONS 9

Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques - Concept and measurement of cost of capital - Specific cost and overall cost of capital.

UNIT III FINANCING AND DIVIDEND DECISION 9

Leverages - Operating and Financial leverage – measurement of leverages – degree of Operating & Financial leverage – Combined leverage, EBIT – EPS Analysis- Indifference point. Capital structure – Theories – Net Income Approach, Net Operating Income Approach, MM Approach – Determinants of Capital structure. Dividend decision- Issues in dividend decisions, Importance, Relevance & Irrelevance theories- Walter‟s – Model, Gordon‟s model and MM model. – Factors determining dividend policy – Types of dividend policies – forms of dividend.

UNIT IV WORKING CAPITAL MANAGEMENT 9

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Receivables Management - Inventory management – Cash management - Working capital finance: Commercial paper, Company deposit, Trade credit, Bank finance.

UNIT V LONG TERM SOURCES OF FINANCE 9

Indian capital market- New issues market- Secondary market - Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. I M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 11th Edition, 2018
2. M.Y. Khan and P.K.Jain, "Financial management", Text, Problems and cases Tata McGraw Hill, 8th Edition, 2017.
3. AswathDamodaran, "Corporate Finance Theory and practice", John Wiley & Sons, 2011.

REFERENCES

1. James C. Vanhorne, "Fundamentals of Financial Management", PHI Learning, 13th Edition, 2014.
2. Brigham, Ehrhardt, "Financial Management Theory and Practice", 14th Edition, Cengage Learning 2015.
3. Prasanna Chandra, "Financial Management", 9th Edition, Tata McGraw Hill, 2017.
4. Srivatsava, Mishra, "Financial Management", Oxford University Press, 2012.

19ME37N ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the basic concept and preparation of financial accounting (K2)
CO2: Illustrate the process of preparing financial statements (K2)
CO3: Summarise the application of cost accounting for cost reduction (K2)
CO4: Discuss the technique of budgetary control in financial planning and controlling (K2)
CO5: Explain the uses of financial management for investment decision making (K2)

UNIT I INTRODUCTION 9

Introduction to Financial, Cost and Management Accounting - Objectives of Financial Accounting – Accounting Principles, Concepts and Conventions – Book keeping and Accounting – Accounting System – Preparation of Journal, Ledger, Cash Book and Trial Balance – Errors disclosed and not disclosed by Trial Balance.

UNIT II FINANCIAL ACCOUNTING 9

Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow Analysis (Elementary), working capital management, ratio analysis – Depreciation.

UNIT III COST ACCOUNTING 9

Cost accounting systems: Job Costing, process costing, allocation of overheads, Activity based costing, variance analysis – marginal costing – Break even analysis.

UNIT IV BUDGETING 9

Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible budgets, zero based budgets and budgetary control.

UNIT V FINANCIAL MANAGEMENT 9

Investment decisions – Investment appraisal techniques – payback period method, accounting rate of return, net present value method, internal rate of return and profitability index method-cost of capital.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Easton, Halsey, McAnally, "Financial & Managerial Accounting for MBAs", Cambridge Business Publisher, 6th Edition, 2021**.**
2. Palanivelu VR, "Accounting for Management", Lexmi Publication (P) Ltd., 2017.
3. Paul M. Collier, "Accounting for Managers: Interpreting Accounting Information for Decision–Making" John Wiley & Sons, 4th Edition, 2012.

REFERENCES

1. Jan Williams, "Financial and Managerial Accounting – The basics for business decisions", 17th Edition, Tata McGraw Hill Publishers, 2015.
2. Stice & Stice, "Financial Accounting Reporting and Analysis", 8th Edition, Cengage Learning, 2015.
3. M.Y.Khan & P.K.Jain, "Management Accounting", Tata McGraw Hill, 2011.

19ME38N	SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the role of security market and its legal formalities for secured investment decision (K2)
CO2: Explain the use and application of fundamental analysis in investment decision (K2)
CO3: Describe the use and application of technical analysis in investment decision (K2)
CO4: Explain how to construct an efficient portfolio (K2)
CO5: Identify the various methods of portfolio evaluation (K2)

UNIT I INVESTMENT SETTING 9

Investment setting – Securities – Sources of investment information – Security market indications – Security Contract regulation Act - Investor Protection.

UNIT II FUNDAMENTAL ANALYSIS 9

Economic Analysis – Economic forecasting and stock Investment Decisions – Forecasting techniques - Economy and Industry Analysis - Industry life cycle – Company Analysis Measuring Earnings – Forecasting Earnings – Applied Valuation Techniques – Graham and Dodds investor ratios.

UNIT III TECHNICAL ANALYSIS 9

Fundamental Analysis Vs Technical Analysis – Charting methods – Market Indicators - Trend – Trend reversals – Patterns - Moving Average – Exponential moving Average – Oscillators – ROC Momentum – MACD – RSI – Stoastics.

UNIT IV PORTFOLIO CONSTRUCTION AND SELECTION 9

Portfolio analysis - Reduction of portfolio risk through diversification – Portfolio risk - Portfolio Selection - Feasible set of portfolios - Efficient set - Markowitz model - Single index model - Construction of optimum portfolio - Multi-index model.

UNIT V PORTFOLIO EVALUATION 9

Capital Asset Pricing model - Lending and borrowing - CML - SML - Pricing with CAPM - Arbitrage pricing theory– Portfolio Evaluation - Sharpe's index Treynor's index, Jensen's index – Mutual Funds – Portfolio Revision.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Kevin.S, “Security Analysis & Portfolio Management”, Prentice Hall of India Private Ltd., New Delhi, 2nd Edition, 2015.
2. V.A.Avadhani, “Securities Analysis and Portfolio Management”, Himalaya Publishing House, 2010.
3. V.K.Bhalla, “Fundamental of Investment Management”, S.Chand & Company Ltd., Kindle Edition, 2010.

REFERENCES

1. Punithavathy Pandian, “Security Analysis & Portfolio Management” Vikas Publishing House Pvt. Ltd., 2nd Edition, 2012.
2. William F Sharpe, Gordon J. Alexander and Jeffery V Bailey, “Investments”, Prentice Hall, 2012.
3. Prasanna Chandra, “Investment Analysis and Portfolio Management”, TATA McGraw Hill Publishing, 2011.
4. Ranganatham, “Investment Analysis and Portfolio Management”, Pearson Education India, 2nd Edition, 2012.

Group – V (Core/Elective courses of other discipline)

		L	T	P	C
19ID01E	**PRODUCT DESIGN AND DEVELOPMENT**	**3**	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: analyze the customer needs and convert them into product design specifications (K4)
CO2: perform concept generation and selection tools to identify the final concept (K4)
CO3: construct the detail design from the conceptual idea (K4)
CO4: understand rapid prototyping techniques in product development (K2)
CO5: recognize the Intellectual Property Protection methods and project management techniques (K2)

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Introduction - A Generic Development Process - Field and Market analysis - Data collection techniques - Analysis of Data, PESTEL analysis - Identifying Customer Needs - House of Quality for Specifications - Establishing Target Specifications - Setting the Final Specifications.

UNIT II CONCEPT GENERATION AND SELECTION 9

Concept generation activities - Pugh concept selection method: Concept screening; Concept scoring - Concept testing - Concepts for smart systems - Value Analysis.

UNIT III EMBODIMENT DESIGN 9

System level Design and issues - Architecture of Product - Sizing of Parts - PESTEL analysis; SWOT analysis - Theory of inventive problem solving (TRIZ) - FAST Method - Failure Mode and Effects Analysis (FMEA) - Design for Assembly - Design for Ergonomics - Virtual Manikins

UNIT IV RAPID PROTOTYPING 9

Prototyping techniques - Additive Manufacturing - Metal Additive Manufacturing techniques - Virtual Prototyping - Topology Optimization - Generative Design.

UNIT V PROJECT MANAGEMENT AND INTELLECTUAL PROPERTY 9

Product Development Economics: Economic Analysis Process - Managing Projects: Protecting intellectual property - Patents, Trade mark and copy right.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. George E Dieter, Linda C Schmidt, “Engineering Design”, McGraw-Hill, International Edition, 5th Edition, 2012.
2. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata McGraw-Hill Education, 4th Edition, 2009.

REFERENCES

1. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2007.
2. Clive L.Dym, Patrick Little, “Engineering Design: A Project-based Introduction”, 4th Edition, John Wiley & Sons, 2013.
3. Yousef Haik, Shahin T M M, “Engineering Design Process”, Cengage Learning, 2nd Edition Reprint, 2010.
4. James R Evens, William M Lindsay “The Management and control of Quality” Pub: son south-western (www.swlearning.com), 6th edition.
5. Reddy G B, “Intellectual Property Rights and the Law”, Gogia Law Agency, 7th Edition Reprint, 2009.
6. Subbaram N R, “Demystifying Intellectual Property Rights”, Lexisexis Butterworths Wadhwa, 1st Edition, 2009.

19ID02E	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Classify the various types of disaster. (K2)
CO2: Interpret various natural and manmade disasters. (K2)
CO3: Choose a Hazard Assessment procedure. (K3)
CO4: Construct the protection measures against Disaster. (K3)
CO5: Apply Science and Technology in Disaster Management. (K3)

UNIT I INTRODUCTION TO DISASTER 9

Hazard, risk, vulnerability, disaster significance, nature, importance, dimensions and scope of disaster management - national disaster management frame work- financial arrangements- disaster- management cycle.

UNIT II SOURCES OF DISASTER 9

Natural disasters- significance, nature, types and effects - floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, climatic change - global warming - sea level rise - ozone depletion. Manmade disasters- nuclear, chemical, biological, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents and sea accidents.

UNIT III DISASTER MITIGATION AND HAZARDS ASSESSMENT 10

Factors affecting damage – types, social status, habitation pattern, physiology and climate - Factors affecting mitigation measures - prediction – preparation - communication – area and accessibility - population - physiology and climate - Vulnerability Assessment and seismic strengthening of buildings - Vulnerability Assessment of Buildings procedure - Hazard Assessment-Visual Inspection and Study of Available Documents.

UNIT IV DISASTER MANAGEMENT 9

Disaster management - efforts to mitigate natural disasters at national and global levels - international strategy for disaster reduction- Rescue, relief And Rehabilitation, Role of National and International Agencies in Disaster Management - National Disaster Policy of India (Salient Features).

UNIT V APPLICATIONS OF SCIENCE AND TECHNOLOGY AND CASE STUDIES 8

Applications of Science and Technology (RS, GIS, GPS) - Early Warning and Prediction Systems- Earthquake, cyclone, landslides, fire accidents, accidents- case studies.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. S.K.Singh, S.C.Kundu, Shobha Singh A, - Disaster Management‖, William Publications, New Delhi, 1997.
2. Vinod K Sharma, ― Disaster Management‖, IIPA, New Delhi, 1995.

REFERENCES

1. Annual Report, 2009-10, Ministry of Home Affairs, GOI.
2. K.Palanivel, ― Disaster Management, Allied Publishers, 2015.

19ID03E	ENERGY ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: explain the operation of Solar Thermal application and Solar Photovoltaic. (K2)
CO2: explain the operation of wind energy systems. (K2)
CO3: describe the concepts of various Bio-Energy Conversion techniques. (K2)
CO4: illustrate the concepts of other conventional and nonconventional power plants. (K2)
CO5: explain the concepts of hydrogen and fuel cell technology. (K2)

UNIT I INTRODUCTION TO SOLAR ENERGY 9

Sun - Earth Geometry, solar radiation, Solar Collectors - Application of solar thermal systems. Direct Electricity Conversion - Types of Solar cell - Solar Photovoltaic system and types.

UNIT II WIND ENERGY 9

Wind energy potential, Principle of wind energy conversion; Basic components, types and their constructional features; design considerations: wind data and site selection.

UNIT III BIO-ENERGY 9

Biomass: sources, characterization, principles of energy transfer technologies. Biogas: Feedstock, types of Biogas plant - parameters affecting biogas production.

UNIT IV OTHER POWER PLANTS 9

Layout of Hydel - thermal - Nuclear - Gas turbine - Diesel - MHD - Geo thermal - OTEC - Tidal Power Plants.

UNIT V HYDROGEN AND FUEL CELLS 9

Energy carrier: Types - Hydrogen: generation, storage, transport and utilization - thermal energy storage: Principle and utilization - Fuel cells: Technologies, types and applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Soteris Kalogirou, "Solar Energy Engineering: Processes and Systems", Academic Press, 2014.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K, 3rd Edition, 2012.

REFERENCES

1. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 2nd Edition, 2006.
2. Hart A B and Womack, G J, "Fuel Cells: Theory & Applications", Prentice Hall, 1997.
3. El-Wakil M M, "Power Plant Technology", Tata McGraw-Hill, 2010.
4. Khandelwal K C and Mahdi S S, "Biogas Technology" - A Practical Handbook, Tata McGraw Hill, 1986.
5. Duffie J A and Beckman W A, "Solar Engineering of Thermal Processes", Wiley, 4th Edition, 2013.
6. Chetan Singh Solanki, "Solar Photovoltaics Fundamentals, Technologies and Applications", Prentice Hall of India, 3rd Edition, 2015.

19ID04E	CONTROL OF ROBOTIC SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply linear and nonlinear logics for developing the control system (K3)
CO2: design the linear control schemes for robotic manipulators(K3)
CO3: develop the nonlinear control strategy for agile robotic manipulators (K3)
CO4: construct the joint space and task space control schemes (K3)

UNIT I BASIC OF CONTINUOUS TIME LINEAR AND NONLINEAR CONTROL SYSTEM 12

Mathematical modeling of Mechanical system - Differential Equations – Transfer Functions, Time and Frequency domain response. Introduction to State Space Model, Solution of state equations, Canonical state models, State transition matrix, controllability, observability. Stability – Routh Hurwitz Test, Root Locus Design, Bode, Nyquist plot, Lyapunov Stability, BIBO stability, Krasovskii and Variable gradient Method.

UNIT II LINEAR CONTROL OF ROBOTICS 11

Introduction to Compensators Design Lead, Lag and Lead-Lag systems, Design of P,PI and PID controllers – State Feedback control, Pole Placement by State Feedback, Full Order and Reduced Order Observers, control law partitioning, Time varying optimal control – LQR steady state optimal control– Solution of Ricatti's equation – Application examples.

UNIT III NONLINEAR CONTROL OF ROBOTICS 11

Properties of Nonlinear Systems, Classification of Nonlinear Systems, Introduction to Phase plane method, Singular points, Limit cycles, Jump resonance, Construction of Phase Trajectory, Stability analysis by describing functions, Manipulator control design based observer based, adaptive and sliding mode control.

UNIT IV JOINT SPACE AND TASK SPACE CONTROL SCHEMES 11

Point to Point Control, trajectory generation, Continuous Path Control, Joint based control, Cartesian Control, Joint Space and Task Space Control Schemes, Introduction to state estimation, Kalman - Bucy filters.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Ogata, K., Modern control engineering, Pearson Education, 5th Edition, 2010
2. Slotine, J.-J. E., & Li, W. Applied nonlinear control. Englewood Cliffs, N.J: Prentice Hall, 1991
3. H Asada; J -J E Slotine, Robot analysis and control, J.Wiley and sons, New York, 1986

REFERENCES

1. I.J.Nagarath, M. Gopal, "Control Systems Engineering", New Age International Publications, 4th Edition, New Delhi, 2006.
2. M.Gopal, "Digital Control and state variable methods – conventional and intelligent control systems", Tata Mcgraw Hill 3rd Edition, New Delhi, 2008.

19ID05E PRODUCT LIFECYCLE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Justify the importance and needs of PLM (K2)
CO2: Discuss the functions and features of PLM/PDM (K2)
CO3: Summarize the different modules offered in commercial PLM/PDM tools. (K2)
CO4: Implement PLM approaches for industrial applications. (K2)
CO5: Discuss the Integration of PLM with legacy databases, CAD and ERP systems (K2)

UNIT I INTRODUCTION 9

Product life cycle – Stages: Introduction, growth, maturity & decline – Marketing strategies - Product Lifecycle Management (PLM), Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (CPDM), Collaborative Product Commerce (CPC). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources – Application Lifecycle Management (ALM).

UNIT II FUNCTIONS AND FEATURES OF PLM/PDM 9

User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions – Communication and Notification, data transport, data translation, image services, system administration and application integration.

UNIT III MODULES IN A PDM/PLM SOFTWARE 9

Case studies based on the top few commercial PLM/PDM tools – Teamcenter, Windchill, ENOVIA, Aras PLM, SAP PLM, Arena, Oracle Agile PLM and Autodesk Vault.

UNIT IV ROLE OF PLM IN INDUSTRIES 9

Case studies on PLM selection and implementation (like auto, aero, computer, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten-step approach to PLM, benefits of PLM for–business, organization, users, product or service, process performance.

UNIT V CUSTOMIZATION/INTEGRATION OF PDM/PLM SOFTWARE 9

PLM Customization, use of EAI technology (Middleware), Integration with legacy database, CAD, SLM and ERP.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Antti Saaksvuori and AnselmiImmonen, “Product Lifecycle Management”, Springer Publisher, 2008.
2. Michael Grieves, “Product Life Cycle Management”, Tata McGraw Hill, 2006.

REFERENCES

1. ArieKarniel and Yoram Reich, Managing the Dynamics of New Product Development Processes: A New Product Lifecycle Management Paradigm, Springer, 2011.
2. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House Publishers, 2003.
3. John Stark, “Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question”, Springer Publisher, 2007.
4. John Stark, “Product Lifecycle Management: 21st Century Paradigm for Product Realization”, Springer Publisher, 2011.
5. Kevin Roebuck, Product Lifecycle Management (PLM): High-impact Strategies - What You Need to Know: Definitions, Adoptions, Impact, Benefits, Maturity, Vendors, Emereo, 2011.

Group – VI (Trans-disciplinary courses) - Self Study Course

19TD01E	SOFT SKILLS AND INTERPERSONAL COMMUNICATION	L	T	P	C
		0	0	0	3

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to:

CO 1: To Enhance the Soft skills for the usage of language effectively. (K3)
CO 2: To inculcate the various components of language skills. (K3)
CO 3: To Uplift the student's presentation skills and interpersonal skills. (K3)
CO 4: To enhance employability skills in students. (K3)
CO 5: To train the students in interview skills and preparing for job interviews. (K3)

UNIT 1

Introduction to Soft Skills- Aspects of Soft Skills- Types of Listening - Language Skills – Understanding and Overcoming barriers in communication- Ethics and Etiquettes (Social and Official Settings)- Negotiation.

UNIT II

Principles of communication - LSRW in communication - Oral – Speaking words – Articulation -written communication- Advanced Writing Skills- Evaluation and Organization of Data in Report Writing.

UNIT III

Advanced Speaking Skills- Verbal & Non verbal communication – Body language - Leadership and Assertiveness Skills-Networking- Decision-Making- Conflict-Resolution

UNIT IV

Methods of Presentation- Effective Reading - Group Discussion - Preparation for a group discussion- Emotional Intelligence- Critical Thinking.

UNIT V

Practicing for the Interview – Effective Resume building-Stress Interview and traditional Interview- Life and Career Planning- Facing Job Interviews.

TEXTS BOOKS

1. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
2. Kumar, Sanajy and Pushp Lata. Communication Skills. New Delhi: OUP. 2011.
3. Chauhan, G.S. and Sangeeta Sharma. Soft Skills. New Delhi: Wiley. 2016.
4. Lucas, Stephen E. The Art of Public Speaking. McGraw-Hill Book Co. International Edition, 11th Ed. 2014.

19TD02E	IMPACT OF SOCIAL MEDIA ON SOCIETY	L	T	P	C
		0	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: discuss the basic operation of social media and its network.
CO2: analyze the various theory corresponding to communication contexts.
CO3: illustrate the impact of social media in physical and mental health of human beings.
CO4: discuss the legal and ethical issues in public and private spheres
CO5: illustrate the dark side of social media over growth of the society.

UNIT I INTRODUCTION TO SOCIAL MEDIA

Evolution of Social Media, utility of social networks, Professional Networking for Career growth, photo sharing service, impact of video sharing on business, online communities

UNIT II COMMUNICATION CONTEXTS FOR SOCIAL MEDIA

Mass Media theory, Social Sphere, Social Bookmarking and Social News, Social Opinion, Wikis, Crowdsourcing, Social Mobility, Privacy and Data Security.

UNIT III SOCIAL MEDIA AND HEALTH

Stress and Anxiety, Depression, Suicide rates, Sleeping Patterns, Fitness, health and Eating habits, Addiction to social media. Psychological and Physiological impacts of Social media

UNIT IV LEGAL AND ETHICAL ISSUES

Legal Pitfalls of Social Media usage, Redefining the Public and Private Spheres in Social Media, Tweets, Blogs, Facebook and Ethics of 21st Century Communication Technology.

UNIT V DARK SIDE OF SOCIAL MEDIA USE FOR SOCIETIES

Privacy, Privacy Paradox and Social Media, Privacy Literacy, Use and gratifications Theory, Lying as a form of Deception, Online Deception, Deception using SOCIAL Media, Catfishing, Self-Presentation lies, Misinformation and Rumors.

TEXT BOOKS

1. Regina Luttrell and Adrienne A. Wallace “Social Media and Society – An Introduction to the Mass Media Landscape” by Rowman and Littlefield, 2021.
2. Pavica Sheldon, Philipp A. Rauschnabel, James M.Honeycutt “The Dark side of Social Media”, Academic Press.

REFERENCES

1. Hana S.Noor AL-Deen and John Allen Hendricks “ SOCIAL Media – Usage and Impact” Lexington Books,2018

19TD03E INTERNATIONAL BUSINESS MANAGEMENT

L	T	P	C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the global business environment.
CO 2: explain the impact of economic, legal, cultural, geographical and political factors on international business.
CO 3: discuss the issues and problems of Multinational Enterprises.
CO 4: discuss the role of various international financial institutions.
CO 5: discuss about important aspects of WTO and GATT agreement.

UNIT I INTERNATIONAL BUSINESS ENVIRONMENT

International Business Environment - Globalization - Forces, Meaning, Dimensions and Stages in Globalization - Trading Environment of International Trade - Tariff and Non-tariff Barriers - Trade Blocks.

UNIT II RISK ANALYSIS AND PRACTICES

Country Risk Analysis - Political, Social and Economic - Cultural and Ethical practices - Responsibilities of International Business - Economic crisis in foreign countries.

UNIT III MULTINATIONAL ENTERPRISES

Managing Multinational Enterprises - Problems and Potential - Multinational Service Organizations - Indian companies becoming multinationals - Potential, Need and Problems.

UNIT IV INTERNATIONAL FINANCIAL MANAGEMENT

Introduction to International Financial Management - Balance of Trade and Balance of Payment - International Monetary Fund, Asian Development Bank and World Bank - Financial Markets and Instruments - Introduction to Export and Import Finance - Methods of Payment in International Trade.

UNIT V INTERNATAIONAL AGREEMENT

General Agreement on Trade and Tariffs, (GATT) - World Trade Organization - Seattle and Doha Round of Talks - Dispute Settlement Mechanism under WTO - Problems of Patent Laws - International Convention on Competitiveness - Global Sourcing and its Impact on Indian Industry - Globalization and Internal Reform Process.

TEXT BOOKS

1. Bhalla V.K, Shivaramu S, “International Business Environment”, 9th Edition, Anmol Publications Pvt. Ltd., Delhi, 2005.
2. Apte P.G, “International Financial Management”, 5th Edition, Tata McGraw Hill, India, 2008.
3. Cherulinam F, “International Business”, 5th Edition, Prentice Hall of India, New Delhi, 2010.

REFERENCES

1. Rao, Rangachari, "International Business", Himalaya Publishing House, New Delhi, 2010.
2. Hill C, "International Business", 10th Edition, Tata McGraw Hill Education, New Delhi, 2014.
3. Daniels J.D, "International Business Environment", 15th Edition, Prentice Hall of India, New Delhi, 2014.

19TD04E BASICS OF MARKETING

L	T	P	C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: describe the basic concepts of marketing.
CO 2: discuss the significance of consumer behavior and market segmentation.
CO 3: discuss brand, trade mark, after- sales service and product life cycle concepts.
CO 4: formulate strategies for pricing and channels of distribution.
CO 5: analyze and selection of best promotional technique.

UNIT I INTRODUCTION

Nature and Scope of Marketing - Importance of Marketing – Concepts: Traditional and Modern - Selling Vs. Marketing - Marketing Mix - Marketing Environment.

UNIT II CONSUMER BEHAVIOR AND MARKET SEGMENTATION

Nature, Scope and Significance of Consumer Behavior - Market Segmentation - Concept and Importance - Bases for Market Segmentation.

UNIT III PRODUCT PLANNING

Concept of Product - Consumer and Industrial Goods - Product Planning and Development - Packaging - Role and Functions - Brand Name and Trade Mark - After-Sales Service - Product Life Cycle Concept.

UNIT IV PRICING AND PHYSICAL DISTRIBUTION

Price - Importance of Price in the Marketing Mix - Factors Affecting Price of a Product/Service - Discounts and Rebates - Distribution Channels - Concept and Role - Types of Distribution Channels - Factors Affecting Choice of a Distribution Channel - Retailer and Wholesaler - Distributions Channels and Physical Distribution.

UNIT V PROMOTION

Definition - Methods of Promotion - Optimum Promotion Mix - Advertising Media - Their Relative Merits and Limitations - Characteristics of an Effective Advertisement - Personal Selling - Selling as a Career - Classification of a Successful Sales Person - Functions of Salesman.

TEXT BOOKS

1. Etzel M.J, Walker B.J, Stanton W.J, “Fundamentals of Marketing”, 13th Edition, McGraw Hill, New York, 2004.
2. Tanner J, Raymond M, “Principles of Marketing”, University of Minnesota Libraries Publishing, New York, 2015.

REFERENCES

1. Rajan Nair N, Varma M.M, “Marketing Management”, 2nd Edition, S.Chand & Sons, New Delhi, 2005.
2. Ramaswamy V.S, Namakumari S, “Marketing Management", 3rd Edition, Macmillan India Limited, London, 2002.

19TD05E	INDIAN ECONOMY	L T P C
		0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO 1: discuss the current economic development in India
CO 2: describe the key indicators of estimation of national income
CO 3: explain elementary concepts of economic planning and development in India
CO 4: discuss the concept of public finance and preparation of budget
CO 5: discuss the influence of infrastructure growth on economic development

UNIT I ECONOMIC DEVELOPMENT

Meaning - Measurement of Economic Development - Characteristic of underdeveloped and developed economies - Causes for Indian economic underdevelopment - Major issues in development - Strategies for economic development Import substitution and Export oriented strategies - Determinants of economic development.

UNIT II NATIONAL INCOME

The National Income and its estimates in India - Limitations of National income estimation - Trends in National income of India: Growth and Structure - Inter-state variations in National income - Income distribution - Measurement of poverty in India.

UNIT III ECONOMIC PLANNING

Planning and economic development in India - Planning models in India (Elementary concepts) - Capital formation - Growth of Public and Private sector in India – Industrial policies an assessment - Capital formation and domestic saving.

UNIT IV INDIAN PUBLIC FINANCE

Budgetary policies of the central government - Composition and trends in public revenue and expenditure - Expenditure control and government consumption expenditure - concepts of Budgetary deficits and implications - state budget.

UNIT V INFRASTRUCTURE AND ECONOMIC DEVELOPMENT

Power and energy - Transport system in India's economic development - Communication system in India - Urban infrastructure - Science and technology - Private investment in infrastructure - Outlook and prospects.

TEXT BOOKS

1. Dutt R, Sundaram K.P.M, "Indian Economy", S.Chand and Co., New Delhi, 2006.
2. Agarwal A.N, Agarwal M.K, "Indian Economy: Problems of Development and Planning", 41st Edition, New Age International Ltd., New Delhi, 2016.

REFERENCES

1. Arvind P, "India:The Emerging Giant", Oxford University Press, USA, 2008.
2. Government of India, Economic Survey, (2010 -11 to 2014 -15).

19TD06E INTERNATIONAL TRADE

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: discuss the importance of international trade in developing countries.
CO 2: describe the impact of Trade agreements in international Business environment.
CO 3: explain the role of foreign exchange and their impact on trade and investment flows.
CO 4: discuss the benefits of Multinational Corporation in Internal Trade
CO 5: analyze the key role of globalisation in Indian economy.

UNIT I INTRODUCTION

International Marketing - Trends in International Trade - Reasons - Global Sourcing and Production Sharing - International Orientations - Internationalization Stages and Orientations - Growing Economic Power of Developing Countries – International Business Decision.

UNIT II INTERNATIONAL BUSINESS ENVIRONMENT

Trading Environment - Commodity Agreements – State Trading - Trading Blocks and Growing Intra-Regional Trade - Regional Groupings – SAARC, BRICS, ECM, ASEAN - Trade Liberalization - The Uruguay Round-Evaluation – UNCTAD – GATT – WTO.

UNIT III INTERNATIONAL FINANCIAL ENVIRONMENT

International Money and Capital Markets - Foreign Investment Flows – Pattern, Structure and Effects - Movements in Foreign Exchange and Interest Rates and their Impact on Trade and Investment Flows - Exchange Rate Mechanism and Arrangement.

UNIT IV MULTINATIONAL CORPORATIONS

Definition - Organizational Structures - Dominance of MNC's - Recent Trends - Code of Conduct - Multinationals in India - Issue in Investment, Technology Transfer, Pricing and Regulations - International Collaborations and Strategic Alliances.

UNIT V INDIA IN THE GLOBAL SETTING

India an Emerging Market - India in the Global Trade - Liberalization and Integration with Global Economy - Factors Favouring and Resisting Globalization - Trade Policy and Regulation in India - Trade Strategies - Export-Import Policy - Regulation and Promotion of Foreign Trade in India.

TEXT BOOKS

1. Daniels J.D, Radebaugh L.H, Sullivan D.P, “International Business: Environment and Operations”, 12th Edition, Prentice Hall, USA, 2009.
2. Ricky W.G, Michael W.P, “International Business: A Managerial Perspective”, Prentice Hall, USA, 2009.

REFERENCES

1. Bhattacharya B, Varshney R.L, “International Marketing Management”, 25th Revised Edition, S. Chand & Sons, New Delhi, 2015.
2. Verma M.L, “International Trade”, Common wealth Publisher, New Delhi, 2010.

19TD07E GLOBAL CHALLENGES AND ISSUES

L T P C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the various global issues.
CO 2: demonstrate a reasonable understanding of environmental debates and issues.
CO 3: explain the developmental issues relating to food, health and energy.
CO 4: demonstrate the economical issues in international trade.
CO 5: describe the civilization issues relating to human rights and social justice.

UNIT I SECURITY ISSUES

Nuclear Issues - Global and South Asian Context - Small Weapons Proliferation and Internal Arms Race - Chemical and Biological Weapons – Terrorism - Causes, Consequences And Trends - Cyber Terrorism – Counter Terrorism.

UNIT II ENVIRONMENTAL ISSUES

Global Warming and Climate Change - Threats to Bio-Sphere and Space - Pollutions, De-Forestation, Solid, Chemical and Nuclear Wastes and their Management - Preserving the Green Cover and Wild Life.

UNIT III DEVELOPMENTAL ISSUES

Food Security - Poverty and Hunger - Energy Security - Supply and Demand - Traditional and Alternative Sources of Energy – ITER - Health Security – Health for all - Development Vs. Environment - Sustainable Development.

UNIT IV ECONOMIC ISSUES ON INTERNATIONAL TRADE

International Trade - GATT, WTO - Regional Associations - ECM, ASEAN, OPEC, BRICS - Financial Crisis - ASEAN, Mexico and Greece - Global Issues in Trade and Commerce.

UNIT V CIVILIZATION ISSUES

Human Rights - Issues Relating to Freedom of Speech and Expression - Right to Self Determination - Preservation of Cultures and Cultural Diversities - Rights of Women and Children - Dividends of Globalization and Social Justice – Good Governance.

TEXT BOOKS

1. Payne R, “Global Issues”, 4th Edition, Pearson Education Ltd., New York, 2013.
2. Owens P, Baylis J, Smith S, “The Globalization of World Politics”, 3rd Edition, Oxford University Press, USA, 2013.

REFERENCE

1. Chirco J.A, “Globalization: Prospects and Problems”, Sage Publications, New Delhi, 2013.

19TD08E INDIAN CULTURE AND HERITAGE

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe Indian culture, civilization and its features.
CO2: demonstrate stone age, Indian races and their contribution in pre-historic culture.
CO3: explain historical development of Indian culture.
CO4: explain the significance, conditions and development of Vedic culture.
CO5: analyze the advent of Islam and European culture.

UNIT I INTRODUCTION

Introduction to Culture - Meaning and Scope - Culture and Civilization - General Characteristics Features of Indian Culture - Geographical Impact on Indian Culture.

UNIT II PRE-HISTORIC CULTURE

Dravidian Culture - Old Stone Age - New Stone Age - Metal Age - Indian Races and their Contribution to Indian Culture.

UNIT III HISTORICAL DEVELOPMENT OF INDIAN CULTURE

Indus Valley Culture - City Planning - Social and Religious Conditions - Vedic and Later Vedic Cultures - Dharmasastras and Caste Systems - Comparison of Indus and Vedic Culture - IMPORTANCE of Indus Valley and Vedic Cultures.

UNIT IV CULTURE IN SANGAM AGE AND POST SANGAM AGE

Sangam Literature - Society - Political and Economical Conditions - Trade - Religion and Fine Arts.

UNIT V ADVENT OF ISLAM AND EUROPEAN CULTURE

Impact on Indian Culture and Heritage – Reform Movements - Brahma Samaj, Ariya Samaj, Self Respect Movement – Post Colonial Development.

TEXT BOOKS

1. Luniya B.N, “Evolution of Indian Culture”, Lakshmi Narain Agarwal Publishers, Agra, 1986.
2. Jeyapalan N, “History of Indian culture”, Atlantic publishers, New Delhi, 2001.
3. Sharma H.C, “Indian Culture and Heritage”, Neha Publishers & Distributors, New Delhi, 2012.

REFERENCES

1. John G.A, “Dictionary of Indian Philosophy (Sanskrit-English)”, University of Madras, Madras, 1998.
2. Misra R.S, “Studies in philosophy and Religion”, Bharathiya Vidya Prakasans, Varanasi, 1991.
3. Misra S.K, “Culture and Rationality”, Sage publications India Pvt. Ltd., New Delhi, 1988.
4. Suda J.P, “Religious in India”, Sterling Publishers Pvt. Ltd., New Delhi, 1978.

19TD09E INDIAN HISTORY

		L T P C
		0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: illustrate the basics of Indian cultural heritage.
CO2: describe interaction between Ancient Indian cultural heritage and Islamic culture.
CO3: demonstrate Innovation by rulers of medieval period in the area of Administration, and their contact with the Europeans.
CO4: analyse modern Indian movements, Economic history and Impact of the British rule on India.
CO5: demonstrate the concepts of Indian National Movement and the history of freedom struggle in India.

UNIT I ANCIENTY INDIAN CULTURE

Ancient Indian Cultural Heritage - Social, Political, Legal and in the Area of Religion and Philosophy.

UNIT II LAW RELATING TO CULTURE

Law Givers and Dispute Resolution Systems in Ancient India (Administration of Justice in Ancient India - Pre-Islamic Period) - Law Relating to Culture - The Advent of Islam - Interaction between Ancient Indian Cultural Heritage and Islamic Culture - The Emergence of Synthetic Indian Culture.

UNIT III ADMINISTRATION IN ANCIENT INDIA

Innovation by Rulers of Medieval Period in the Area of General and Revenue

Administration - District Administration - Court Systems - Indian Contact with the Europeans.

UNIT IV SOCIO-ECONOMIC HISTORY

Socio-Religious Reform Movements in Modern India and its Legal Culture - Economic History of India During British Period - Impact of the British Rule on India – Education.

UNIT V EUROPEAN CULTURE IMPACT

Impact of European Culture and Liberal Thought on India – The Indian National Movement - The History of Freedom Struggle in India upto 1947.

TEXT BOOKS

1. Sreenivasa M.H.V, “History of India Part I and II”, JBA Publishers, New Delhi, 2015.
2. Agarwal R.C, Bhatnagar M, “Constitutional Development and National Movement of India”, S. Chand Publishers, New Delhi, 2005.

REFERENCES

1. Altekar S, “State and Government in Ancient India”, Motilal Banarsidass Publishers, New Delhi, 2002.
2. Majumdur R.C, “History and Culture of the Indian People”, Vol. 2, The Age of Imperial Unity, Bharatiya Vidya Bhavan, New Delhi, 2001

19TD10E SUSTAINABLE DEVELOPMENT AND PRACTICES

L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: recognize the sustainable development and the way to achieve the sustainable development.
CO 2: outline the concept, factors governing the sustainability and their linkages.
CO 3: explain the environmental impact assessment and environmental audit.
CO 4: describe the environmental planning and managing the resources.
CO 5: acquire the knowledge about the environmental problems and their solutions.

UNIT I SUSTAINABLE DEVELOPMENT

Need for Sustainability - Nine Ways to Achieve Sustainability - Economics as the Dismal Science - Population, Resources and Environment.

UNIT II CHALLENGES OF SUSTAINABLE DEVELOPMENT

Concept of Sustainability - Factors Governing Sustainable Development - Linkages among Sustainable Development, Determinants of Sustainable Development - Case Studies on Sustainable Development.

UNIT III ENVIRONMENT IMPACT ASSESSMENT AND AUDIT

Concepts-process-evaluation methodology-EIA and EMS integration-setting up of audit programme - typical audit process - carrying out the audit-benefits of environmental auditing-environmental audit programmes in India.

UNIT IV ENVIRONMENTAL PLANNING

Introduction - Perspective of Environmental Planning - land resource development planning - Planning and managing the natural resources - landscape ecological planning - information and decision of environmental planning - Land use policy in India.

UNIT V ENVIRONMENTAL EDUCATION

Knowledge about the environment - Knowledge about the environment and population growth -Knowledge about the solution and environmental problems - Environmental education (EE) – Strategies for EE – Models for future Environmental Education Systems.

TEXT BOOKS

1. Rogers P, Jalal K.F, Boyd J.A, “An Introduction to Sustainable Development”, Earth scan Publications Ltd., UK, 2006.
2. Santra S.C,” Environmental Science”, 3rd Edition, New Central Book Agency (P) Ltd., London, 2013.

REFERENCES

1. Stavins R.N. “Economics of the Environment: Selected Readings”, 5th Edition, W.W. Norton and Company, New York, 2005.
2. Sachs J.D, “The Age of Sustainable Development”, Columbia University Press, New York, 2015.

19TD11E WOMEN IN INDIAN SOCIETY

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate historical perspective about women in Indian society.
CO2: Explain social problems of women.
CO3: Understand the legislation for women protection in India.
CO4: Demonstrate the involvement of women literacy, career and politics.
CO5: Analyse the role of NGO’s in women empowerment.

UNIT I INTRODUCTION

A Historical Perspective - Early Vedic, Colonial and Modern Periods - Position of Women in Contemporary India.

UNIT II SOCIAL ISSUES

Issues of Girl Child - Female Infanticide and Foeticide, Sex Ratio, Child Marriage, Dowry and Property Rights - Women's Health and Birth Control - Reproduction - Violence against Women - Domestic Violence - Female Headed Households - Women in the Unorganized Sector of Employment - Women's Work- Status and Problems - Problems of Dalit Women.

UNIT III PROTECTIVE LEGISLATION FOR WOMEN

Protective Legislation for Women in the Indian Constitution - Anti Dowry, SITA, PNDT, And Prevention Sexual Harassment At Workplace (Visaka Case) - Domestic Violence (Prevention) Act.

UNIT IV WOMEN AND EDUCATION

Formal and Non-Formal Literacy - Post Literacy - Vocational Training - Dual Career Modernization – Women and Politics - Political Status - Global Movements and Indian Movements.

UNIT V ROLE OF NGO'S IN WOMEN EMPOWERMENT

Gender Economy - All India Women's Conference (AIWC) – Women's India Association (WIA) - National Council of Women in India (NCWIE) - Indian Association of Women's Studies – Women Development Cells - Self Help Groups.

TEXT BOOKS

1. Majumdar M, "Social Status of Women in India", Wisdom Press, New Delhi, 2012.
2. Harish R, Harishankar V.B, "Re-Defining Feminisms", Rawat Publications, Jaipur, 2011.

REFERENCES

1. Rathod P.B, "An Introduction to Women's Studies", ABD Publishers, Jaipur, 2010.
2. Ray R, "Hand Book of Gender", Oxford University Press, New Delhi, 2012.

19TD12E BIO MECHANICS IN SPORTS

L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1**:** discuss the basics of biomechanics in sports & movement technique accurately.
CO2**:** discuss the basics of linear kinematics and its applications in the field of sports.
CO3: demonstrate the linear kinematics in the field of sports.
CO4**:** discuss the basics of angular kinematics and its applications in the field of sports.
CO5: demonstrate the angular kinematics in the field of sports.

UNIT I INTRODUCTION

Meaning, Aim and Objectives, Importance of Biomechanics in Sports - Types of Motion Linear, Angular, Curvilinear and Circular Motion.

UNIT II LINEAR KINEMATICS

Speed, Velocity, Acceleration, Motion, Projectile Motion – Application of Linear Kinematics in The Field of Physical Education and Sports.

UNIT III ANGULAR KINEMATICS

Angular Speed - Angular Velocity - Angular Acceleration - Relationship between Linear and Angular Motion – Application of Angular Kinematics in the Field of Physical Education and Sports.

UNIT IV LINEAR KINETICS

Mass, Weight, Force, Pressure, Work, Power, Energy, Impulse, Momentum, Impact, Friction, Newton’s Law of Motion - Law of Inertia and Types of Inertia.

UNIT V ANGULAR KINETICS

Levers, Equilibrium and Centre of Gravity – Friction and its Types, Centrifugal and Centripetal Force Bio Mechanical Principles Involved in Designing Sports Equipments.

TEXT BOOKS

1. Singh S.K, “Biomechanics in Sports”, Neha Publishers & Distributors, New Delhi, 2009.
2. McGinnis P.M, “Biomechanics of Sports and Exercise”, 2nd Edition, Human Kinetics Publishers, USA, 2004.

REFERENCES

1. Saxena A, “Biomechanics in Sports”, Neha Publishers & Distributors, New Delhi, 2011.
2. Heyward V.H, Gibson A.L, “Advanced Fitness Assessment and Exercise Prescription”, 7th Edition, Human Kinetics, USA, 2014.

B.E. – MECHANICAL ENGINEERING

PROGRAMME ELECTIVE COURSES

19ME01E	**REFRIGERATION AND AIR CONDITIONING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the concept and performance of Refrigeration and Air conditioning systems. (K2)
CO2: Demonstrate the cryogenics techniques and environmental issues of different refrigerants. (K2)
CO3: Design and select Refrigeration and Air conditioning components for different applications. (K3)
CO4: Design the Air conditioning systems using cooling load calculation, duct design and air distribution. (K3)
CO5: Demonstrate and interpret the applications of Refrigeration and Air conditioning systems. (K3)

UNIT I REFRIGERATION SYSTEMS 9

Introduction, Refrigeration machine and Reversed Carnot cycle - simple vapour compression refrigeration system - Gas cycle refrigeration - Absorption refrigeration - steam jet refrigeration, thermo electric refrigeration.

UNIT II REFRIGERANTS AND CRYOGENICS 9

Refrigerant – Properties – Classification: Halo-carbon, Azeotrope, Inorganic and Hydro Carbon refrigerants. Substitute for CFC refrigerants – Secondary refrigerants. Multistage compression and evaporator system - compound systems - cascade system, Manufacture of solid carbon di-oxide, Liquefaction of gases, Linde and Claude systems for liquefaction of air, Liquefaction of Hydrogen and Helium, Production of low temperature by adiabatic demagnetization of paramagnetic salt.

UNIT III REFRIGERATION AND AIRCONDITIONING SYSTEM COMPONENTS 9

Compressor-reciprocating, rotary, screw and scroll -Performance, capacity control and selection of compressor. Condenser - Types - Condenser capacity and efficiency, Evaporator - types, capacity and efficiency, Throttling devices-capillary tube, TEV, EEV, Solenoid valve, capacity and selection. Cooling towers.

UNIT IV AIRCONDITIONING SYSTEMS 9

Basic Air conditioning processes, cooling load calculations, Air duct design, Design of room air distribution, Air handling unit, Types of Air conditioner, VAV and VRV Systems.

UNIT V APPLICATIONS OF REFRIGERATION AND AIRCONDITIONING SYSTEMS 9

Cold storages and low temperature applications, quick freezing, Ice manufacturing, milk processing, Food Preservation, Marine Air-conditioning, Transport refrigeration, Humidification plant for textile mills/textile processing, solar cooling.

L:45; TOTAL:45 PERIODS

Note: ***Use of Refrigeration tables and charts are permitted in the End Semester Examination***

TEXT BOOKS

3. Arora C P, "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 2010.
4. Ananthanarayanan P N, "Basic Refrigeration and Air conditioning", Tata McGraw-Hill Education, 4th Edition 2013.

REFERENCES

6. Manohar Prasad, "Refrigeration and Air conditioning", New Age International (P) Ltd., Revised 2nd Edition Rev. 2011.
7. http://nptel.ac.in/courses/Webcourse-Contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/New_index1.html
8. ISHRAE-HVAC Engineers Handbook, Second Edition, 2014.
9. ASHRAE Handbook for HVAC.
10. IS 1391 (PART 2): 1992 Room Air Conditioners -Specification/

19ME02E	DESIGN OF HEAT EXCHANGER AND PRESSURE VESSEL	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the types and working of heat exchangers and regenerators. (K2)
CO2: Demonstrate the design of heat exchanger. (K2)
CO3: Design compact heat exchangers and condensers. (K3)
CO4: Analyze the stresses in pressure vessels. (K4)
CO5: Design simple pressure vessels. (K3)

UNIT I INTRODUCTION TO HEAT EXCHANGERS 12

Heat exchangers - shell and tube heat exchangers - regenerators and recuperators - Parts description, classification as per Tubular Exchanger Manufacturers Association.

UNIT II DESIGN OF HEAT EXCHANGERS 12

Thermal design using ε-NTU, P-NTU and LMTD methods - Effectiveness - Optimization - Calculation of heat Transfer Coefficient - Calculation of Pressure Drops - Mechanical design of baffles and tube sheets - Complete Problems - Exposure to HTRI Software.

UNIT III COMPACT HEAT EXCHANGERS, CONDENSERS AND COOLING TOWERS 12

Types- Merits and Demerits - Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations - Design of surface and evaporative condensers - cooling tower - performance characteristics.

UNIT IV STRESSES IN PRESSURE VESSEL 12

Introduction - Stresses in a circular ring, cylinder Membrane stress Analysis of Vessel - Cylindrical, spherical and, conical heads - Introduction to ASME Section VIII and Section II standards, internal pressure, external pressure calculation of cylindrical, spherical and conical heads using ASME Section VIII, nozzle thickness and reinforcement calculations, WRC. Thermal Stresses - Discontinuity stresses in pressure vessels. Exposure to Pressure Vessel Elite (PV Elite) Software.

UNIT V DESIGN OF PRESSURE VESSEL 12

Design of horizontal pressure vessel using ASME Section VIII- Supports, Saddles and lifting lugs for vessels - Theory of Reinforcement - Pressure Vessel Design for horizontal and vertical vessels, introduction to design of storage tanks, exposure to API 650 Standard and IS 803 Design of tanks.

L:30; P:30; TOTAL:60 PERIODS

Note: ***Use of approved design data book is permitted in the End Semester Examination***

TEXT BOOKS

1. SadikKakac and Hongtan Liu, "Heat Exchangers Selection", Rating and Thermal Design, CRC Press, 2012.
2. Shah RK, Dušan P Sekulić, "Fundamentals of heat exchanger design", John Wiley & Sons, 2003.

REFERENCES

1. KuppanThulukkanam, “Heat Exchanger Design Handbook “, Second Edition, CRC Press, 2013.
2. Heat Exchanger Equipment Field Manual. Gulf Professional Publishing, 2012.
3. Manfred Nitsche, Raji OlayiwolaGbadamosi, Heat Exchanger Design Guide: A Practical Guide for Planning, Selecting and Designing of Shell and Tube Exchanger, Butterworth-Heinemann, 2015.
4. Handbook for Heat Exchangers and Tube Banks Design, D. Annaratone, Springer Verlag, 2010
5. ASME SEC VIII DIV-1 Boiler and Pressure Vessel Code: Rules for Constructing Pressure Vessels, ASME, 2013.
6. Dennis Moss, “Pressure Vessel Design Manual” Gulf professional Publishing, Third Edition 2012.
7. ASME Boiler and pressure vessel code Section VIII
8. ASME Boiler and pressure vessel code Section II
9. API 650 Tank design codes
10. IS 803 Code of practice for design, of storage tanks.

19ME03E	**AUTOMOBILE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify the automobile structure, various systems and components, comfort and safety systems. (K2)

CO2: Differentiate between the principles of SI and CI engines and discuss the recent development in the area of alternates for automotive engines. (K2)

CO3: Explain the need and components of the transmission system in an automobile. (K2)

CO4: Describe the constructional features and components of the steering, brake and suspension system. (K2)

CO5: Appraise recent trends in Electrical and Electronics for Engine and Vehicle Management System. (K2)

UNIT I VEHICLE STRUCTURE, COMFORT AND SAFETY 9

Automobiles - Vehicle Construction - layouts, chassis, frame, body material, design and construction. Vehicle Aerodynamics. Ergonomics and anthropometry - Driver seat for comfort and safety, safety belts, Air bags, Crumple Zone, driver drowsiness detection system. Recent trends in automotive safety systems - Safety regulations and testing.

UNIT II ENGINE AND AUXILIARY SYSTEMS 9

Fuel Injection System - MPFI, GDI & CRDI, Turbochargers. Variable Timing Control (VTC), Variable Valve Timing (VVT), Variable compression ratio (VCR) and Lift Electronic Control (VTEC), Homogenous Charge Compression Ignition (HCCI) Advanced Turbulent Flow Technology (ATFT), Emission control and standards - EGR and Catalytic Converter.

UNIT III TRANSMISSION SYSTEMS 9

Transmission system - need and Construction of Clutch, Gear Box - Manual and Automatic - Over Drives - Transfer Box, Fluid flywheel, Torque convertors. Continuously Variable Transmission (CVT). Propeller shaft - Hotchkiss drives, Torque tube drive, Universal joints. Differential. Rear axle types and construction.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Front axle - types, construction and materials. Steering Geometry - steering gear box, power steering. Braking Systems - Types - braking torque. Exhaust brakes, power and power assisted brakes. Antilock Braking System (ABS), Electronic Brake Force Distribution (EBD) and Traction control.

Suspension - types, factors influencing ride comfort, shock absorbers. Static and rolling properties of pneumatic tyres - tubeless tyres, aspect ratio, tyre wear and maintenance.

UNIT V AUTOMOTIVE ELECTRICAL AND ELECTRONICS 9

Introduction to automotive electrical systems - Automotive electricity generation, storage & distribution systems, wiring harness. Charging, starting & ignition System - Bendix drive, over running clutch drive. Automotive lighting. Automotive Sensors & Actuators, Engine

Management Control, Body Control Module. Vehicle Management System - vehicle tracking system, Collision avoidance, Radar warning system, Global Positioning Systems.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Kirpal Singh, Automotive Engineering, Vol. I & II, 14thEdition, Standard Publishers, New Delhi, 2017.

REFERENCES

1. Newton, K., Steeds, W., and Garrett, T.K., "The Motor Vehicle", 13thEdition Butterworth, 2000.
2. David C Barton, John D Fieldhouse, "Automotive Chassis Engineering", Springer, 2018.
3. Joseph Heitner, "Automotive Mechanics", 2ndEdition, East-West Press, 2004.
4. Heinz Heisler, "Advanced Engine Technology", SAE international publications USA, 1995.
5. William B.Riddens "Understanding Automotive Electronics", 5th Edition, Butter worth Heinemann Woburn, 2013.
6. Automotive Safety Handbook by Ulrich W. Seiffert and Lothar Wech, SAE International, 2007.

19ME04E	INTERNAL COMBUSTION ENGINES	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Discuss the combustion phenomenon and influence of combustion chamber design parameters in IC engines (K2)
CO2: Discuss fuel metering and fuel supply systems of I C engines. (K2)
CO3: Describe the effect of engine emission on environment, their measurement and control techniques incorporating the standard emission norms. (K2)
CO4: Identify the viable alternate fuels for IC engines for the emission control and sustainable development. (K2)
CO5: Describe recent trends in IC engines and the principle of modern engine management systems. (K2)

UNIT I COMBUSTION PHENOMENA IN SI AND CI ENGINES 9

Normal and Abnormal combustion of SI and CI engines - Factors influencing abnormal combustion - Types of Combustion chambers of SI and CI engines - Effect of combustion chamber design and engine parameters on the combustion of both engines.

UNIT II FUEL SUPPLY SYSTEMS OF SI AND CI ENGINES 9

Fuel Supply systems in SI engines - Air-fuel ratio requirements, Design of carburettor - Electronic Fuel Injection Systems and their types - Fuel Supply systems in CI engines - Components - Description - Supercharging and Turbo charging.

UNIT III ENGINE EMISSION AND CONTROL 9

Emissions from SI and CI engines - Mechanism of formation of NOx, HC, CO, Smoke and Particulate emissions, Emission measuring equipment's, Methods of controlling emissions, Indian Driving Cycles and emission norms-Indian/International.

UNIT IV ALTERNATE FUELS 9

Need for Alternate fuels - Oxygenated Fuels, Vegetable oils and bio-diesel, gaseous fuels, Hydrogen - Properties and Suitability of the alternate fuels, Engine - Modifications, Performance, Combustion and Emission Characteristics of SI and CI Engines using these alternate fuels.

UNIT V RECENT TRENDS IN IC ENGINES AND ENGINE MANAGEMENT SYSTEMS 9

Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Variable Compression Ratio Engine, Dual Fuel Engine, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Engine Electronics Management, Data Acquisition System - pressure pick up, charge amplifier PC for Combustion and different sensors used in engine management system - Introduction to simulation of IC engine - Hybrid electric vehicle.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. John B Heywood, “Internal Combustion Engine Fundamentals”, McGraw-Hill Education (India) Pvt. Limited, 2017.
2. Ganesan V, “Internal Combustion Engines”, Tata McGraw-Hill, 4thEdition, 2017.

REFERENCES

1. Richard Stone, “Introduction to Internal Combustion Engines”, Palgrave Macmillan, 3rdEdition, 2012.
2. Gupta H N, “Fundamentals of Internal Combustion Engines”, Prentice Hall of India, 2ndEdition, 2014.
3. Allan T. Kirkpatrick Colin R. Ferguson, “Internal Combustion Engines: Applied Thermal Sciences” 2ndEdition, Wiley India 2011.
4. Mathur.M L and Sharma.RP, “Internal Combustion Engines”, Dhanpat Rai and Sons, 2008.
5. SAE International Journal of Engines.
6. http://nptel.ac.in (Engine Combustion, Engine Emissions).

19ME05E	GAS DYNAMICS AND PROPULSION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Calculate the adiabatic and isentropic properties in various regions of flow. (K2)
CO2: Evaluate the adiabatic and isentropic properties in various conditions of flows during friction, heat transfer and mass addition. (K2)
CO3: Derive the conditions for the change in pressure, density and temperature for flow through a normal, oblique and expansion shock waves. (K2)
CO4: Explain how thrust and shaft powers are interrelated in various types of propulsion engines. (K2)
CO5: Apply the gas dynamics principles in the space propulsion. (K2)

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9

Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone - Effect of Mach number on compressibility - Isentropic flow through variable ducts - Nozzle and Diffusers.

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - variation of flow properties - Simple flow with mass addition.

UNIT III NORMAL AND OBLIQUE SHOCKS 9

Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl-Meyer relations - Wind Tunnel - Applications.

UNIT IV JET PROPULSION 9

Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION 9

Types of rocket engines - Propellants-feeding systems - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - space flights.

L:45; TOTAL:45 PERIODS

Note:*Use of approved Gas Table is permitted in the End Semester Examination*

TEXT BOOKS

1. S.M. Yahya, Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion, New Age International Publishers, Sixth Edition, 2018.
2. EthirajanRathakrishnan, Gas dynamics, PHI Learning, sixth Edition 2017.

REFERENCES

1. V Ganesan, Gas Turbines, McGraw Hill Education, third Edition, 2017.
2. Hill, Mechanics and Thermodynamics of Propulsion, pearson publishers, second Edition, 2009
3. John Anderson, Modern Compressible Flow: with Historical Perspective, McGraw Hill Education, third Edition, 2017.
4. Patrick H. Oosthuizen, Introduction to Compressible Fluid Flow (Heat Transfer), CRC Press, second Edition, 2013.
5. Balachandran P, Gas Dynamics for Engineers, PHI Learning, 2010.

19ME06E	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the construction, operation of various components of thermal power plant and performance of steam boilers. (K2)

CO2: Describe the functions of different components of nuclear and hydel power plants. (K2)

CO3: Summarize the functions of different components of diesel and gas turbine power plants. (K2)

CO4: Explain the basic concept and working of Solar, Wind and Bio-Energy power plants. (K2)

CO5: Recognize the environmental and regulatory issues related to various power plants and Estimate the economy of power plants. (K3)

UNIT I THERMAL POWER PLANT 9

Layout - Fuel and ash handling, Combustion Equipment for burning coal, Mechanical Stokers. Pulveriser, Electrostatic Precipitator, Draught, condenser and Cooling Towers - Steam Boilers - High pressure and Super Critical Boilers - Fluidized Bed Boilers - Performance of boiler - Environmental effects.

UNIT II NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear Energy - Fission, Fusion Reaction, Types of Reactors, Waste disposal and safety- nuclear waste transportation norms - Hydel Power plant - Layout - Essential Elements, Selection of turbines, governing of Turbines- Micro hydel developments.

UNIT III DIESEL AND GAS TURBINE POWER PLANT 9

Layout - Types of diesel plants, components, Selection of Engine type, applications - Gas turbine Power plant - Layout - Gas turbine material - open and closed cycles - reheating - Regeneration and inter cooling - combined cycle.

UNIT IV SOLAR, WIND AND BIO ENERGY POWER PLANT 9

Radiation, Solar Collectors - Application of solar thermal systems, Direct Electricity Conversion. Wind energy potential, Principle of wind energy conversion; Basic components, types and their constructional features; Biomass: sources, characterization, principles of energy transfer technologies.

UNIT V ECONOMICS AND ENVIRONMENTAL EFFECT OF POWER PLANTS 9

Cost of Electric Energy - Fixed and operating costs - Energy rates - Types tariffs - Economics of Load sharing - comparison of various power plants - Emission from various power plants -Environmental affects and its remedies - Environmental regulatory and norms for power plant.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Arora SC and Domkundwar S, "A Course in Power Plant Engineering", Dhanpat Rai, Eighth Edition 2016.
2. El-Wakil MM," Power Plant Technology", Tata McGraw-Hill, 2010.

REFERENCES

1. Sharma SC and Nagpal, "A Text Book of Power Plant Engineering", Jain publication, 16th Edition, 2015.
2. Nag PK, "Power Plant Engineering", Tata McGraw- Hill, 4th Edition, 2017.
3. Ramalingam KK, "Power Plant Engineering", Scitech Publications, 2015.
4. Rai GD, "Introduction to Power Plant technology", Khanna Publishers, 11th Reprint Edition, 2013.
5. Indian boiler regulations (IBR) Act, 2005.

19ME07E RENEWABLE ENERGY SOURCES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explicate the physics of solar radiation and estimate the solar energy potential and its availability. (K2)
CO2: Interpret the different solar energy collectors for solar energy conversion. (K2)
CO3: Familiarize with the concepts of different solar energy storage techniques and its applications. (K2)
CO4: Interpret the concepts of extraction of wind energy and various Bio-Energy conversion techniques (K2)
CO5: Recognize the other available forms of renewable energy sources. (K2)

UNIT I SOLAR RADIATION 9

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT II SOLAR ENERGY COLLECTORS 9

Flat plate and concentrating collectors - Heat removal rate- Useful energy gain - Losses in the collectors - efficiency of flat plate collectors - testing of flat plate collectors. Concentric collectors - classification of concentrating collectors - concentrator mounting - tracking mechanism - thermal analysis, advanced collectors.

UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS 8

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications - solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT IV WIND ENERGY and BIO ENERGY 9

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT V OTHER RENEWABLE ENERGY SOURCES 10

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Rai G.D. “Non-Conventional Energy Sources”, Khanna Publishers, 2013.
2. Twidell& Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011.

REFERENCES

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, Re-print 2015.
2. Ramesh R & Kumar K.U, “Renewable Energy Technologies”, Narosa Publishing House, Re-print 2018.
3. Solanki, Chetan Singh “Renewable Energy Technologies: A Practical Guide for Beginners”, 2nd Edition, P.H.I, New Delhi, 2013.
4. Kothari D.P, Singhal., K.C., “Renewable energy sources and emerging technologies”, 2nd Edition, P.H.I, New Delhi, 2015.

19ME08E	SOLAR PHOTOVOLTAIC ENERGY CONVERSION	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: recognize the fundamentals of solar cells. (K2)
CO2: understand the various solar cell fabrication processes. (K2)
CO3: realize the technology of PV module assembly (K2)
CO4: design and analyze on-grid PV applications. (K3)
CO5: design off-grid PV systems and perform cost benefit analysis of PV installations. (K3)

UNIT I SOLAR CELL FUNDAMENTALS 9

Fundamentals of Semiconductors, energy band, direct & indirect band gap, doping, PN Junction, charge carriers, carrier motion & recombination, Photovoltaic effect, Solar cells - Design characteristics, parameters influencing performance, losses in solar cells, Solar radiation measurement - pyranometer, pyrheliometer.

UNIT II SOLAR CELL FABRICATION 9

Preparation of metallurgical, electronic and solar grade silicon - Production of polycrystalline and monocrystalline silicon: Czochralski (CZ) and Float zone (FZ), wafer dicing, refining. Thin film solar cells - A-Si, CIS/CIGS, Thin film deposition techniques - Physical vapour deposition (PVD), Chemical vapour deposition (CVD) - Plasma enhanced CVD, Emerging technologies - Organic cells, Multi-junction cells, Dye sensitized cells.

UNIT III SOLAR PV MODULE ASSEMBLY 8

Diffusion, Optical loss minimization - Anti reflective coating, Surface texturing, minimization of recombination - Surface passivation, Metal contacts - pattern defining and deposition. PV module fabrication: Number of cells in a module, blocking and bypass diode, packing density, Hot spots, Solar simulator: I-V measurement, PV module specifications.

UNIT IV ON-GRID PV SYSTEMS 9

PV string and array - Balance of system -DC-DC converters - Inverters - Maximum power point tracking - On-Grid PV system - Design & analysis -Net Metering - Performance evaluation& monitoring - Field visit - Grid tied PV power plant.

UNIT V OFF-GRID PV SYSTEMS 10

Off-Grid standalone PV system -System sizing - Module & Battery-Charge controller - Storage Batteries for PV systems -Design & analysis - Performance evaluation & monitoring - Economic indicators: Simple payback, Life cycle costing.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Chetan Singh Solanki “Solar Photovoltaics Fundamentals, Technologies and Applications”, 3rd Edition, Prentice Hall of India, 2015.

REFERENCES

1. Chetan Singh Solanki “Solar Photovoltaic Technologies and Systems - A manual for Technicians, Trainers and Engineers”, Prentice Hall of India, 2014.
2. Robert Foster Majid Ghassemi, Alma Cota “Solar Energy - Renewable Energy and the Environment”, CRC Press, 2010.
3. James P. Dunlop, “Photovoltaic Systems”, 3rdEdition, American Technical Publishers, 2015.
4. A. Goetzberger,V.U. Hoffmann “Photovoltaic Solar Energy Generation”, Springer-Verlag Berlin, Heidelberg, 2019.
5. Martin Green “Solar Cells: Operating principles, technology and systems application”, Prentice Hall, 2016.
6. www.pveducation.org

19ME09E	THERMAL DESIGN AND MANAGEMENT OF ELECTRONIC EQUIPMENTS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

CO1: Explain the needs of thermal management in electronics packaging. (K2)
CO2: Apply the concept of conduction in cooling for electronic circuit board. (K3)
CO3: Estimate the performance of convective cooling in electronics. (K3)
CO4: Utilize the concept of heat pipe in latest electronic equipment. (K3)
CO5: Estimate the thermal and electrical reliability of the electronic equipment. (K3)

UNIT I INTRODUCTION TO THERMAL MANAGEMENT 8

Introduction - importance of thermal management of electronics - Issues in Electronics packaging design - technical management issues - temperature effects on different failure modes - Basics of conduction, convection and radiation heat transfer in electronic components - Cooling Specifications for Electronics.

UNIT II HEAT CONDUCTION IN ELECTRONIC EQUIPMENTS 10

Mountings of electronic components - uniformly distributed heat source, steady state conduction - thermal resistance, junction to case resistance, contact interface resistance - circuit board with an aluminum heat sink core, chassis with non-uniform wall sections, heat conduction through sheet metal cover and heat transfer in cylindrical shell.

UNIT III HEAT CONVECTION IN ELECTRONIC EQUIPMENTS 10

Free convection - flow through flat horizontal and vertical plates - finned surface - cooling for PCB - forced Convection cooling - fan cooled electronic box - hollow core PCB - undesirable airflow reversal - direct air impingement cooling - finned cold plate and heat exchanger - effect of altitude in heat exchanger performance.

UNIT IV SPECIAL APPLICATION FOR COOLING 9

Introduction to latest technology in cooling - Heat Pipes - degraded performance in heat pipes - performance - application - Liquid cooling - direct and indirect cooling - forced liquid cooling systems - pumps for cooling - liquid coolant - simple liquid cooling systems - mounting components for indirect liquid cooling - transistors on water cooled cold plate - solid state thermoelectric cooling.

UNIT V RELIABILITY ANALYSIS 8

Mechanical reliability - stress analysis - engineering assumption - failure - life expectancy - thermal stress and strains. Electrical reliability - MTTF - first year failure - reliability model - system failure rate.

L:45 TOTAL: 45 PERIODS

Note:*Use of HMT data book is permitted in the end semester examinations.*

TEXT BOOKS

1. Practical Guide to the packaging of electronics - Thermal and Mechanical design and analysis, Ali, CRC press Inc, 3rd Edition, 2016.
2. Cooling Techniques for Electronics Equipment, Dave S. Steinberg, John Wiley & Sons, 2nd revised Edition, 1991.

REFERENCES

1. Younes Shabany, Heat Transfer: Thermal Management of Electronics, CRC Press Inc, 2010.
2. Ravi Kandasamy and Arun S. Mujumdar, Thermal Management of Electronic Components, Lambert Academic Publishing, 2010.
3. Rao R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill, 2019.
4. Yunus A. Cengel, Heat Transfer: A Practical Approach, McGraw-Hill, 2008.
5. Sung Jin Kim, Sang Woo Lee, Air Cooling Technology for Electronic Equipment, Taylor & Francis, 2020.

19ME10E	ENERGY CONSERVATION AND WASTE HEAT RECOVERY	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

CO1: Describe the necessity and various energy conservation methods to meet the present energy scenario. (K2)
CO2: Explain the basic characteristics of instruments for energy conservation. (K2)
CO3: Recognize the various measures for energy conservation in thermal utilities. (K2)
CO4: Familiarize with recent energy efficient opportunities in electrical utilities. (K2)
CO5: Explain the concept and significance of various waste heat recovery systems. (K2)

UNIT I INTRODUCTION 7

Energy Scenario - Principles and Imperatives of Energy Conservation - Energy Consumption Pattern - Resource Availability in India and worldwide - Energy Audit-Purpose, Methodology for various applications and Report Preparation - Role of Energy Auditor in Industries.

UNIT II INSTRUMENTS FOR ENERGY CONSERVATION PROCESS 9

Instrument characteristics - Measurement of flow, velocity, pressure, temperature, speed, Lux, power and humidity. Analysis of stack, water quality, power and fuel quality.

UNIT III ENERGY CONSERVATION IN THERMAL UTILITIES 11

Various Energy Conservation Measures in Steam System - Losses in Boiler - Steam Traps- Types, Function and Necessity - Energy conservation in pumps, Fans & Compressors, Air conditioning and refrigeration systems.

UNIT IV ENERGY CONSERVATION IN ELECTRICAL UTILITIES 9

Potential Areas for Electrical Energy Conservation in Various Industries-Energy Management Opportunities in Electrical Heating, Lighting system, Cable selection - Energy Efficient Motors - Factors involved in Determination of Motor Efficiency.

UNIT V WASTE HEAT RECOVERY SYSTEMS 9

Selection criteria for waste heat recovery technologies - Recuperators, Regenerators, Economizers - Plate Heat exchangers, fluidized bed heat exchanger, heat pipes exchanger - heat pumps, sorption systems - Waste heat boilers design Considerations.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Steve Doty, Wayne C. Turner, “Energy management handbook”, 8th Edition, lulu Press, Inc., 2013.
2. F Kreith, D.Y. Goswami, “Energy management and conservation handbook”, 2nd Edition, Taylor & Francis, 2016.

REFERENCES

1. Patrick, Energy Conservation Guidebook, 3rd Edition, Taylor & Francis Exclusive, 2014.
2. Taimoor Pervez, Sohaib Ejaz Randhawa, Nauman Sadiq, Waste Heat Recovery and Energy Conservation of Arl Distillation Unit, LAP publisher, 2011.
3. Steven Fawkes, Energy Efficiency: The Definitive Guide to the Cheapest, Cleanest, Fastest Source of Energy 1st Edition, Rout ledge publication, 2013.
4. Ming Yang, Xin Yu, Energy Efficiency: Benefits for Environment and Society (Green Energy and Technology), 2015.

19ME11E	HEATING VENTILATION AND AIR CONDITIONING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the concept of HVAC system. (K2)
CO2: Evaluate heat load calculations. (K3)
CO3: Understand the basic principle and components of ventilation system. (K2)
CO4: Discuss the concept of chilled water system. (K2)
CO5: Identify and selection of HVAC components. (K3)

UNIT I INTRODUCTION TO HVAC SYSTEM 9

Scope of HVAC Industry with overview of Consulting & Construction industry, Concepts of Air conditioning Systems, Refrigeration cycle, cooling and heating system, Chilling system, Humidification and dehumidification methods, Filtration, Air conditioning system- Window, Split, Packaged and Centralized, Chilled water system, Psychrometric chart and Properties of air, Refrigerants, Refrigerant pipe sizing.

UNIT II HEAT LOAD ESTIMATION 9

Introduction to ASHRAE and ISHRAE standards, Basics of Heat Transfer in a building envelop, understanding of outdoor and indoor conditions, Factors affecting the Load estimate, Sources of external and internal heat gain, Heat gain through ventilation and infiltration air, Heat gain through duct, Calculating RSH, RLH, OASH, OALH, GTH, ESHF, ADP and dehumidified CFM. Demonstration of Heat load calculation with simple computing software.

UNIT III DESIGN OF AIR DISTRIBUTION SYSTEM 9

Components of Air distribution, Types of Ducts, Duct Fittings, Dampers, Types of Diffusers, Return Air Grill, Flexible Duct, Flexible connector, End Cap, Sound Attenuator, Duct elbow sections, vanes location and number of vanes required, Duct material calculation, Duct Design and Fan selection, Ventilation system - Types and components.

UNIT IV CHILLED WATER SYSTEM DESIGN 9

Introduction to chilled water and hot water system, classification chillers, chiller arrangements, cooling tower arrangements, Pumps required in chilled water system, chilled water system pipe designing, pipe designators, piping standards, piping fittings and components, valves used in chilled water system, Frictions loss in pipes, fitting, and valves, calculating TDH for pump.

UNIT V EQUIPMENT SELECTION, ERECTION AND DETAILING 9

AHU and FCU classification and selection, Selection of Package unit, DX chiller, Condenser, cooling tower and Expansion tank. Detailing and installation of chillers, AHU, package units, FCU, condensing units, Estimation of project, Drafting of HVAC systems.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Robert McDowall, “Fundamentals of HVAC Systems”, ASHRAE E-learning system, 2007.

REFERENCES

1. William Bobenhausen, “Simplified Design of HVAC Systems”, Wiley, 1994.
2. Walter T.Grondzik, “Air-Conditioning System Design Manual”, Butterwoth-Heinemann, 2007.
3. Mohsen SheikholeslamiKandelousi, “HVAC System”, Intech Open, 2018.
4. Robert McDowall, “Fundamentals of Air System Design”, ASHRAE E-learning system, 2009.

19ME12E	TURBOMACHINES	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the basic principles of operation, classifications, types and applications of pumps, fans, blowers and compressors. (K2)
CO2: Analyze thermodynamically the performance of turbo machines. (K3)
CO3: Describe the geometry of blades, cascade parameters, performances of cascade. (K2)
CO4: Describe performance, design parameters and specifications of turbo machines used for different applications. (K2)
CO5: Describe the principles of operations, performance of different types of wind turbine and their applications. (K2)

UNIT I BASIC TURBO SYSTEMS 9

Turbo Machine: Basic concept and significant, Turbines, Compressors, Fan, blowers - classifications and types, working principles, applications.

UNIT II TURBOMACHINES AND THERMODYNAMIC PRINCIPLES 9

Turbomachine - Application of Laws of thermodynamics, thermal performance - different types of thermal efficiencies.

UNIT III DYNAMIC ANALYSIS 9

Aerofoil, blade geometry, cascades, cascade analysis, different types of losses, estimation of losses, design concepts.

UNIT IV SELECTION OF TURBO-MACHINES 9

Non-dimensional parameters - Performance of turbomachines -losses and performance curves - design condition and off design conditions - design parameters - specifications - selection criteria.

UNIT V WIND TURBINES 9

Types - Construction and working - performance - latest developments - small and micro wind mills.

L:45; TOTAL:45 PERIODS

Note: Use of Gas tables and steam tables are permitted in the End Semester Examination

TEXT BOOK

1. Yahya S M, “Turbines, Compressors & Fans”, Tata-McGraw Hill Co., 2017.

REFERENCES

1. Kadambi V and Manohar Prasad, “An Introduction to energy conversion”, Volume III - Turbo machinery, New Age International Publishers (P) Ltd., Second Edition, 2011.
2. Gopalakrishnan G and Prithvi Raj D, “A Treatise on Turbo machines”, ScitechPublications India Pvt. Ltd., 2008.
3. William W Perg, “Fundamentals of Turbomachinery” John Wiley & Sons, Inc. 2008.
4. Logan R, Ramendra R, “Handbook of Turbomachinery”, Marcel-Dekker, 2nd Edition Revised, 2003.

19ME13E	AUTOMOTIVE ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: discuss the components mechanisms in automotive starting system (K2)
CO2: describe the constituents and working of charging and lighting systems (K2)
CO3: express the importance of electronics in ignition and fuel injection systems (K2)
CO4: explain the role of sensors and microprocessors in automobiles (K2)
CO5: explain the safety systems in recent automobiles (K2)

UNIT I BATTERIES AND STARTING SYSTEM 9

Different types of Batteries-principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms- Bendix drive, Overrunning clutch drive. Starter switches.

UNIT II CHARGING SYSTEM LIGHTING AND ACCESSORIES 9

DC Generators and Alternators their characteristics. Control unit- cut out, electronic regulators, bridge rectifiers. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn - Horn relay.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9

Spark plugs - Spark advance mechanisms - Different types of ignition systems. Electronic fuel injection systems, mono and multi point fuel injection system (MPFI).

UNIT IV SENSORS AND MICROPROCESSORS 9

Basic sensor arrangements. Types of sensors - oxygen sensor, hot wire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer - controlled devices in automobiles - voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT V SAFETY SYSTEMS 9

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti-theft system.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. A. L. Statini, “Automotive Electrical and Electronics”, Delmar Publications, 2013.
2. Tom denton, “Automotive Electrical and Electronics Systems”, Allied Publishers, 2016.

REFERENCES

1. William B.Riddens “Understanding Automotive Electronics”, 5th Edition, Butter worth Heinemann Woburn, 2013.
2. A K Babu, “Automotive Electrical and Electronics”, Khanna Publishers, 2016.
3. J Marek, H P Trah, Y Suzuki, I.Yokomori, “Sensors for Automotive Applications”, Wiley-VCH, 2003.

19ME14E ENERGY STORAGE SYSTEMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: Describe the methods of energy storage (K2)
- CO2: Describe sensible and latent heat thermal energy storage system (K2)
- CO3: Understand the concept of mechanical and chemical energy storage (K2).
- CO4: Demonstrate the storage behavior in electro chemical systems (K2)
- CO5: Realize the concept of electrical energy storage systems and evaluate their performance parameters (K2)

UNIT I ENERGY STORAGE METHODS 9

Introduction: Energy storage needs - Potential energy - Pumped hydro, compressed air - Kinetic energy - mechanical flywheels - Thermal energy storage with phase change material - ice, organic and inorganic PCM - Chemical energy - hydrogen, methane - Electrochemical energy - batteries, fuel cells - Electrostatic energy - capacitors, Electromagnetic energy - superconducting magnets.

UNIT II THERMAL ENERGY STORAGE SYSTEMS 9

Thermal Energy Storage Concepts - Materials for Sensible and Latent Heat Storage - Simple water and Rock-bed storage systems; pressurized water storage system - Phase

Change Materials (PCMs); Selection criteria of PCMs; Organic, Inorganic Eutectic Materials, Materials for Low and High Temperature Storage Applications.

UNIT III MECHANICAL AND CHEMICAL ENERGY STORAGE SYSTEMS 9

Pumped hydro energy storage, Compressed air energy storage, Energy storage in Advanced Flywheels, Hydrogen Energy - production of hydrogen by reforming & electrolysis, Hydrogen storage methods.

UNIT IV ELECTROCHEMICAL ENERGY STORAGE SYSTEMS 9

Introduction to batteries, factors effecting battery performance, storage density, energy density, losses in cells - Battery classification, Lithium; Lead acid batteries; Nickel Cadmium batteries; Advanced batteries - (i) zinc-Air (ii) Nickel Hydride.
Introduction to fuel cells, hydrogen-oxygen cells, hydrogen-air cell, hydrocarbon-air cell, alkaline fuel cell - advantages and drawbacks.

UNIT V ELECTRIC ENERGY STORAGE SYSTEMS 9

Capacitor: Comparison and application; Super capacitor: Basic components, Electrochemical Double Layer Capacitor (EDLC), principle of working, structure, performance and application, role of activated carbon and carbon nano-tube. Electromagnetic energy storage: Superconducting Magnetic Energy Storage.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Robert Huggins, 'Energy Storage: Fundamentals, Materials and Applications', 2nd Edition, Springer, 2015.

REFERENCES

1. Yves Brunet., 'Energy storage', Wiley publications, 2013.
2. Detlef Stolten, "Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications", Wiley, 2010.
3. Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, 'Electrochemical Technologies for Energy Storage and Conversion', John Wiley and Sons, 2012.
4. Francois Beguin and Elzbieta Frackowiak, 'Super capacitors', Wiley, 2013.
5. Ibrahim Dincer and Mark A Rosen, 'Thermal Energy Storage Systems and Applications', John Wiley and Sons 2011.
6. Luisa F.Cabeza., 'Advances in thermal energy storage systems', Woodhead publications, 2014.

19ME15E	**COMPUTATIONAL FLUID DYNAMICS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

CO1: Apply computational techniques for solving engineering problems. (K3)
CO2: Discuss the fundamentals and procedures used in CFD/FEM. (K3)
CO3: Apply CFD to analyze the fluid flow. (K4)
CO4: Apply CFD to analyze the thermal systems. (K4)
CO5: Perform static and dynamic analysis using FEA in structural members. (K4)

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 12

Basics of computational fluid dynamics - Governing equations of fluid dynamics - Continuity, Momentum and Energy equations - Physical boundary conditions - Laminar and Turbulent Flow - Turbulent-Kinetic Energy Equations - Mathematical behaviour of PDEs on CFD -Elliptic, Parabolic and Hyperbolic equations.

UNIT II TURBULENCE MODELS AND MESH GENERATION 12

Turbulence models, mixing length model, Two equation (k-Є) models - High and low Reynolds number models - Structured Grid generation - Unstructured Grid generation - Mesh refinement - Adaptive mesh - Software tools.

UNIT III APPLIED PROJECTS CFD - I 12

Internal Fluid flow - Pipe bends, Branch and lateral-Symmetric - Transient - Header Flow Distribution Post processing - Different CFD Outputs: Contour plots - Surface Plots, Plotting, Vectors, Turbulence Modeling External Flow - Flow over a circular cylinder, simple car and aero plane.

UNIT IV APPLIED PROJECTS CFD - II 12

Radiation problems - Heat Transfer distribution - Porous media - Pump - Fan - Gaseous Combustion -Particle Study - Multi phase problems.

UNIT V APPLIED PROJECTS FEA 12

Stress - Strain - FOS -Machine elements under Static Structural Loads - Modal Analysis - Thermal Analysis - Vibrations - Non-Linear Analysis.

L:30; P:30; TOTAL: 60 PERIODS

TEXT BOOKS

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd. Second Edition, 2007.
2. Jiyuan TL, Guan HengYeoh, “Computational Fluid Dynamics A Practical Approach” Butterworth-Heinemann, First Edition 2008.

REFERENCES

1. Hyoung Woo Oh, “Applied Computational Fluid Dynamics”, InTech Publishers, 2012.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005.
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2003.

5. Prodip Niyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.
6. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.
7. Anderson “Computational Fluid Dynamics the Basics with Application” Mcgraw Hill, 1996.

19ME16E	HYBRID ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the concepts of electric and hybrid vehicle and drive trains. (K2)
CO2: Identify and select suitable components of propulsion systems for electric vehicles (K2)
CO3: Recognize the proper energy storage systems for vehicle applications (K2)
CO4: Estimate the size of the drive system of electric vehicles (K2)
CO5: Explain the energy management strategies of electric and hybrid electric vehicles. (K2)

UNIT I INTRODUCTION TO HYBRID ELECTRIC VEHICLES 9

History, social and environmental importance of hybrid and electric vehicles - Impact of modern drivetrains on energy supplies - Hybrid Electric Drive-trains and Electric Drive-trains - Basic concept of electric traction - Introduction to various electric drive-train topologies - Power flow control in electric drive-train topologies- Fuel efficiency analysis.

UNIT II ELECTRIC PROPULSION UNIT 9

Introduction to electric components used in hybrid and electric vehicles - Configuration and control of DC Motor drives - Configuration and control of Induction Motor drives - Configuration and control of Permanent Magnet Motor drives - Configuration and control of Switch Reluctance Motor drives - Drive system efficiency.

UNIT III ENERGY STORAGE UNIT 9

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles - Battery based energy storage and its analysis - Fuel Cell based energy storage and its analysis - Hybridization of different energy storage devices.

UNIT IV SIZING THE DRIVE SYSTEM 9

Matching the electric machine and the internal combustion engine (ICE) - Sizing the propulsion motor - Sizing the power electronics - Selecting the energy storage technology – Communications and supporting subsystems.

UNIT V ENERGY MANAGEMENT STRATEGIES 9

Introduction to energy management strategies used in hybrid and electric vehicles - Classification of different energy management strategies - Comparison of different energy management strategies - Implementation issues of energy management strategies - Case Studies - Design of a Hybrid Electric Vehicle (HEV) and a Battery Electric Vehicle (BEV).

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, 2nd Edition, CRC Press, 2011.
2. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2012.

REFERENCES

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2010.
2. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2001.
3. http://nptel.ac.in/courses/108103009/

19ME17E	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify the fluid power symbols and select suitable fluid for different applications. (K2)
CO2: Choose suitable fluid power driving system and actuators for any given application. (K3)
CO3: Select appropriate fluid power control elements for simple fluid power systems. (K2)
CO4: Describe the working of pneumatics components and circuits. (K2)
CO5: Design and develop the fluid power circuit for any specific applications. (K3)

UNIT I FUNDAMENTALS OF FLUID POWER SYSTEMS 9

Introduction to Fluid power systems - Types, Advantages and Applications. Properties of hydraulic fluids - General types of fluids - Basics of Hydraulics system. Applications of Pascal’s Law - Laminar and Turbulent flow - Reynold’s number - Darcy Weisbach equation - Losses in pipe, valves and fittings - Problems - Case studies on simple hydraulic systems.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 9

Sources of Hydraulic Power - Pumping theory - Pump classification - Construction and working of Gear, Vane and Piston pumps - Performance. Fluid Power Actuators- Linear actuators - Single acting, Double acting, special cylinders like tandem, Rod less, Telescopic. Cushioning mechanism in linear actuators. Rotary actuators - Gear, Vane and Piston motors. ISO symbols of Fluid power components.

UNIT III CONTROL COMPONENTS 9

Types of control components - Direction control valves - Shuttle valve - check valve - pressure control valve - counterbalance valves - pressure reducing valve - sequence valve. Flow control valves - fixed and adjustable, solenoid valves, relays. Accumulators and Intensifiers - types - working principle - sizing of accumulators - accumulators circuits, pressure intensifier - applications.

UNIT IV PNEUMATIC SYSTEM COMPONENTS AND SERVO SYSTEMS 9

Properties of air - Pneumatic components - Compressors - Filter, Regulator, and Lubricator (FRL) unit - air control valves, quick exhaust valves, and pneumatic actuators. Servo systems - Hydromechanical servo systems, Electro-hydraulic servo systems and proportional valves. Introduction to PLC - ladder diagrams - applications of PLC in fluid power control - case studies on simple pneumatic systems.

UNIT V DESIGN OF FLUID POWER CIRCUITS 9

Fluid Power Circuit Design, Circuits for acceleration and deceleration, synchronizing circuit, regenerative circuits, feed circuits, sequencing circuits, fail-safe circuits, Pneumo-hydraulic circuit, Sequential circuit design for simple applications using cascade method. Applications in Assembly, Metalworking, materials handling and plastics working.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Anthony Esposito, Fluid Power with Applications, Pearson Education New Delhi, 2013.
2. Andrew Parr, Hydraulics and Pneumatics, Jaico Publishing House, 2013.

REFERENCES

1. Majumdar SR, Pneumatic Systems - Principles and Maintenance, Tata McGraw Hill, 2006.
2. Majumdar SR, Oil Hydraulic Systems - Principles and Maintenance, Tata McGraw-Hill, 2006.
3. Illango S and Soundararajan V, Introduction to Hydraulics and Pneumatics Prentice Hall of India, 2011.
4. John S Cundiff, Fluid Power Circuits and Controls - Fundamentals & Applications, CRC Press, 2019.
5. James L Johnson, Introduction to Fluid Power, Cengage Learning, 2002.
6. William Bolton, Pneumatic & Hydraulic Systems, Elsevier Science and Technology, 1997.

19ME18E DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Select locating and clamping devices for a given machining operation. (K3)
CO2: Design jig and fixture for a simple component to perform simple operation. (K3)

CO3: Estimate press capacity and prepare strip layout. (K3)
CO4: Design and develop bending and drawing dies. (K3)
CO5: Design a blanking and piercing die. (K3)

UNIT I LOCATING AND CLAMPING PRINCIPLES 9

Principles of location - Locating methods and devices. Principles of clamping - Clamping elements with mechanical, pneumatic and hydraulic actuations. Standard parts - Drill bushes- Tolerances and error analysis. Design considerations for Jigs and Fixtures.

UNIT II JIGS AND FIXTURES 9

Types of Jigs - post, turnover, channel, latch, box, pot, angular post jigs - Indexing jigs. General principles of milling, Lathe, boring, broaching and grinding fixtures - Assembly, Inspection and Welding fixtures - Modular fixtures- Quick change fixtures. Design of jigs and fixtures for given component.

UNIT III ELEMENTS OF PRESS TOOLS 9

Press Working Terminologies - operations - Types of presses - press accessories - Computation of press capacity - Strip layout - Centre of pressure - Material Utilization - Shearing action -Clearances - Press Work Materials - Functions of various elements of dies - Die Block - Punch holder, die set, guide plates - Stops - Strippers - Pilots - Selection of Standard parts.

UNIT IV BENDING AND DRAWING DIES 9

Blank development for the above operations - Types of bending dies - Press capacity - spring back - knockouts - pressure pads - ejectors - variables affecting metal flow in drawing operations - draw die inserts - Design and development of bending and drawing dies.

UNIT V BLANKING DIES 9

Design and development of blanking, piercing, compound and progressive dies. Recent trends in tool design - computer assisted metal forming.

L:45; TOTAL:45 PERIODS

Note: ***Use of P S G Design Data Book is permitted in the End Semester Examination***

TEXT BOOKS

1. Joshi P H, “Jigs and Fixtures”, Tata McGraw Hill, 3rd Edition, New Delhi, 2010.
2. Donaldson, Lecain and Goold “Tool Design”, Tata McGraw Hill, 4th Edition, 2012.

REFERENCES

1. Design Data Hand Book, PSG College of Technology, Coimbatore, 2020.
2. Hoffman, “Jigs and Fixture Design”, Thomson Delmar Learning, Singapore, 2004.
3. Venkataraman, K, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2015.
4. Kempster, “Jigs and Fixture Design”, Hodder and Stoughton, 3rd Edition 1987.
5. Joshi P H, “Press Tools - Design and Construction”, Wheels publishing, 2008.
6. ASTME Fundamentals of Tool Design, Prentice Hall of India, 1984.

19ME19E	MECHATRONICS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the importance of mechatronics systems and its applications. (K2)
CO2: Discuss types and functions of various actuators and sensorssystems. (K2)
CO3: Explain the signal conditioning and DAQ systems. (K2)
CO4: Interpret actual models of simple systems and controllers. (K2)
CO5: Describe the significance of PLC and micro mechatronics systems for automation. (K2)

UNIT I INTRODUCTION TO MECHATRONICS 9

Introduction - Definition - need - elements. Traditional and Mechatronics Design process - Design Parameters - Advanced approaches in Mechatronics for Industrial applications. Continuous monitoring system - Case study on the application of Mechatronics system in process automation, manufacturing, product design and testing.

UNIT II ACTUATORS AND SENSORS 9

Introduction to pneumatic and hydraulic systems - over view - valves and its types - selection. electro-pneumatic actuator - solenoids. Electric motors - DC motors, AC motors, single phase motor - 3-phase motor - induction motor - synchronous motor - stepper motors.

Importance of sensors and transducers - classification - static and dynamic characteristics - Measurements - displacement, strain, position, velocity, flow, pressure, temperature, humidity, vibration, liquid level and light sensors - Case study on selection of sensors for specific applications.

UNIT III SIGNAL CONDITIONING AND DATA ACQUISITION SYSTEM 9

Analog Signal Conditioning - Op-Amp Circuits - Principles of Analog to Digital Converters (DAC) and Digital to analog converters (ADCs) - Multiplexer and De-multiplexer. Overview of Data Acquisition System (DAQ) - Analog and Digital Data Acquisition Systems. Overview of Data Logger - Functional block diagram, use of Data Acquisition System in industries.

UNIT IV SYSTEM MODELS AND CONTROLLERS 9

Building blocks for simple mechanical, electrical, fluid and thermal systems - Rotational transnational systems - Electro mechanical systems. Continuous and discrete process controllers - Control modes - introduction - Two-step, Proportional, Derivative, Integral mode and PID controllers. Applications of controllers for process monitoring activities.

UNIT V PLC and MICRO MECHATRONIC SYSTEMS 9

Introduction to Programmable Logic Controllers (PLC)-Basic Structure - Input / Output Processing - Programming - Mnemonics - Timers, Internal relays and counters - Shift

Registers - Master and Jump Controls - Data Handling - Analogs Input/Output - Applications. Micro-Mechatronics elements, Micro-sensor - Micro actuator - characteristics, Applications of Micro Mechatronics systems.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Bolton, W., "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", 7th Edition, Pearson Education, 2018.
2. NitaigourPremchandMahalik, "Mechatronics - Principles, Concepts and Applications", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2006.

REFERENCES

1. Alciatore, D.G. and Histand, M.B., Introduction to Mechatronics and Measurement Systems, 4th Edition, McGraw Hill, 2012.
2. David G Alciatore and Michael B Histand, "Introduction to Mechatronics and Measurement Systems", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2012.
3. Doeblin E O, "Measurement Systems", 5th Edition, McGraw Hill, 2008.

19ME20E	**INDUSTRIAL ROBOTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the basic configurations of robots (K2)
CO2: Discuss the robot drive system and the forward and inverse kinematics (K2)
CO3: Explain the working of sensors and Machine Vision system (K2)
CO4: Write simple robot programming (K2)
CO5: Discuss the use of robot in various fields (K2)

UNIT I INTRODUCTION 9

Robot - Definition - Robot Anatomy - Co-ordinate Systems, Work Envelope - Types - Classification. Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions - Need for Robots - Different Applications.

UNIT II COMPONENTS AND OPERATIONS 9

Basic control system concepts - control system analysis - robot actuation and feedback, Manipulators - Coordinate transformation - Brief of Robot dynamics. Types of end effectors - Grippers - Tools as end effectors.

UNIT III SENSORS AND MACHINE VISION 9

Types of sensors - Range sensors - Proximity sensors - Touch sensors - Force and Torque sensors- applications. Introduction to Machine vision - Sensing and digitizing - Image processing and analysis.

UNIT IV ROBOT PROGRAMMING 9

Methods - languages - Capabilities and limitation - Artificial intelligence (AI) - Knowledge representation - Search techniques - simple programming.

UNIT V INDUSTRIAL APPLICATIONS 9

Influence of robots in industry 4.0 - Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - CIM - Hostile and remote environments.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, Industrial Robotics: Technology, Programming and Applications, 2nd Edition, Tata McGraw Hill, 2012.
2. Mark R. Miller "Robots and Robotics" McGraw Hill International Edition, 2018.

REFERENCES

1. Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger N. Nagel, Ashish Dutta, "Industrial Robotics: Technology, Programming and Applications" McGraw Hill Education; 2nd Edition, 2017.
2. S K. Saha "Introduction to Robotics" 2nd Edition, 2014.
3. Ashitava Ghosal, "Robotics fundamental concepts and Analysis", oxford university press, 2006.

19ME21E	ADVANCED MODELING TECHNIQUES	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon successful completion of this course the students will be able to

- CO1: Apply the principles and concepts of Geometric modeling, solid modeling and assembly. (K3)
- CO2: Apply advanced modeling and computational tools for complex mechanical parts. (K3)
- CO3: Produce detailed exploded assembly views with Bill of Materials. (K3)
- CO4: Execute weldment and sheet metal CAD drawings for mechanical engineering applications in the current industrial practice. (K3)
- CO5: Describe the fundamentals of GD &T. (K2)

UNIT I MODELING CORE CONCEPTS 12

Planes and Axis - 2D Sketch - Line, Rectangle, arcs, relations, Constrained sketch. Part modeling - Extrude, Revolve, Sweep, Loft, Rib, Fillet, Chamfer, Shells, Mirroring, Patterns, drafts, custom properties.

Assembly constraints - Mates, Smart mates, Interference, Collision, Dynamic clearance, Exploding assembly.

UNIT II ADVANCED PART MODELING AND ASSEMBLY 12

3D Sketch - Parabola, conic, splines, derived sketches. Advanced part modeling - Flex, Bending, Twisting, Tapering & Stretching, Splitting, Multi body, Configurations. Assembly - Flexible sub assembly, Path, Linear coupler, Gear, Cam, Screw, Limit and Hinge mates, Assembly Configurations.

UNIT III ADVANCED DRAFTING AND ANIMATIONS 12

Different views - Model, projection, section, detail, broken, exploded. Dimensions - ordinate, driving, baseline, annotations, balloons, Bill of materials, tables, Tolerances. Animations -walkthrough videos, Photo view, Rendering.

UNIT IV WELDMENT AND SHEET METAL MODELING 12

Weldment - Structural Members, Trim, Extend, Gusset end caps, Weld beads, Cut List, Sub-weldment, Custom profiles. Sheet Metal - Cone, Cylinder, Lofts, Base Flange, Edge Flange, Swept flange, Mitre flange, sketched bend, Jog, Hem. Surfacing - Spline, boundary surface, knit.

UNIT V GEOMETRIC DIMENSIONING AND TOLERANCING 12

Engineering drawing and tolerance - Limits, fits and Tolerance - Tolerance symbols and terms - rules and concepts of GD&T - significance of GD&T - MMC, LMC - datum - Form - Orientation - profile - Runout.

L:30; P:30; TOTAL:60 PERIODS

Note: The End Semester Examination will be conducted in computer aided design laboratory

REFERENCES

1. Ibrahim Zeid, “CAD/CAM, Theory and Practice”, Tata Mc Graw Hill, 2010
2. Donald Hearn, “Computer Graphics”- Pearson Education Ltd, 2nd Edition, 2011.
3. Matt Lombard, Mastering Solidworks, 2018.
4. Alex Krulikowsi, Fundamentals of Geometric Dimensioning and Tolerancing, 2nd Edition, Delmar publications, 2012.
5. Standards for dimensioning and tolerancing - ASME Y 14.5, 2009
6. James D Meadows, GD&T Application, analysis and Measurements, ASME Press 2009.

19ME22E	PIPING DESIGN ENGINEERING	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Apply the fundamental principles for designing pipes and creating engineering drawings. (K2)

CO2: Explain the working principle of piping components and design of pipes for various piping codes and standards. (K2)

CO3: Analyze the stresses induced in the pipes under static loading condition. (K4)

CO4: Design pipes and pipe support structures considering weld reinforcement and stress intensifications. (K3)
CO5: Predict mathematically the behavior of pipes under dynamic conditions. (K4)

UNIT I FUNDAMENTALS 12

Engineering drawing fundamentals - Piping drawings - P and ID - Plot Plan - Layout - Mechanical Design fundamentals - Pressure, Temperature, Flow rates, stress, strain, theory of failure, Young's modulus, moment of inertia, section modulus and radius of gyration. Dynamic loads - Harmonic, Modal, Spectrum, frequencies.

UNIT II PIPING ELEMENTS AND MATERIALS 12

Introduction to piping - Piping Components - Pipe, Fittings, Flanges, Gaskets and Bolting - Valves - Isolation, Regulation, Non-return and Special purpose. Piping Materials - Piping Codes and Standards - Pipe Sizing, Diameter and Pressure drop calculations.

UNIT III PIPING SUPPORTS AND STATIC STRESS ANALYSIS 12

Piping Supports - Restraints and hangers - Variable and Constant load spring hangers - selection design methodologies - Stress analysis introduction - Method of analysis -Static Stress analysis exercises - Piping Flexibility - Code Stress requirement.

UNIT IV WRC AND SIF IN PIPING 12

Welding reinforcement calculations - Nozzle design - Stress intensification at elbows, tees and branch - Structure basics - Piping supporting structure modeling.

UNIT V DYNAMIC ANALYSIS 12

Wind and Seismic analysis - Damping - Lumped Mass - Steady state vibration and harmonic analysis - Time history Analysis.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Mohinder L Nayyar, "Piping Handbook", McGraw Hill Handbook, 7thEdition, 2000.
2. George A Antaki, "Piping and Pipeline Engineering: Design, Construction, Maintenance Integrity and Repair", CRC Press, 2003.

REFERENCES

1. "Power and Process Piping Standards" ASME B 31.1 & B 31.3, 2012.
2. Kellogg M W, "Design of Piping Systems", John Wiley & Sons, 2019.
3. Liang-Chuan Peng and Tsen-Loong Peng, "Pipe Stress Engineering", ASME Press, New York, 2009.

19ME23E	**VIBRATION CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the basic concepts of vibration and vibration control. (K2)
CO2: Analyze the vibration generation mechanism. (K3)
CO3: Explain the passive vibration control techniques. (K2)
CO4: Discuss the active vibration control methods. (K2)
CO5: Articulate the vibration measurement and analysis techniques. (K2)

UNIT I BASIC CONCEPTS OF VIBRATION 9

Basic Concepts: Review of free and forced vibrations with and without damping; Free and forced vibration of single, two and multi-degree of freedom systems with and without viscous damping. Basics of Vibration Control: reduction at source, Active feedback control, vibration isolation.

UNIT II VIBRATION GENERATION MECHANISM 9

Vibration generation mechanisms: Source classification, self-excited vibration, flow induced vibration, field balancing of rigid rotors/flexible rotors and damping models and measures, Design consideration of material selection.

UNIT III PASSIVE VIBRATION CONTROL 9

Basics, design of absorber, absorber with ideal spring, shock absorber, isolators with stiffness and damping.

UNIT IV ACTIVE VIBRATION CONTROL 9

Basics, Piezoelectric materials, electro-rheological fluids, magneto-rheological fluids, Electro- Magneto strictive Materials in Vibration Control, shape memory alloys and electro-magnetic materials.

UNIT V VIBRATION MEASUREMENT 9

Introduction -Transducers - Vibration Pickups - Frequency - Measuring Instruments - Signal Analysis: FFT analysis and filters- Machine condition Monitoring and Diagnosis.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Singiresu S.Rao, “Mechanical Vibrations”, 6th Edition, Pearson Education, 2018.
2. Inman DJ, “Vibration and Control”, John Wiley & Sons Inc, 2014.

REFERENCES

1. Grover. G.K., “Mechanical Vibrations”, 8th Edition, Nem Chand and Bros., 2020.
2. Balakumar Balachandran and Edward B. Magrab, “Fundamentals of Vibrations”, 1st Editon, Cengage Learning, 2014.
3. Ambedkar A.G, “Mechanical Vibrations and Noise Engineering”, Eastern Economy Edition, 2006
4. Tamadonni S & Graham S. Kelly, “Mechanical Vibrations”, Schaum’s outline Series, Mc-Graw Hill Inc, 2011.

19ME24E	VEHICLE SYSTEMS DESIGN	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Discuss the importance of aerodynamic factors on vehicle body design. (K2)
CO 2: Explain the role of ergonomics and vibration control in automobile design. (K2)
CO 3: Discuss the design criteria of chassis and suspension system. (K2)
CO 4: Explain the design considerations for braking and transmission systems. (K2)
CO 5: Discuss failure analysis and its importance in vehicle design. (K2)

UNIT I BODY DESIGN 9

Aerodynamics - Aerodynamic forces - Drag - Drag reduction - Stability and cross-winds - Noise - Under hood ventilation - Cabin ventilation - Wind tunnel testing - Computational fluid dynamics. Recent trends in automotive safety systems - Safety regulations and testing.

UNIT II HUMAN COMFORT IN VEHICLE DESIGN 9

Occupant accommodation - Ergonomics - Eight fundamental fallacies - Ergonomics methods and tools. Vibration control - Fundamentals of acoustics - Human response to sound - Sound measurement - Automotive noise criteria - noise sources - control techniques and Standards.

UNIT III CHASSIS AND SUSPENSION DESIGN 9

Load case, introduction - Chassis types, introduction - Vehicle suspension - Factors affecting design - Definitions and terminology - Mobility of suspension mechanisms - Kinematic analysis - Anti-squat and Anti-pitch suspension geometry- Roll centre analysis - Force analysis.

UNIT IV TRANSMISSION AND BRAKING SYSTEM DESIGN 9

Engine Characteristics - Vehicle’s power requirement - manual gearbox - automatic transmission - Continuously variable transmissions. Fundamentals of braking - Legislation - Brake proportioning and adhesion utilization - design of brake materials.

UNIT V FAILURE PREVENTION AND CRASHWORTHINESS 9

Aspects of failures - endurance and durability - Testing and failure prediction - automotive failures Accident and injury analysis - Crashworthiness - Vehicle impacts: general dynamics - crush characteristics - Structural collapse.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, Reed Educational and Professional Publishing Limited, 2012.

REFERENCES

1. Vivek D Bhise, “Ergonomics in the Automotive Design Process”, CRC Press, 2015.
2. Donald E Malen, “Fundamentals of Automobile Body Structure Design”, SAE

International, 2011.
3. Jan PN orbye, “Car Design: Structure & Architecture”, Tab Books, 2011.
4. Thomas D. Gillespie, “Fundamentals of Vehicle Dynamics”, SAE International, 2020.
5. Lorenzo Morello et.al, “The Automotive Body; Volume II: System Design”, Springer, New York, 2011.

19ME25E	**INDUSTRIAL TRIBOLOGY**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Discuss the basic concepts of Tribology in detail. (K2)
CO2: Discuss about the fundamental concepts and different mechanism involved in friction and wear. (K2)
CO3: Discuss the basic principles of hydrodynamic lubrication and the influence of various operating parameters on the thin film. (K2)
CO4: Discuss the basic principles of hydrostatic lubrication and the influence of various operating parameters on the thick film. (K2)
CO5: Select suitable surface modification methods based on the bearing materials. (K2)

UNIT I INTRODUCTION TO TRIBOLOGY 12

Introduction - Surface topography - Tribology in design - Tribology in industry - economic aspects of Tribology - lubrication - properties of lubricants - types of additives - extreme pressure lubricants - Tribology in condition monitoring - oil analysis.

UNIT II FRICTION AND WEAR 12

Friction - Laws of friction - types of Friction - Causes of friction - Friction Measurement- Theories of Friction - effect of surface preparation. Wear - Mechanism - Wear between solids and liquids - Factors affecting wear -Measurement of wear - Theories of Wear - Methods to Control Friction and Wear.

UNIT III HYDRODYNAMIC LUBRICATION 12

Theory of hydrodynamic lubrication, mechanism of pressure development in oil film, two-dimensional Reynold’s equation, infinitely long journal bearing, infinitely short journal bearing and finite bearing. Hydrodynamic thrust bearing: Introduction, flat plate thrust bearing, pressure equation, load, centre of pressure and friction in tilting pad thrust bearing.

UNIT IV HYDROSTATIC LUBRICATION 12

Basic concept, advantages and limitations, viscous flow through rectangular slot, load carrying capacity and flow requirement of hydrostatic step bearing, energy losses and optimum design of step bearing. Compensators and their actions. Squeeze film lubrication: introduction, circular and rectangular plates approaching a plane.

UNIT V SURFACE ENGINEERING 12

Concept of Wear and Corrosion resistance - Diffusion, coating, electro and electro less plating, hot deep coating, metal spraying, cladding, crystallizing coating, selection of coating for wear and corrosion resistance, potential properties and parameters of coating.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Bharat Bhushan, "Introduction to Tribology", John Wiley & Sons Ltd, Publication, 2nd Edition, USA, 2013.
2. Mehtha NK, "Machine Tool Design and Numerical Control", Tata Mc-GrawHill, 3rd Edition, 2017.

REFERENCES

1. Gwidon Stachowiak and Andrew W Batchelor, "Engineering Tribology", Elsevier International Publishing, Australia, 4th Edition, 2013.
2. Michael M Khonsari and Richard Booser E "Applied Tribology: Bearing Design and Lubrication", John wiley& Sons Ltd Publication, 3rd Edition, USA, 2017.
3. Giovanni Straffelini, "Friction and Wear: Methodologies for Design and Control-Springer Tracts in Mechanical Engineering", Springer International Publishing, Switherland, 2015.
4. Ghosh M K, Majumdar B C, Mihir Sarangi, "Fundamentals of Fluid Film Lubrication", McGraw Hill Education (India) Pvt. Ltd, New Delhi, 1stEdition, 2013.

19ME26E NEW PRODUCT DEVELOPMENT

L	T	P	C
2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Discuss the basic principles of generic development process and need analysis (K2)

CO2: Explain the process of concept selection for new product design and development (K2).

CO3: Summarize various aspects in detail design (K2)

CO4: Comprehend the principles of design validation and prototyping techniques (K2)

CO5: Interpret the concepts of economics principles and project management practices (K2)

UNIT I PRODUCT DEVELOPMENT AND NEED ANALYSIS 12

Introduction - A Generic Development Process - Field and Market analysis - Data collection techniques - Analysis of Data, PESTEL analysis - Identifying Customer Needs - House of Quality for Specifications - Establishing Target Specifications - Setting the Final Specifications.

UNIT II CONCEPT GENERATION AND EVALUATION 12

Concept generation activities - Pugh concept selection method: Concept screening; Concept scoring - Concept testing - Concepts for smart systems - Value Analysis.

UNIT III EMBODIMENT DESIGN 12

System level Design and issues - Architecture of Product - Sizing of Parts - Selection of materials using Bubble chart - Selection of Manufacturing Processes - Design for Manufacturing - Design for Assembly - Design for Ergonomics - Virtual Manikins - Importance of Tolerances - Detail Design and Bill of Materials.

UNIT IV DESIGN VALIDATION AND PROTOTYPING 12

Prototyping techniques - Additive Manufacturing - Metal Additive Manufacturing techniques - Virtual Prototyping using FEA -Topology Optimization - Generative Design.

UNIT V COST ANALYSIS AND PRODUCT LEGALITY 12

Product Development Economics: Economic Analysis Process - Managing Projects: Protecting intellectual property - Patents, Trade mark and Copy right.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. George E.Dieter, Linda C.Schmidt, “Engineering Design”, McGraw-Hill International Edition, 5th Edition, 2012.
2. Karl T Ulrich, Steven D Eppinger, Maria C Yang, “Product Design and Development”, 7th Edition, Tata McGraw-Hill Education, 2020.

REFERENCES

1. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2007.
2. Clive L.Dym, Patrick Little, “Engineering Design: A Project-based Introduction”, 4th Edition, John Wiley & Sons, 2013.
3. S.P. Jain & K.L. Narang, “Advanced Cost Accounting”, Kalyani Publishers, 2017.

19ME27E	DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENTS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the general principles of manufacturability (K2)
CO2: Understand the factors influencing form design (K2)
CO3: facilitate machining using various design features (K2)
CO4: redesign of castings based on Parting line considerations (K2)
CO5: know the concepts to design various components for the environmental concern (K2)

UNIT I INTRODUCTION 9

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits - Datum features - Tolerance stacks.

UNIT II FACTORS INFLUENCING FORM DESIGN 9

Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT III COMPONENT DESIGN - MACHINING CONSIDERATION 9

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machining area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly - Product design for manual assembly - Product design for automatic robotic assembly.

UNIT IV DESIGN FOR CASTING AND WELDING 9

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design – Design aspects for the welded components and assembly.

UNIT V DESIGN FOR THE ENVIRONMENT 9

Introduction - Environmental objectives - Global issues - Regional and local issues - Basic DFE methods - Design guide lines - application. Lifecycle assessment - Basic method - AT&T's environmentally responsible product assessment - Weighted sum assessment method - Lifecycle assessment method - Techniques to reduce environmental impact - Design to minimize material usage - Design for disassembly - Design for recyclability - Design for manufacture - Design for energy efficiency - Design to regulations and standards.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Harry Peck, Designing for manufacture, Pitman, 1973.
2. Kevin Otto and Kristin Wood, Product Design. Pearson Publication, (Fourth Impression) 2009.

REFERENCES

1. Bralla, Design for Manufacture handbook, McGraw hill, 1999.
2. Fixel, J. Design for the Environment McGraw Hill., 2011.
3. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 1996.
4. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 2001.
5. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
6. Boothroyd, G, Marcel Dekker, "Design for Assembly Automation and Product Design", New York, 1980.

19ME28E	**MEMS DEVICES - DESIGN AND FABRICATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Explain the fundamentals of MEMS and its applications (K2).

CO 2: Discuss the working of various sensors and actuators (K2).

CO 3: Explain various micro-machining processes (K2).

CO 4: Explain MEMS materials & fabrication methods (K2).

CO 5: Discuss applications of MEMS technology in various fields (K2).

UNIT I INTRODUCTION 8

Introduction to MEMS - Micro sensors, Micro actuators - microelectronics fabrication-micromachining - micro fluids- Mechanical MEMS, Magnetic MEMS, Thermal MEMS, RF MEMS - Nanotechnology - MEMS packaging and design considerations - Micro instrumentation- Applications and advantages of MEMS.

UNIT II SENSORS AND ACTUATORS 10

Principles of sensing and actuation - beam and cantilever - microplates - strain and pressure measurements-piezoelectric materials for MEMS, MEMS gyroscopes, shear-mode piezo-actuator, Applications. Interdigitated Finger capacitor - Comb drive devices - Micro Grippers - Micro Motors. Thermal Sensing and Actuation - Thermistors - Thermal couples - Thermal resistors - Thermal Bi-morph - Applications. Magnetic Actuators - Micro magnetic components - Use of Shape Memory Alloys in MEMS. Piezo-resistive and Piezoelectric sensors and actuators - piezoelectric effects - piezoelectric materials - Applications.

UNIT III MICRO MACHINING 9

Silicon Anisotropic Etching- Anisotrophic Wet Etching - Dry Etching of Silicon -Plasma Etching -Deep Reaction Ion Etching (DRIE) - Isotropic Wet Etching -Gas Phase Etchants-Case Studies-Basic surface micro machining processes -Structural and Sacrificial Materials -Acceleration of sacrificial Etch-Striction and Antistriction methods-LIGA Process-Assembly of 3D MEMS -Foundry process.

UNIT IV MEMS MATERIALS AND FABRICATION METHODS 9

MEMS Materials Properties, Microelectronic Technology for MEMS, Micromachining Process - Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, fabrication of Micro-machined Microstructure, Micro-stereo-lithography.

UNIT V APPLICATIONS OF MEMS TECHNOLOGY 9

Wafer Bonding, Chemical Mechanical Polishing, Bonding & IC Packaging of MEMS, Micro Scaling Considerations, Applications in Automotive Industry, Mechanical, Optical, Biomedical & Chemical industries - Case studies.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. NitaigourPremchandMahalik, "MEMS", McGraw Hill Education (India) Pvt Ltd, 11th reprint, 2016.
3. Stephen D Senturia, ‘Microsystem Design’, Springer Publication, 2007.
4. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata Mc-Graw Hill, New Delhi, 2002.

REFERENCES

1. Nadim Maluf, “An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, "Micro Sensors MEMS and Smart Devices", John Wiley & Son Ltd., 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer, 2010.

19ME29E	APPLIED NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the basic concept of nanotechnology. (K2)
CO2: Discuss synthesis of nano materials by different methods. (K2)
CO3: Demonstrate the various imaging technique to characterize nano materials. (K2)
CO4: Select nanomaterials for functional applications (K2)
CO5: Discuss the application of nanomaterials for heat transfer and energy storage (K2)

UNIT I INTRODUCTION TO NANO MATERIALS 9

Background to Nanoscale Science and Technology, fundamental physics and chemistry of nano materials, Effect of nano dimension on materials properties. Classification of nano materials - properties and applications, Quantum confinement effects with examples.

UNIT II SYNTHESIS OF NANOMATERIALS 9

High energy ball mill –– Mechanochemical process – Arc plasma - Sol gel processing - Spray pyrolysis - Electro spraying and spin coating -Vapour deposition and different types of epitaxial growth techniques (CVD, MOCVD, MBE) - Pulsed laser deposition, Magnetron sputtering.

UNIT III CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy – modes of operation, Resolution and contrast enhancement, TEM- modes of operation- Specimen preparation, HRTEM in nanostructures, AFM- Different modes of operation – contact and non-contact mode - Imaging and manipulation of samples in air/liquid environments, Surface and molecular manipulation using scanning tunnelling microscopy, Nanoindentation.

UNIT IV PROCESSING OF NANOCOMPOSITE FOR FUNCTIONAL APPLICATIONS 9

Bulk metal and ceramic nanocomposites, Processing of nanocomposites: Powder metallurgy method, Pressure Infiltration technique, ultrasonic based stir Casting, Processing of polymer nanocomposites, Nano composites for hard coatings, DLC coating. Carbon nanotube-based nanocomposites, Functional Low dimensional Nanocomposite.

UNIT V NANOMATERIALS FOR ENERGY STORAGE AND HEAT TRANSFER APPLICATION 9

Heat Transfer Fluids, Nanocomposites, Nanomaterials for energy storage, Solar collector, energy Harvesting, Fuel cell and hydrogen storage applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Chattopadhyay K. K and Banerjee A. N, “Introduction to Nanoscience and nanotechnology”, PHI Learning Private Ltd, 2009.
2. Ying Wang and Guozhong Cao, “Nanostructures and Nanomaterials: Synthesis, Properties and Applications”, World Scientific Publishing Ltd, 2nd Revised Edition, 2010

REFERENCES

1. S. Zhang and Nasar Ali, “Nanocomposite Thin Films and Coatings: Processing, Properties and Performance”, Imperial College Press, 2007.
2. Edelstein A.S. and Cammaratra R.C., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1998.
3. Suryanarayana C., “Mechanical alloying and milling”, Marcel Dekker, Inc., New York, 2005.
4. Cao G., “Nanostructures & Nano materials: Synthesis, properties & applications”, Imperial college press, 2004.
5. John Dinardo N, “Nanoscale characterization of surfaces & Interfaces”, Weinheim Cambridge, Wiley-VCH, 2nd Edition, 2008.
6. George J., “Preparation of thin films”, Marcel Dekker, Inc., New York, 2005.

19ME30E	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the fundamentals of composite materials and its classification(K2)

CO2: Describe the knowledge in polymer matrix composites and its processing methods (K2)

CO3: Understand the metal matrix composites and its manufacturing processes (K2)
CO4: Comprehend the ceramic matrix composite and its processing routes. (K2)
CO5: Discuss Mathematical techniques to predict the macroscopic properties of different Laminates. (K2)

UNIT I INTRODUCTION TO COMPOSITE MATERIALS 9

Definition, need –Classification of composite materials – General characteristics – Applications – Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Fibers – Glass, Carbon, Ceramic and Aramid fibers - characteristics of fibers and matrices -Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law - Reduction to Homogeneous Orthotropic Lamina - Rule of mixtures.

UNIT II METAL MATRIX COMPOSITES 9

Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC, limitations of MMC, Reinforcements – particles – fibres. Effect of reinforcement – volume fraction – rule of mixtures. Manufacturing methods of MMC – powder metallurgy process - diffusion bonding – stir casting –In-situ reactions-applications of MMC in aerospace, automotive industries.

UNIT III POLYMER MATRIX COMPOSITES 9

Polymer resins – thermosetting resins, thermoplastic resins – reinforcement fibres – ravings –woven fabrics – non woven random mats – various types of fibres. PMC Manufacturing methods - hand lay-up processes – compression moulding – injection moulding - resin transfer moulding – Pultrusion – Filament winding. Laminates- Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. - applications of PMC in aerospace, automotive industries.

UNIT IV CERAMIC MATRIX COMPOSITES 9

Engineering ceramic materials – properties – advantages – limitations – monolithic ceramics - need for CMC – ceramic matrix - various types of ceramic matrix composites-oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Applications of CMC in aerospace, automotive industries.

UNIT V MECHANICS OF COMPOSITES 9

Orthotropic Stiffness matrix (Q_{ij}), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Krishan K. Chawla, "Composite Materials: Engineering and Science", 3rd Edition, Springer, 2013.

2. Mallick, P K, “Fiber-reinforced composites: Materials, manufacturing and Design”, Third Edition, CRC press, 2007.

REFERENCES

1. John Cuppoleeti, “Metal, ceramic and polymeric composites for various uses”, In tech, 2011.
2. Ronald F. Gibson, “Principles of Composite Material Mechanics”, CRC Press; 4th Edition, 2016.
3. Ning Hu, “Composites and their properties”, Intech, 2012.
4. Adel zakiel-sonbati, “Thermoplastic-composite materials”, 2012.
5. T. H. G. Megson “Aircraft Structures for engineering students”, Fourth Edition Butterworth-Heinemann, 2007.

19ME31E	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the technological and commercial needs of unconventional machining processes. (K2)

CO2: Describe the applications and process parameters of various mechanical energy-based unconventional machining processes. (K2)

CO3: Explain the influence of EDM process parameters on MRR and surface finish. (K2)

CO4: Discuss the features of chemical energy-based machining processes. (K2)

CO5: Explain various high energy density machining processes and its applications. (K2)

UNIT I OVERVIEW OF UNCONVENTIONAL MACHINING PROCESSES 9

Technological and commercial need, Advantages over conventional machining, classification, performance constraints, selection of UCMP, hybrid processes.

UNIT II MECHANICAL ENERGY BASED PROCESSES 9

Abrasive Jet Machining - Water Jet Machining - Abrasive Water Jet Machining -Ultrasonic Machining - Working Principle - equipment- Process parameters – MRR - Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 9

Electric Discharge Machining and Wire cut EDM - working Principle - equipment - Power and control Circuits - Process Parameters - Surface Finish, MRR, Tool Wear, Dielectric and Flushing - Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining - masks - Etchants - Applications. Principles of ECM-equipment Electrical circuit - Process Parameters - Surface Roughness and MRR - ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES 9

Laser Beam machining and drilling, plasma Arc machining and Electron Beam Machining Principles - Equipment -Types - Beam control techniques - Applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Gary F Benedict, “Non-traditional Manufacturing Processes”, Marcel Dekker Inc., New York, 2017.
2. Pandey PC and Shan HS, “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2008.

REFERENCES

1. Paul De Garmo, Black JT, and Ronald AKohser, “Material and Processes in manufacturing”, 8th Edition Prentice Hall of India Pvt. Ltd., New Delhi, 2011.
2. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
3. Vijay K Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2009.

19ME32E ADDITIVE MANUFACTURING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the development of AM technology and how AM technology propagated into various businesses and developing opportunities. (K2)

CO2: Comprehend the knowledge on process of transforming a concept into the final product in AM technology. (K2)

CO3: Explain the vat polymerization and material extrusion processes and its applications. (K2)

CO4: Comprehend the knowledge on process and applications of powder bed fusion and direct energy deposition. (K2)

CO5: Describe the advantages, limitations, applications of binder jetting, material jetting and laminated object manufacturing processes. (K2)

UNIT I INTRODUCTION 9

Overview – Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping- Rapid Tooling – Rapid Manufacturing – Additive Manufacturing. AM Process Chain- Classification – Benefits. Applications: Building Printing-Bio Printing- Food Printing-Printing Electronics. Business Opportunities and Future Directions.

UNIT II DESIGN FOR ADDITIVE MANUFACTURING (DFAM) 9

Concepts and Objectives- AM Unique Capabilities: Part Consolidation-Topology Optimization- Lightweight Structure - DFAM for Part Quality Improvement. Data Processing - CAD Model Preparation -Part Orientation and Support Structure Generation -Model Slicing - Tool Path Generation-Customized Design and Fabrication for Medical Applications- Case Studies.

UNIT III VAT POLYMERIZATION AND MATERIAL EXTRUSION 9

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process - Advantages- Limitations- Applications. Digital Light Processing (DLP) - Materials – Process - Advantages - Applications. Extrusion Based System: Fused Deposition Modeling (FDM)- Process-Materials - Applications and Limitations.

UNIT IV POWDER BED FUSION AND DIRECT ENERGY DEPOSITION 9

Powder Bed Fusion: Selective Laser Sintering (SLS): Process – Powder Fusion Mechanism – Process Parameters – Typical Materials and Application. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications.

Beam Deposition Process: Laser Engineered Net Shaping (LENS)- Process -Material Delivery -Process Parameters -Materials -Benefits -Applications.

UNIT V OTHER ADDITIVE MANUFACTURING PROCESSES 9

Binder Jetting: Three-Dimensional Printing - Materials -Process - Benefits and Limitations. Material Jetting: Multi-jet Modeling- Materials - Process - Benefits. Wire Arc Additive Manufacturing - Sheet Lamination Process: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding – Thermal Bonding-Materials-Application and Limitation.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for Prototyping and Manufacturing”, Hanser publications, United States, 2015.
2. Ian Gibson, David W.Rosen and Brent Stucker “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, 2nd edition, Springer., United States, 2015.

REFERENCES

1. Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press., United States, 2015.
2. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing”, Hanser Gardner Publication, Cincinnati., Ohio, 2011.
3. Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer., United States, 2006.
4. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press., United States, 2011.
5. Milan Brandt, “Laser Additive Manufacturing: Materials, Design, Technologies, and Applications”, Woodhead Publishing., United Kingdom, 2016.

19ME33E	WELDING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the construction and working principles of gas and arc welding process. (K2)
CO2: Explain the construction and working principles of resistance welding process. (K2)
CO3: Explain the construction and working principles of various solid-state welding process. (K2)
CO4: Explain the construction and working principles of various special welding processes. (K2)
CO5: Summarize the concepts on weld joint design, weldability and testing of weldments. (K2)

UNIT I GAS AND ARC WELDING PROCESSES 9

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES 9

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations, and applications.

UNIT III SOLID STATE WELDING PROCESSES 9

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT IV ADVANCED WELDING PROCESSES 9

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9

Criteria for weld joint design - Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and non-destructive testing of weldments.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Little R.L., “Welding and welding Technology”, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.
2. Parmer R.S., “Welding Engineering and Technology”, 1st Edition, Khanna Publishers, New Delhi, 2008.
3. Parmer R.S., “Welding Processes and Technology”, Khanna Publishers, New Delhi, 1992.

REFERENCES

1. AWS- Welding Hand Book. 8th Edition. Vol- 2. “Welding Process”
2. Christopher Davis. “Laser Welding- Practical Guide”. Jaico Publishing House.
3. Davis A.C., “The Science and Practice of Welding”, Cambridge University Press, Cambridge, 1993.
4. Nadkarni S.V. “Modern Arc Welding Technology”, Oxford IBH Publishers, 1st Edition, 2005.

19ME34E	MAINTENANCE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the principles of maintenance planning and evaluate the system reliability. (K2)
CO2: Use different maintenance policies for industrial configuration. (K3)
CO3: Utilize state of the art condition monitoring techniques to develop effective maintenance policies. (K3)
CO4: Identify and apply suitable repair method for basic machine elements. (K3)
CO5: Identify and apply a suitable repair method for material handling equipment. (K3)

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 9

Basic Principles of maintenance planning and activity - Importance and benefits of active Maintenance systems -Reliability and machine availability - MTBF, MTTR and MWT - Factors of availability - Maintenance organization - Maintenance economics.

UNIT II MAINTENANCE POLICIES 9

Types of Maintenance policies - Merits and demerits - Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication - Total productive maintenance.

UNIT III CONDITION MONITORING 9

Condition Monitoring (CM) - Cost comparison with and without CM - On-load and off load testing - Methods and instruments for CM - Temperature sensitive tapes - Pistol thermometers - fluid and vibration monitoring. Ferrography – spectroscopic oil analysis program- wear-debris analysis.

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 9

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings - Failure analysis - Failures and their development - Logical and sequential fault location methods.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 9

Repair methods for Material handling equipments - Equipment records - Job order systems -Use of computers in maintenance.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Srivastava SK, “Industrial Maintenance Management”, S. Chand and Co., 2002.
2. Bhattacharya SN, “Installation, Servicing and Maintenance”, S. Chand and Co., 2013.

REFERENCES

1. White EN, “Maintenance Planning, Control and Documentation”, Gower Press, 1979.
2. Garg M R, “Industrial Maintenance”, S. Chand & Co., 2010.
3. Higgins LR, Keith Mobley “Maintenance Engineering Hand book”, McGraw Hill, 7th Edition, 2014.
4. Davies, “Handbook of Condition Monitoring”, Chapman & Hall, 2012.

19ME35E	NON-DESTRUCTIVE EVALUTION	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify the suitable NDT processes for practical application. (K2)
CO2: Discuss liquid penetrant and magnetic particle test for identifying welding defects. (K2)
CO3: Explain the concept for identifying defects. (K2)
CO4: Interpret the radiographic test to identify defects in welded components. (K2)
CO5: Discuss the advanced testing of Non-destructive testing. (K2)

UNIT I INTRODUCTION 12

Introduction non-destructive testing -visual examination-different visual examination aids - selection of NDT processes – detection of manufacturing defects.

UNIT II LIQUID PENETRANT AND MAGNETIC PARTICLE TESTING 12

Physical principle – procedure – penetrant testing materials and methods – sensitivity – advantages and limitations. Physics of magnetism - magnetization techniques – equipment and accessories – demagnetization- advantages and limitations.

UNIT III ULTRASONIC TESTING 12

Fundamentals of ultrasonic waves – inspection methods - equipment - calibration of testing equipment - advantages and limitations.

UNIT IV RADIOGRAPHIC TESTING 12

Geometric exposure principle – radiation sources – radiography techniques – radiation safety - radiographic film processing – radiographic image quality - Interpretation and evaluation of radiographs- advantages and limitations.

UNIT V ADVANCED TESTING 12

Acoustic emission testing – Thermography testing – Eddy current testing – Advanced Ultrasonic testing (TOFD, PAUT) – Advanced radiography (computed radiography & computerized tomography, Digital radiography).

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2. Parmer R.S, "Welding Engineering and Technology", 2nd Edition, Khanna publishers, Delhi, 2010.

REFERENCES

1. ASM Metals Handbook Vol. 17 – Nondestructive Evaluation and Quality Control, published by ASM, USA
2. R Halmshaw, "Introduction to the Non-Destructive Testing of Welded Joints"- 2nd Edition, Woodhead Publishing, 1997.
3. www.nde-ed.org.

19ME36E	QUALITY CONTROL OF WELDED STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Select appropriate welding process for making welded structures for various material combinations. (K2)
CO2: Prepare quality assurance plan for a structure. (K2)
CO3: Estimate the quality of the welded structure and acquires skills for welding inspection. (K2)
CO4: Explain the visual inspection of welded structures. (K2)
CO5: Understand the various codes and standards on welding applications. (K2)

UNIT I WELDING PROCESSES 9

Welding processes – principles and applications - fusion welding – plastic welding – welding defects – advantages and limitations.

UNIT II QUALITY SYSTEM 9

Quality control- quality assurance - manufacturing quality plan - quality control procedures.

UNIT III QUALITY CONTROL 9

Raw material inspection - welding procedure specification- procedure qualification records.

UNIT IV INSPECTION OF WELD JOINTS 9

Inspection - before, during and after welding - mechanical testing – joint categories – welding symbols - visual inspection.

UNIT V WELDING CODES AND STANDARDS 9

Introduction – welding codes and standards - IS 814 weld symbol – IS 7215 Welded assemblies - Testing of materials and weld joints - consumables testing and qualification as per ASME/AWS.

L:30; P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Parmer R.S, “Welding Engineering and Technology”, 2nd Edition, Khanna publishers, Delhi, 2010.
2. Howard B. Cary; Scott Helzer,” Modern Welding Technology”, 6th Edition, Pearson, 2005.

REFERENCES

1. Little R.L, “Welding and Welding Technology” - Tata McGraw Hill Publishing Limited, New Delhi, 1989.
2. Larry Jeffus, “Welding and Metal Fabrication”, Cengage Learning, 2012.
3. Welding Handbook “Welding Science and Technology” vol.1, Ninth Edition.
4. ASME sec IX 2017.

19ME37E	MACHINE TOOL CONTROL	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the kinematic motions in a machine tool. (K2)
CO2: Explain systems used for achieving required speeds and feeds. (K2)
CO3: Explain the design of Slide ways, spindles and lead screws for reducing friction and achieving high product accuracy. (K2)
CO4: Explain the reasons for chatter in machining and vibrations. (K2)
CO5: Discuss the various quality tests to be performed on the machine tool. (K2)

UNIT I INTRODUCTION TO MACHINE TOOL DRIVES AND MECHANISMS 9

Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission. Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations.

UNIT II MACHINE TOOL STRUCTURES 9

Functions of Machine Tool Structures and their Requirements, Design for Strength Design for Rigidity, Materials for Machine Tool Structures, Machine Tool, Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages.

UNIT III GUIDE WAYS, POWER SCREWS AND SPINDLES 9

Functions and Types of Guide ways, Design of Guide ways, Design of Aerostatic Slide ways, Design of Anti-Friction Guide ways, Combination Guide ways, Design of Power Screws.

UNIT IV DYNAMICS OF MACHINE TOOLS 9

Machine Tool Elastic System, Static and Dynamic Stiffness, Stability Analysis, Machine

Tool Chatter, Damping Characteristics, Damping Methods.

UNIT V CONTROL SYSTEMS IN MACHINE TOOLS 9

Machine tool control systems, Control Systems for Speed and Feed Changing, Adaptive Control Systems.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. N.K. Mehta, Machine Tool Design and Numerical Control, TMH, New Delhi, 2017

REFERENCES

1. G.C. Sen and A. Bhattacharya, Principles of Machine Tools, New Central Book Agency, 2009.
2. D. K Pal, S. K. Basu, “Design of Machine Tools”, 5th Edition. Oxford IBH, 2008.
3. F. Koenigsberger, “Design Principles of Metal-Cutting Machine Tools”, Elsevier Science 2013.

19ME38E	COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the basic concepts of CAD, CAM and computer integrated manufacturing systems (K2)

CO2: Summarize the production planning and control and computerized process planning (K2)

CO3: Differentiate the different coding systems used in group technology (K2)

CO4: Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system (K2)

CO5: Classify the robots used in industrial applications (K2)

UNIT I INTRODUCTION 9

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control-Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system –Types of production – Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING 9

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control

Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) – Simple Problems.

UNIT III CELLULAR MANUFACTURING 9

Group Technology (GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method – Arranging Machines in a GT cell – Hollier Method – Simple Problems

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

Types of Flexibility – FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS 9

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability – Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mikell.P.Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2018.
2. Radhakrishnan P, SubramanyanS.and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi, 2008.

REFERENCES

1. Gideon Halevi and Roland Weill, “Principles of Process Planning – A Logical Approach”, Chapman and Hall, London, 2012.
2. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall India, 1995.
3. Rao. P, N Tewari &T.K. Kundra, “Computer Aided Manufacturing”, Tata McGraw Hill Publishing Company, 2000

19ME39E	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the quality management philosophies and Framework. (K2)

CO2: Discuss the need of customer expectations, employee involvement and Supplier partnership. (K2)

CO3: Analyse the TQM tools and Techniques to improve the product and process Quality. (K3)

CO4: Apply modern tools to improve quality of the product. (K3)

CO5: Describe ISO 9001, Environmental Management Standards and ISO 14001 certification process. (K2)

UNIT I INTRODUCTION 9

Introduction - Need, evolution and definition of quality - Dimensions of manufacturing and service quality - Basic concepts, definition and framework of TQM - Contributions of Deming, Juran and Crosby - Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality statements - Customer focus, orientation, satisfaction, complaints and retention - Employee involvement - Motivation, Team and Teamwork, Recognition and Reward, Performance appraisal - Supplier partnership - Partnering, Supplier selection, Supplier Rating - Continuous process improvement - PDSA cycle, 5s and Kaizen.

UNIT III TQM TOOLS AND TECHNIQUES 9

Quality circles - Quality Function Deployment (QFD) - Taguchi quality loss function -TPM - Concepts, improvement needs - Quality cost, types and its analysis techniques - Performance measures.

UNIT IV APPLICATION OF TQM TOOLS AND TECHNIQUES 9

Seven traditional tools of quality - New management tools - Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages and types - criteria for getting Quality awards.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9000-2000 Quality System - Elements, Documentation, Quality auditing- QS 9000 - ISO 14000 - ISO 17025 - Concepts, Requirements and Benefits - Case studies of TQM.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

3. Dale H Besterfiled, “Total Quality Management”, Pearson Education Asia, 3rd Edition, Indian Reprint 2012.
4. Ramachandran S, “Total Quality Management”, Air Walk Publications, 3rd Edition 2014.

REFERENCES

7. James R Evans and William M Lindsay, “The Management and Control of Quality”, 6th Edition, Cengage Learning, 2019.
8. Oakland J S, “TQM - Text with Cases”, Butterworth - Heinemann Ltd., Oxford, 3rd Edition, 2012.
9. Suganthi L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.

19ME40E	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Compute the constraints on the availability of resources, develop a model and give an optimal solution during the given circumstances. (K3)
CO2: Appraise the challenges in the transportation and production problems and furnish a rational solution to maximize the benefits. (K3)
CO3: Plan the purchase/ manufacturing policies, manage the spares/ stocks and meet the customer demands. (K3)
CO4: Analyse the queue discipline and explore the avenues for better customer service. (K3)
CO5: Investigate the nature of the project/ failure and offer methodical assistance towards decision making. (K3)

UNIT I LINEAR PROGRAMMING PROBLEMS 9

OR-Definition - Phases - models, LP problem formulation – Graphical solution, GLPP, Standard and Canonical forms of LPP- simplex methods- Big M, Two phase methods, Alternate optimal solutions, Duality in LP.

UNIT II TRANSPORTATION 9

Transportation problems- Basic feasible solution, Optimal solution By MODI method, Balanced and Unbalanced TP, Degeneracy, Production problems. Assignment problems – Hungarian method Traveling salesman problems - Sequencing models- Johnson algorithm, n job 2 machines, n job 3 machines and n job m machines.

UNIT III INVENTORY CONTROL 9

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Purchase andProduction models with and without shortages-EOQ with price breaks - Stochastic inventoryproblems - Multi product problems - Systems of inventory control (P and Q Systems)-Determination of buffer stock and re-order levels - Selective inventory control techniques (ABC, VED, SDE, etc.)

UNIT IV PROJECT MANAGEMENT AND REPLACEMENT MODELS 9

Project management: Network logic – Ford-Fulkerson's rule - AON diagram - CPM and PERTtechniques, Critical path and float calculations Replacement models -types of failures – Gradual failures-replacement of items: Efficiency deteriorates with time, sudden failures- individual and group replacement policies.

UNIT V QUEUING THEORY 9

Queuing system - Characteristics - symbols - Poisson process and exponential distribution –Single server queuing models – Multi-server queuing models, Simulation Monte Carlo technique - Queuing problems.

L:45; TOTAL:45 PERIODS

Note: Use of Normal distribution tables is permitted in the End Semester Examination

TEXT BOOKS

1. Wayne.L.Winston, "Operations research applications and algorithms",4th Edition, Cengagelearning, 2004.
2. Hamdy A Taha, "Operations research an introduction", 10thEdition, PHI/Pearson education, 2017.

REFERENCES

1. Srinivasan G, "Operations research principles and applications", 3rd Edition EEE PHI, 2017.
2. Pannerselvam R, "Operations research", 2nd Edition, PHI, 2009.
3. Ravindran, Phillips and Solberg, "Operations research principles and practice", 2nd Edition, Wiley India, 2007.
4. Sharma J K, "Operations research theory and applications", 5th Edition, Macmillan India, 2013.
5. Premkumar Gupta and D.S.Hira, "Problems in Operations research", S.Chand, 2009.

19ME41E	IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: explain the basic concept, terminology, quality control and quality management system. (K2)

CO 2: describe ways of applying quality management in the actual organization. (K2)

CO 3: demonstrate the capability of making quality management system for the industries. (K2)

CO 4: identify the existence or nonexistence of the implemented quality management system. (K2)

CO 5: demonstrate the quality management principles for excellence in industries. (K2)

UNIT I INTRODUCTION 9

Introduction - Definitions of quality, basic concepts - Overview of historical development - Management theory. Statistical quality control - Integrated quality control - Contemporary developments in the field of quality management - The role of quality control in the modern enterprise - Responsibility as a result of poor quality - Quality and standardization.

UNIT II	**QUALITY MANAGEMENT SYSTEM**	**9**

The development path of a series of ISO 9000 standards. Functional scheme - without / with the QMS. Overview of the requirements of ISO 9000, ISO 9001 and ISO 9004. The establishment of a QMS. Prerequisites. Structure of the documentation. Implementation of documented system.

UNIT III	**BUILDING OFQUALITY MANAGEMENT SYSTEM**	**9**

Building of QMS - Commitment to Quality (Policy Document) - Procedures Manual (Process Documents) - Work Instructions (Task Documents) - Risk-based Thinking - Risk Assessment – Improvement - Improvements using through ISO 9001:2015 - Process Improvements -Corrective Action. Tools - Customer feedback - Self-awareness - Failure Mode and Effects Analysis (FMEA).

UNIT IV	**JUDGMENT AND WITNESSING SYSTEM**	**9**

Judgment and witnessing system. Internal judgment - The national system of accreditation - External independent judgment - Horizontal and vertical judgment - Auditor’s task - Modes of judgment. Real world Case study - Concluding Remarks (phases, price, terms and benefits).

UNIT V	**QUALITY MANAGEMENT PRINCIPLES FOR EXCELLENCE**	**9**

Quality management systems - Quality control methods - Quality audit and certification of management systems - Sustainable development - Environment management systems - Occupational health and safety management system - Eco-labeling - Total quality management.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Besterfield D. H., “Quality Control”, Seventh edition, Pearson College Div; Subsequent edition, New Jersey, 2009.
2. Barrie G Dale, “Managing Quality”, Oxford: Blackwell Publishing, 2016.

REFERENCES

1. Evans J. R., Lindsay W. M, “The management and control of quality”, South-Western college publishing, USA, 2010.
2. Foster T. S, “Managing quality: An Integrative Approach”, Prentice Hall, New Jersey, 2003.
3. Goetsch D. L., Davis S. B., “Quality management. Introduction to TQM for production, processing and services”, 4th Edition, Prentice Hall, New Jersey, 2006.

19ME42E	**PRODUCTION AND OPERATIONS MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: outline the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment. (K2)
CO2: discuss sufficient knowledge and skills to forecast demand for Production and Service Systems. (K2)
CO3: explain Aggregate Planning strategies and Material Requirement Plan. (K2)
CO4: express analytical skills to calculate capacity requirements and developing capacity alternatives. (K2)
CO5: apply scheduling and Lean Concepts for improving System Performance. (K3)

UNIT I INTRODUCTION 9

Objectives of Operations Management, Scope of Operations Management, Relationship of Operations with other Functional areas, Manufacturing Vs Service sector, Operations Decisionmaking, Phases in Product Design and Development, Product Life Cycle, Process Selection.

UNIT II FORECASTING 9

Need, Determinants of Demand, Demand Patterns, Qualitative Forecasting Methods-Delphitechniques. Market Research, Nominal Group Technique. Quantitative Forecasting methods –Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

UNIT III AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING 9

Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixedstrategies, Mathematical Models for Aggregate planning – Transportation Method, Linearprogramming Formulation, Linear Decision Rues, Master Production Schedule (MPS), Procedure for developing MPS, MRP -Lot sizing methods – Implementation issues, MRP – II, Introduction to ERP.

UNIT IV CAPACITY MANAGEMENT 9

Measures of capacity, Factors affecting capacity, Capacity Planning, Systematic approach tocapacity planning, Long-term and short-term capacity decisions, Tools for capacity planning,Capacity Requirement Planning- Business Process Outsourcing

UNIT V PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING 9

Objectives and Activities of Production Activity Control -JIT- Kanban- Introduction to Scheduling in different types of Production Systems. Lean Manufacturing - Principles – Activities – Automated Tools and techniques - Case studies.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Panneerselvam. R, Production and operations Management, PHI, 3rd Edition, 2012.

REFERENCES

1. Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman, "Operations Management: Processes and Supply Chains", Pearson Education,11th Edition,2015
2. Norman Gaither, Greg Frazier, "Operations Management", Thomson Learning, 9th Edition, 2006.
3. William J Stevenson, "Operations Management", McGraw Hill,13th Edition, 2018.

19ME43E	VALUE ANALYSIS AND VALUE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Summarise the advantages, applications of value engineering. (K2)
CO2: Outline the function, its approach and evaluation. (K2)
CO3: Explain the job plan and cost reduction program (K2)
CO4: Identify the application of the value analysis value engineering techniques. (K2)
CO5: Illustrate the application of value analysis for cost reduction. (K2)

UNIT I FUNDAMENTALS OF VALUE ENGINEERING 9

Definition of Value - Value Analysis - Value Engineering - Objective - Value Analysis versus Value Engineering –Value Types – How to add value job plan – Technique employed – who will do value engineering – Organizing the value engineering study – Benefits.

UNIT II FUNCTIONAL COST AND ITS EVALUATION 9

Functional cost - Rules for functional definition - Types of functions - Function evaluation process - Methods of function evaluation - matrix technique - MISS technique - Numerical evaluation of functional relationships.

UNIT III VALUE ENGINEERING JOB PLAN 9

Meaning and Importance - Phases of job plan proposed by different value engineering experts - Cost reduction programs - criteria for cost reduction program, Value analysis change proposal.

UNIT IV VALUE ENGINEERING AND VALUE ANALYSIS TECHNIQUES 9

Result Accelerators or New Value Engineering Techniques – Listing - Role of techniques in Value Engineering - Functional analysis system technique - Value Analysis of Management Practice (VAMP) - Steps involved in VAMP - Application of VAMP.

UNIT V APPLICATION OF VALUE ANALYSIS 9

Application of Value analysis in the field of Accounting - Appearance Design - Cost reduction - Quality Control - Comparison of approach of Value analysis & other management techniques.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

3. Lawrence D. Miles, "Techniques of Value Analysis and Engineering", 3rd edition, McGraw Hill Book Company, 2015.

4. Anil Kumar Mukhopadhyaya, “Value Engineering: Concepts Techniques and applications”, SAGE Publications 2010.

REFERENCES

2. Richard J Park, “Value Engineering – A Plan for Inventions”, St.Lucie Press, London, 2017.
3. Robert B. Stewart, “Fundamentals of Value Methodology”, Xlibris, 2007.

19ME44E	SUPPLY CHAIN AND LOGISTICS MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explain the fundamentals of supply chain management (K2)
CO2: Outline the functions of logistics management (K2)
CO3: Analyse the network design for efficient distribution (K3)
CO4: Apply inventory management for production and sales forecasting (K3)
CO5: Discuss the issues and recent developments in supply chain and logistics (K2)

UNIT I INTRODUCTION 9

Meaning - Evolution – Fundamentals and Importance - Supply chain strategy - Enablers/ Drivers of Supply Chain Performance - Supply Chain relationships - Green supply chain management.

UNIT II LOGISTICS MANAGEMENT 9

Functions, objectives and solution - Customer Service - Warehousing and Material Storage - Material Handling - Transportation and Packaging – 3PL and 4PL.

UNIT III NETWORK DESIGN 9

Distribution Network Design – Role, Factors Influencing and Options - Value Additions - Models for Facility Location and Capacity allocation - Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

UNIT IV SOURCING AND INVENTORY MANAGEMENT 9

Sourcing – Make Vs. buy decision - Creating World Class Supply base - World Wide Sourcing Inventory Management – managing cycle inventory - Value of information - Bullwhip effect - Coordination in supply chain - Analysing impact of supply chain redesign on the inventory.

UNIT V CURRENT TRENDS 9

E-Business – Framework and Role of Supply Chain in e- business and B2b practices - Supply Chain IT Framework - E-Supply Chains - E – Logistics – eSRM – eLRM – eSCM - Agile Supply Chains - Reverse Logistics - Global Logistics – Real time examples.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Bowersox Donald J, Logistical Management – The Integrated Supply Chain Process" Tata McGraw Hill, 2011.
2. Chopra S and Meindl P, "Supply Chain Management: Strategy, Planning, and Operation", Pearson, 2013.

REFERENCES

1. Donald J. Bowersox, David J. Closs and M. Bixby Cooper, "Supply Chain Logistics Management", Tata McGraw Hill, 2012.
2. Altekar Rahul V, Supply Chain Management-Concept and Cases, Prentice Hall India, 2005.
3. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, "Principles of Supply Chain Management- A Balanced Approach", South-Western, Cengage Learning 2014.
4. NarayaRangarj, G. Raghuram, Mandyam M. Srinivasan, "Supply Chain Management for Competitive Advantage – Concepts and Cases", Tata McGraw Hill, 2009.
5. R.P. Mohanty and S.G. Deshmukh, "Supply Chain Management", Biztantra, 2005.

19ME45E	STATISTICAL QUALITY CONTROL	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply the 7 QC tools in problem solving for continuous improvement. (K3)
CO2: design the control charts for quality control and perform process capability study. (K3)
CO3: understand the concepts of acceptance sampling. (K2)
CO4: discuss the concepts of the reliability and to determine the system reliability. (K2)
CO5: select a suitable method for improving the reliability. (K2)

UNIT I INTRODUCTION: STATISTICAL PROCESS CONTROL 9

Introduction - quality – Inspection- Quality Control and Quality assurance - Life cycle approach to quality costs- Seven SPC tools -Histogram, Check sheets, Ishikawa diagrams, Pareto, Scatter diagrams, Control charts and flow chart.

UNIT II PROCESS CONTROL FOR VARIABLES AND ATTRIBUTES 9

Control chart for variables – X chart, R chart and σ chart - Control Chart for Nonconforming - p chart and np chart - Control Charts for Nonconformities - C and U charts - Control Chart for Number of non-conformities per unit - State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT III ACCEPTANCE SAMPLING 9

Importance -Types - Purpose - Components- Procedure - Classification of costs - Cost elements - Overhead expenses - Break-even analysis. The acceptance sampling problem-single sampling plan for attributes-Double, Multiple, and Sequential sampling, AOQL, LTPD, OC curves.

UNIT IV RELIABILITY CONCEPTS 9

Reliability engineering - fundamentals – failure data analysis, Mean failure rate, Mortality curve- concept of burn –in period, useful life and wear out phase of a system, mean time to failure, mean time between failure, hazard rate –-Maintainability and availability.

UNIT V RELIABLITY ESTIMATION 9

System reliability: Series, Parallel and Mixed configurations, Reliability improvements techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy- fault tree analysis – Product design – Product analysis – Product development – Product life cycles.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Douglas.C.Montgomery, “Introduction to Statistical quality control”, John Wiley, 7th Edition, 2013.
2. L.S.Srinath, “Reliability Engineering”, East west press, 4thEdition 2011.

REFERENCES

1. Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons, 2016.
2. Connor, P.D.T.O., “Practical Reliability Engineering”, John Wiley, 2012
3. Besterfield D.H., “Quality Control”, Prentice Hall, 2013.
4. John.S. Oakland. “Statistical process control”, Elsevier Butterworth-Heinemann, 2018.

19ME46E PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: explain method study, work measurement tools to improve the process (K2)
CO2: describe a process plan for a given Product (K2)
CO3: Prepare cost elements for a given product (K2)
CO4: estimate the cost of a product based on manufacturing methods (K2)
CO5: estimate the cost for machining a product (K2)

UNIT I WORK STUDY AND ERGONOMICS 9

Method study – Definition – Objectives - Tools and Techniques -Motion economy - Principles - Applications - Work measurement - Standard time – Ergonomics – principles – applications.

UNIT II PROCESS PLANNING 9

Design of a process plan – Selection of production processes, tools and process parameters- Positioning and work holding devices, Selection of inspection devices and tools, Documenting the process plan - Computer-Aided Process Planning (CAPP) – Benefits, Architecture and approaches.

UNIT III INTRODUCTION TO COST ESTIMATION 9

Importance-Types- Purpose- Components-Procedure-Classification of costs - Cost Elements-Overhead expenses - Break-even analysis.

UNIT IV PRODUCTION COST ESTIMATION 9

Estimation of production cost for Casting, Welding and Forging processes – Numerical problems.

UNIT V ESTIMATION OF MACHINING TIME IN DIFFERENT SHOPS 9

Machining time – Estimation - Lathe operations, Drilling, Milling, Shaping and Planning, and Grinding, Cost estimation for machining processes.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Chitale, A. K., and Gupta, R. C., “Product Design and manufacturing”, Prentice Hall of India, New Delhi, 6th Edition 2013.
2. Adithan, M. “Process Planning and Cost Estimation”, New Age International Publishers, 2007.
3. Banga T.R and Sharma.S.C, “Estimating and costing”, Khanna Publishers, New Delhi, 16th Edition, 2011.

REFERENCES

1. Nanua Singh, “System Approach to Computer Integrated Design and Manufacturing”, John Wiley & Sons, New York, 2011.
2. S N Chary, “Production and Operations Management” Tata McGraw - Hill Education, 2009.
3. Phillip.FOstwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 2008.

19ME47E	LEAN MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the concept of lean manufacturing. (K2)
CO2: understand the various tools and methods of lean manufacturing. (K2)
CO3: explain the various tools for lean manufacturing (LM). (K2)
CO4: study the various concepts in six sigma. (K2)
CO5: describe the above tools to implement LM system in an organization. (K2)

UNIT I INTRODUCTION TO LEAN MANUFACTURING 9

Objectives of lean manufacturing-key principles and implications of lean manufacturing-traditional Vs lean manufacturing.

UNIT II LEAN MANUFACTURING CONCEPTS 9

Value creation and waste elimination-main kinds of waste-pull production-different models of pull production-continuous flow-continuous improvement / Kaizen-worker involvement - cellular layout-administrative lean.

UNIT III LEAN MANUFACTURING TOOLS AND METHODOLOGY 9

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source-5S principles -preventative maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction -production leveling-Value stream mapping-Procedure and principles.

UNIT IV VALUE STREAM MAPPING 9

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -Poke Yoke -Kanban –overall equipment effectiveness - Six Sigma implementation.

UNIT V JUST IN TIME MANUFACTURING AND CASE STUDY 9

Introduction -elements of JIT -uniform production rate -pull versus push method - Kanban system -small lot size -quick, inexpensive set-up -continuous improvement. Optimized production technology.

Toyota Production System (TPS) Tools & Techniques, Application of TPS - Various case studies of implementation of lean manufacturing at industries.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2007.
2. Mikell P. Groover, “Automation, Production Systems and CIM”, Pearson Education, New Delhi, 2016
3. Rother M. and Shook J, “Learning to See: Value Stream Mapping to Add Value and Eliminate Muda”, Lean Enterprise Institute, Brookline, MA. 2003.

REFERENCES

1. Micheal Wader, “Lean Tools: A Pocket Guide to Implementing Lean Practices”, Productivity and Quality Publishing Pvt Ltd, 2002.
2. Richard B Chase F Robert Jacobs and Nicholas J Aquilano, “Operations Management for Competitive Advantage”, 10th Edition, McGraw Hill/Irwin, 2005.
3. Masaaki Sato, “The Toyota Leaders –An Executive Guide”, Vertical Inc, New York, 2008.

19ME48E	**INDUSTRIAL SAFETY ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Appraise the concept of accidents and their prevention. (K2)
CO2: Use the ergonomics to design the work system and to change the human behavior to avoid accidents. (K3)
CO3: Appraise various industrial hazards and their control measures. (K2)
CO4: Select the appropriate fire extinguishing systems for various classes of fire. (K3)
CO5: Use various safety management techniques to promote safety practice and avoid accidents. (K3)

UNIT I ACCIDENT INVESTIGATION, ANALYSIS AND PREVENTION 9

Concept of an Accident, reportable and non-reportable accidents, reporting to statutory authorities. Principles of accident prevention - accident investigation and analysis - Unsafe act and unsafe condition - Domino sequence - cost of accidents - role of safety officer - safety supervisor - safety committee - Factories act and rules related to safety.

UNIT II ERGONOMICS AND HUMAN BEHAVIOUR 9

Introduction to ergonomics and its area of application in the work system. Anatomy, Posture and body mechanics - low back pain, risk factors for musculoskeletal disorders in the work place - behavioral aspects of posture - effectiveness. Individual differences, Factors contributing to personality, fitting the man to the job. Motivation -job satisfaction - Emotion and frustration. Attitudes - determination of attitudes- changing attitudes.

UNIT III HAZARDS AND THEIR CONTROL 9

Physical hazards-Noise, heat, vibration, ionizing and non-ionizing radiations and effects. Chemical hazards-dusts, fumes, mist, vapor, fog, gases, types, concentration, exposure Vs dose, TLV. Mechanical hazards. Hazards prevention - Administrative control methods, Engineering control methods- use of personal protective equipment.

UNIT IV FIRE PREVENTION AND PROTECTION 9

Fire triangle-principles of fire extinguishing - various classes of fire - A, B, C, D types of fire extinguishers - Industrial fire protection systems. Sprinklers - Fire hydrants - Alarm and detection systems - other suppression systems - CO_2 system, foam system and DCP system.

UNIT V SAFETY MANAGEMENT TECHNIQUES, EDUCATION AND TRAINING 9

Incident Recall Technique, Disaster Control, Job Safety Analysis, safety survey, safety inspection, safety Audit. Safety training, seminars, conferences, competitions - method of promoting safe practice - creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign - Domestic Safety and Training.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. L M Deshmukh, “Industrial Safety Management”, Tata McGraw-Hill Education, 2010.
2. Charles D. Reese, “Occupational Health and Safety Management: A Practical Approach”, CRC Press, 2018.

REFERENCES

1. Edward Ghali, V. S. Sastri, M. Elboujdaini, “Corrosion Prevention and Protection: Practical Solutions”, John Wiley & Sons, 2007.
2. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.
3. R. Keith Mobley, Maintenance Fundamentals, Elsevier, 2011.
4. W. E. Vesely, F. F. Goldberg, Fault Tree Handbook, Create space Independent Pub, 2014.
5. “Accident Prevention Manual for Industrial Operations”, N.S.C. Chicago, 1982.

19ME49E	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the functions and significances of production planning and control. (K2)
CO2: Apply suitable work study methods to improve production process. (K3)
CO3: Prepare the route sheet for manufacturing a product. (K3)
CO4: Analyze the feasible production scheduling method to improve productivity. (K3)
CO5: Discuss the recent techniques in production planning. (K2)

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control - Functions of production control - Types of production environment - Product development and design - Marketing, functional, operational, durability, dependability and aesthetic aspects - Profit consideration - standardization - Break even analysis - Economics of a new product design.

UNIT II WORK STUDY 9

Method study - basic procedure - Micro and memo motion study - work measurement and techniques.

UNIT III PRODUCT AND PROCESS PLANNING 9

Product planning - Extending the original product information - Value analysis - Problems in lack of product planning. Process planning and routing - Pre requisite information needed for process planning - Steps in process planning - Quantity determination in batch production - Machine capacity, balancing - Analysis of process capabilities in a multi-product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems - Loading and scheduling - Master Scheduling - Gantt charts - Basic scheduling problems - Line balancing - Product sequencing - Manufacturing lead time -Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control - Effect of demand on inventories - Ordering Procedures - Two bin system -Ordering cycle system - ABC analysis - Kanban and JIT - Introduction to computer integrated production planning systems - MRP II and ERP.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mukhpadyay S K, “Production Planning and Control”, PHI Learning Pvt. Ltd., 2015.
2. MartandTelsang, “Industrial Engineering and Production Management”, S.Chand and Company, 3rd Revised Edition, 2018.

REFERENCES

1. Upendra Kachru, “Production and operations management - Text and cases”, Excel books, 1st Edition, 2009.
2. James B Dilworth, “Operations management - Design, Planning and Control for manufacturing and services”, McGraw Hill International Edition, 1992.
3. Kanishka Bedi, “Production and Operations management”, Oxford University press, 2nd Edition, 2016.
4. Norman Gaither, Frazier G, “Operations management”, Thomson learning, 9th Edition, IE, 2007.
5. Elwood Buffa S, and Rakesh Sarin K, “Modern Production / Operations Management”, 8th Edition, John Wiley and Sons, 2007.

19ME50E ENGINEERING ECONOMICS AND COST ANALYSIS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe basic concepts and terminologies used in engineering economics. (K2)
CO2: Explain the concept of value engineering and find the time value of money. (K2)
CO3: Compare and select alternative methods based on time value of money. (K3)
CO4: Perform replacement and maintenance analysis for different alternatives. (K3)
CO5: Estimate the depreciation and economic life of asset. (K3)

UNIT I INTRODUCTION TO ECONOMICS 9

Introduction to Economics- flow in an economy, law of supply and demand, concept and scope of engineering economics - engineering and economic efficiency - element of costs-break-even analysis- P/V ratio, elementary economic Analysis.

UNIT II VALUE ENGINEERING 9

Make or buy decision, value engineering - function, aims and procedure. Interest formulae and their applications - Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate.

UNIT III CASH FLOW DIAGRAM 9

Methods of comparison of alternatives - present worth method, Future worth method, Annual equivalent method, rate of return method.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and maintenance analysis - types of maintenance and replacement problem, determination of economic life of an asset, replacement of an asset with a new asset - capital recovery with return and concept of challenger and defender, simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation, Straight line method, declining balance method - Sum of the years digits method, sinking fund method, Annuity method, service output method -Evaluation of public alternatives - Inflation adjusted decisions - procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

L:45; TOTAL:45 PERIODS

Note: (Use of Interest tables is permitted in the End Semester Examination)

TEXT BOOKS

1. Panneer Selvam R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2nd Edition, 2013.
2. Suma Damodaran, “Managerial economics”, Oxford University press, 2010.

REFERENCES

1. Chan S Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2016.
2. Donald G Newman and Jerome P Lavelle, “Engineering Economics and analysis”, Engg. Press, Texas, 2016.
3. Degarmo EP, Sullivan WG and Canada JR, “Engineering Economy”, Macmillan, New York, 1984.
4. Smith GW, “Engineering Economy”, Lowa State Press, Iowa, 1987.
5. Truettand Truett, “Managerial economics - Analysis, problems & cases”, 8th Edition, Wiley India, 2004.
6. Luke M Froeb / Brian T Mccann, “Managerial Economics - A problem solving approach” Thomson learning, 2017.

19ME51E	**E-COMMERCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Demonstrate the foundations and importance of E-commerce (K2)
CO2: Explain and develop solutions for implementing an ecommerce site. (K2)
CO3: Discuss security, electronic payment technology and requirements for internet-based payments. (K2)
CO4: Summarisethe concept of e-commerce in business applications. (K2)
CO5: Discuss present and future technologies in E-commerce. (K2)

UNIT I INTRODUCTION TO E-COMMERCE 9

Framework – Architecture - Benefits and Impact of e-Commerce - The Anatomy of e-Commerce applications - e-Commerce Consumer applications - e-Commerce Organisation Applications - Consumer Oriented Electronic commerce – Mercantile Process models e-commerce in India - Prospects of e-commerce.

UNIT II BUILDING AN E-COMMERCE WEBSITE, MOBILE SITE AND APPS 9

Systematic approach to build an E-Commerce - Implementation and Maintenance - Optimize Web Performance - Choosing hardware and software – Other E-Commerce Site tools – Developing a Mobile Website and Mobile App.

UNIT III E-COMMERCE SECURITY AND PAYMENT SYSTEMS 9

E-Commerce Security Environment – Security threats in E-Commerce – Technology Solutions – Encryption - Securing Channels of Communication - Protecting Networks - Protecting Servers and Clients – Management Policies - Business Procedure and Public Laws –Electronic, Digital and Virtual Internet Payment System

UNIT IV E-COMMERCE MODELS 9

Business-to-Business–Hubs - Market Places - Business-to-Business Exchange - Business-to-Consumer - Consumer-to-consumer - Business-to-Government - Government-to-Government.

UNIT V FUTURE DIRECTIONS OF E-COMMERCE 9

Software Agents - Technology Behind Software Agents - Frame-work for Software Agent-based e-commerce - m-commerce - m-commerce Architecture - Areas of Potential Growth and Future for m-commerce.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Kenneth C Laudon: “E-commerce”, Pearson Education, Mumbai, 2014.
2. C.S.V.Murthy: “E-Commerce–Concepts, Models & Strategies”, Himalaya Publishing house, Mumbai, 2010.
3. Kamalesh K Bajaj &Debjani Nag: E-Commerce, the Cutting Edge of Business- Tata McGraw- Hill, New Delhi, 2009.

REFERENCES

1. P.T.Joseph: "E-Commerce – An Indian Perspective", 6th Edition, PHI Learning, New Delhi 2019.
2. Gary P Schneider: E Commerce, Cengage Learning, New Delhi, 2014.
3. Christopher Westland J, Theodore H K Clark: "Global Electronic Commerce", Universities Press, Hyderabad, 2009.

19ME52E	INDUSTRY 4.0	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss the challenges in various industrial and need for Industry 4.0 (K2)
CO2: Elaborate the components and support systems involved in Industry 4.0 environment (K2)
CO3: Explain the concept of cloud manufacturing and open manufacturing architecture (K2)
CO4: Discuss the concept of smart factory and machine vision system (K2)
CO5: Summarize the applications of industrial IoT in various domains (K2)

UNIT I INTRODUCTION 9

Introduction- various Industrial Revolutions- Challenges in Manufacturing Industries - need for Industry 4.0 - need for Industrial Big Data and Predictive Analytics for Smart Business Transformation - case studies.

UNIT II COMPONENTS OF INDUSTRY 4.0 9

Internet of Things (IoT) - Industrial Internet of Things (IIoT) - Internet of Services- Smart Devices - Cyber Physical Systems. Robotic Automation and Support System for Industry 4.0. Introduction to Mobile Computing - Augmented Reality and Virtual Reality, Artificial Intelligence – Data collection from sensors - Big Data and Advanced Analysis - case studies.

UNIT III INDUSTRY 4.0 AND CLOUD MANUFACTURING 9

Cyber-physical production systems - Control System as a Service (CSaaS) - Additive Manufacturing for industry 4.0 - Open manufacturing cloud platform for future manufacturing business - Cloud-based decision making in complex engineering environments such as product configuration for manufacturing, process planning, product planning, resource allocation, production planning and Scheduling-examples and case studies.

UNIT IV AUTOMATED MANUFACTURING AND MACHINE VISION 9

Introduction to IT-enabled Smart factories - Smart / intelligent Manufacturing, Overview of CIM, significance of rapid prototyping- - Introduction to Machine Vision - Components-Machine Learning and Applications of Machine Vision in manufacturing/process industries.

UNIT V INDUSTRIAL IoT APPLICATIONS 9

Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries Case studies.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Carlos Toro, Wei Wang, Humza Akhtar, Implementing Industry 4.0: The Model Factory as the Key Enabler for the Future of Manufacturing, Springer, 2021.
2. Anand Nayyar, Akshi Kumar, A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development, Springer, 2020.
3. Carolina Machado, J. Paulo Davim, Industry 4.0-Challenges, Trends, and Solutions in Management and Engineering, CRC press, 2020.

REFERENCES

1. Boris Sokolov, Dmitry Ivanov, Alexandre Dolgui, Scheduling in Industry 4.0 and Cloud Manufacturing, Springer, 2020
2. Elena G. Popkova, Yulia V. Ragulina, Aleksei V. Bogoviz, Industry 4.0: Industrial Revolution of the 21st Century, Springer, 2019
3. Mohammad Dastbaz, Peter Cochrane, Industry 4.0 and Engineering for a Sustainable Future, Springer, 2019
4. Kaushik Kumar, DivyaZindani, J. Paulo Davim, Industry 4.0: Developments towards the Fourth Industrial Revolution, Springer-Singapore, 2019
5. Max Hoffmann, Smart Agents for the Industry 4.0: Enabling Machine Learning in Industrial Production, Springer FachmedienWiesbaden;Springer Vieweg, 2019
6. Kaushik Kumar, DivyaZindani, J. Paulo Davim, Digital Manufacturing and Assembly Systems in Industry 4.0, CRC Press, 2019.
7. Le, Chung Van; Le, Dac-Nhuong; Nguyen, Nhu Gia; Tromp, Jolanda G, Emerging technologies for health and medicine: virtual reality, augmented reality, artificial intelligence, internet of things, robotics, industry 4.0, John Wiley & Sons, 2018
8. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress, 2016

B.E. – MECHANICAL ENGINEERING

ONE CREDIT ELECTIVE COURSES

19ME01L SHELL AND TUBE HEAT EXCHANGER DESIGN

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Analyse a design based on the information provided for a specific application (K4).
CO2: Determine the size of heat exchanger for a given requirement (K4).

Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators – Parts description, classification as per Tubular Exchanger Manufacturers Association – Uses.

Kern method – Bell Delware method – classification of baffles – Demo about HTRI Suite Software.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Kuppan T, "Heat Exchanger Design handbook", 2nd Edition, CRC Press, 2013.
2. SadikKakac and Hongtan Liu, "Heat Exchangers Selection, Rating and Thermal Design", CRC Press, 2012.

19ME02L ENERGY AUDIT AND MANAGEMENT

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Recognise the role of energy manager in an industry (K4).
CO2: Apply the methodology to carry out energy audit and management of equipment and processes (K3).

Energy Scenario – Energy monitoring, auditing & targeting – Economics of various Energy Conservation schemes. Total Energy Systems.

Steam engineering – Conservation Measures in Steam; Boilers – types, losses and efficiency calculation as per Bureau of Energy Efficiency

Refrigeration and Air conditioning – Heat load estimation as per Bureau of Energy Efficiency – Energy conservation in cooling towers.

Energy conservation in Centrifugal pumps, Fans & Blowers, Air compressor – energy consumption and energy saving potentials.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Frank Kreith, Yogi Goswami D, "Energy Management and Conservation Handbook", 2nd Edition, CRC Press, 2016.
2. Tarik Al-Shemmeri, "A Workbook for Energy Management in Buildings", John Wiley & Sons, 2011.
3. Penni McLean-Conner, "Energy Efficiency: Principles and Practices", Penn Well Books, 2009.
4. Barney L Capehart, Wayne C Turner, William J Kennedy, "Guide to Energy

Management", The Fairmont Press, Inc., 8th Edition2020.
5. Eastop T D, Croft D R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, 1990.
6. Reay D A, "Industrial Energy Conservation", 1st Edition, Pergamon Press, 1979.
7. Bureau of Energy Efficiency Books, Volumes I-IV.

19ME03L	**PYROLYSIS AND GASIFICATION**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Design and development of pyrolysis and gasification process (K4).

Pyrolysis: Introduction – Types of pyrolysis – pyrolysis products – kinectics. Pyrolzer types – simple design.
Gasification: Gasifier Reactions and steps – gasification process – types of gasifiers: Fixed bed, fluidized bed and Simple process design.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Yongseung Yun, "Gasification for Practical Applications", InTech, 2012.
2. Prabir Basu, "Biomass Gasification and Pyrolysis Practical Design and Theory", Academic Press, Elsevier, 2010.
3. Jean – Pierre, "Biomass gasification: chemistry, Processes and applications", Nova Science Publishers, UK, 2009.
4. Christopher Higman, "Gasification", 2nd Edition, Gulf professional, Elsevier, 2008.
5. Berlin A A, "Chemical Physics of Pyrolysis, Combustion, and Oxidation", Nova Publishers, 2005.

19ME04L	**GRID TIED PV SYSTEM DESIGN**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Design and analyse on-grid photovoltaic systems. (K4)

Solar cells to solar array - On-Grid PV system - With and Without storage – Balance of system - DC-DC converters - Inverters - Net Metering - Design and analysis - Performance evaluation and monitoring - Field visit - Grid tied PV power plant.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Suneel Deambi, "Photovoltaic System Design: Procedures, Tools and Applications", CRC Press, 2016.

2. Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems: a manual for technicians, trainers and Engineers", Prentice Hall of India, 2014.
3. John R Balfour, Michael Shaw, "Advanced Photovoltaic System Design", Jones & Bartlett Publishers, 2011.
4. Roger Messenger, Amir Abtahi, "Photovoltaic Systems Engineering", 3rd Edition, CRC Press, 2010.
5. James P Dunlop, "Photovoltaic Systems", American Technical Publishers, 2nd Edition, 2012.
6. Web sources: www.pveducation.org; www.pveducation.com;
7. nptel.ac.in/courses/108105058/17

19ME05L	MICRO GRID	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the main motivations and challenges for the implementation of microgrids. (K2)

Definition of Microgrids - Components & Microgrid Layouts - Power Electronic Interfaces in Microgrids - Intelligent Local Controllers – Storage devices for Microgrids - Control in Microgrids - DC Microgrids- Protection – Faults

L:15; TOTAL:15 PERIODS

REFERENCES

1. Chetan Singh Solanki, "Solar Photovoltaics Fundamentals, Technologies and Applications", Prentice Hall of India, 2nd Edition, 2015.
2. James P Dunlop, "Photovoltaic Systems", American Technical Publishers, 2nd Edition, 2012.
3. Robert Foster, Majid Ghassemi and Alma Cota, "Solar Energy – Renewable Energy and the Environment", CRC Press, 2009.

19ME06L	THERMAL ENERGY STORAGE SYSTEMS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify the optimal energy storage technology to any application (K3).

Thermal Storage Concepts - Materials for Sensible and Latent Heat Energy Storage - Materials for Low and High Temperature Storage Applications - charging and discharging characteristics - Design of storage system– performance - Thermo-chemical storage.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Palacios A, Barreneche C, Navarro ME, Ding Y, "Thermal energy storage technologies for concentrated solar power – A review from a materials perspective", Renewable Energy, 2019.
2. Nazir Hassan et al., "Recent developments in phase change materials for energy storage applications: A review". International Journal of Heat and Mass Transfer, vol. 129 (2019), pp. 491-523.
3. KocakBurcu, Fernandez Ana Ines, PaksoyHalime "Review on sensible thermal energy storage for industrial solar applications and sustainability aspects" Solar Energy, vol. 209 (2020), pp. 135-169.
4. Luisa F. Cabeza, Advances in Thermal Energy Storage Systems: Methods and Applications, Elsevier Woodhead Publishing, 2015
5. Ibrahim Dincer and Marc A Rosen, "Thermal Energy Storage: Systems and Applications", 2nd Edition, John Wiley & Sons, Ltd., 2010.
6. H.P. Garg, S.C. Mullick, Vijay K. Bhargava, "Solar Thermal Energy Storage" D Reidel Publishing Co., 2011

19ME07L	**SOLAR COOLING SYSTEMS**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Estimate the size of cooling system components based on hardware, climate, and economic constraints. (K4).

Introduction - Conversion of Solar Radiation into Cooling or Air-conditioning - Absorption Cooling - Rankine Cycle Heat Engine Cooling - Desiccant Cooling - Other Cooling Methods - Estimating System Size - System Controls - Piping, Pumps, Valves - Collectors - Other Considerations – Case studies.

L:15; TOTAL:15 PERIODS

REFERENCES

1. IoanSarbu Calin Sebarchievici, "Solar Heating and Cooling Systems, Fundamentals, Experiments and Applications", 1st Edition, Academic Press, 2016.
2. SotiriosKarellas, Tryfon C Roumpedakis, Nikolaos Tzouganatos, Konstantinos Braimakis." Solar Cooling Technologies", CRC Press; 1st Edition (18 October 2018).
3. Daniel Mugnier, Daniel Neyer, Stephen D. White, "The Solar Cooling Design Guide-Case Studies of Successful Solar Air Conditioning Design: Case Studies of Successful Solar Air Conditioning Design", John Wiley & Sons, Inc., 2017.
4. Paul Kohlenbach, Uli Jakob, "Solar Cooling the Earthscan Expert Guide to Solar Cooling Systems", 1st Edition, Taylor & Francis, 2014.
5. R.Z. Wang and T.S. Ge," Advances in Solar Heating and Cooling", Elsevier Ltd., 2016.
6. John A. Duffie, William A. Beckman, "Solar Engineering of Thermal Processes", Third Edition, John Wiley & Sons, 2006.

19ME08L	DESALINATION	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Choose suitable desalination technology for given application (K3).

Desalination technologies – Membrane, Thermal and hybrid Desalination – Forward osmosis - Construction and design of Simple solar still – Solar PV powered Desalination - Solar disinfection and its methods - Solar thermal Desalination: passive and active type - Materials for Insulation, Heat storage – Technical Challenges – Performance - Case studies

L:15; TOTAL:15 PERIODS

REFERENCES

1. Ahmad et al., “Current advances in membrane technologies for produced water desalination”, Desalination, Vol-493, pp-114643, 2020.
2. Shaheen Fatima Anisa, RaedHashaikeha, Nidal Hilal, “Functional materials in desalination: A review”, Desalination, Vol-468, pp-114077, 2019.
3. Farah Ejaz Ahmed, RaedHashaikeh, Nidal Hilal, “Hybrid technologies: The future of energy efficient desalination – A review”, Desalination, Vol-495, pp-114659, 2020.
4. B.Anand et al., “A review on solar photovoltaic thermal integrated desalination technologies”, Renewable and Sustainable Energy Reviews, Vol-141, pp-110787, 2021.
5. Chauhan VK, Shukla SK, Tirkey JV, Singh Rathore PK, “A comprehensive review of direct solar desalination techniques and its advancements”, Journal of Cleaner Production, 2020.
6. HP Garg and J Prakash: Solar Energy: Fundamentals and Applications, Tata McGraw Hill, 2010.
7. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi, 2010.

19ME09L	THERMAL CHARACTERIZATION OF MATERIALS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Choose the method for thermal characterization of the materials. (K3)

Thermal characterization of materials such as: Organic - polymeric materials - composites - bio-materials - general theory of inorganic materials - metals. The micro and macroscopic thermal properties – Specific Heat, Thermal Diffusivity, Thermal Conductivity, coefficient of linear thermal expansion, moisture diffusivity, heat of vaporization and heat of combustion.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Askeland D.R. (1996) Thermal Properties of Materials. In: The Science and Engineering of Materials. Springer, Boston, MA. https://doi.org/10.1007/978-1-4899-2895-5_21
2. Jannot, Y., &Degiovanni, A, “Thermal properties measurement of materials”, John Wiley & Sons, 2018.
3. Khachan, J, “Thermal properties of matter”, Morgan & Claypool Publishers, 2018.

19ME10L	THERMAL ANALYSIS OF MECHANICAL SYSTEMS USING FEM	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply finite element solutions to Formulate and solve thermal problems on some simple mechanical systems. (K3)

Introduction to Scalar problems – One dimension and Two-dimension Finite element Heat Transfer: Basic equations of heat transfer and finite element formulation: Energy balance equation, Rate equation: conduction, convection, radiation, energy generated in solid, energy stored in solid - Case studies: heat transfer in composite sections, straight fins, Thermal analysis of an IC engine cylinder - Transient Thermal Analysis. Demonstration using FEM.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Seshu P, “Textbook of finite element analysis” PHI learning pvt ltd, New Delhi, 2012
2. David V Hutton “Fundamentals of finite element analysis” Tata McGraw Hill, 2005.
3. Logan, D. L., A first course in the finite element method,6th Edition, Cengage Learning, 2016.
4. Rao, S. S., Finite element method in engineering, 5th Edition, Pergaman Int. Library of Science, 2010.
5. Chandrupatla T. R., Finite Elements in engineering, 2nd Edition, PHI, 2013.
6. J.N.Reddy, “Finite Element Method”- McGraw -Hill International Edition.
7. Cook R. D., et al. “Concepts and Application of Finite Elements Analysis”- 4th Edition, Wiley & Sons, 2003.

19ME11L	INDUSTRIAL DRAWING READING WITH GEOMETRIC DIMENSIONING AND TOLERANCING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: inteapret limits, fits and tolerance in component drawing (K3)

Industrial Drawing reading – First and third angle projection – free hand sketches – BIS SP46 - Engineering drawing and tolerance – Limits, fits and Tolerance – Tolerance symbols and terms – rules and concepts of GD&T - use of GD&T – MMC, LMC – datum – Form – Orientation – profile – Runout.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Alex Krulikowsi, “Fundamentals of Geometric Dimensioning and Tolerancing”, 2nd Edition, Delmar publications, 2012.
2. Standards for dimensioning and tolerancing - ASME Y 14.5, 2009.
3. James D Meadows, “GD&T Application, analysis and Measurements”, ASME Press 2009.

19ME12L FUNDAMENTALS OF PROCESS EQUIPMENT

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: design the components of process equipment (K3).

Pressure Vessel Introduction – Design of Flanges – Design of supports for vertical and horizontal vessels – Openings, nozzles and External loadings – Storage Vessels - Evaporators crystallizers – Distillation and fractionization equipment.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Joshi, “Process Equipment Design”, Macmillan Company of India, 2016.
2. Dennis R Moss, Michael M. “Pressure Vessel Design Manual”, 4th Edition, Butterworth-Heinemann, 2012.
3. James R Couper, Roy Penney W, James R Fair, “Chemical Process Equipment: Selection and Design”, 3rd Edition, Elsevier, 2012.
4. Stanley M Walas, “Chemical Process Equipment Selection and design”, Butterworth-Heinemann, 1988.
5. Lloyd E Brownell and Edwin H Young, “Process Equipment Design: Vessel Design”, John Wiley & Sons, 1959.

19ME13L TECHNIQUES FOR VIBRATION MONITORING AND CONTROLS

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Apply vibration-based condition monitoring in rotating machineries. (K3).

Condition monitoring- methods – measurement of vibration, Vibration analysis, Vibration and predictive maintenance, Monitoring machine vibration, Vibration transducers, Common vibration monitoring techniques, Error analysis - Industrial case studies. Active and passive techniques in vibration control.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Davies A, “Handbook of Condition Monitoring: Techniques and Methodology”, Springer Science & Business Media, 2012.
2. Anders Brandt, “Noise and Vibration Analysis: Signal Analysis and Experimental Procedures”, John Wiley & Sons, 2011.
3. Robert Bond Randall, “Vibration-based Condition Monitoring”, John Wiley and Sons, Ltd., 2011.
4. Peter Tavner, Li Ran, Jim Penman, “Condition Monitoring of Rotating Electrical Machines”, the Institution of Engineering and Technology, London, United Kingdom, 2008.
5. Lihui Wang, Robert X Gao, “Condition Monitoring and Control for Intelligent Manufacturing”, Springer Science & Business Media, 2006.
6. Rao B K N, Davies A, “Handbook of Condition Monitoring Techniques and Methodology”, Springer-science business media, 1998.
7. Rao B K N, “Handbook of Condition Monitoring”, Elsevier, 1996.

19ME14L	CRASHWORTHINESS OF TUBULAR SHELLS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Assess the crashworthiness characteristics of thin-walled tubes/plates (K3).

Structural members – types – Introduction to Plates and Shells – Difference between plates and shells - selection and applications. Crashworthiness – definitions - types of loading - Influence of materials, shape, and boundary conditions on energy absorption and mode of collapse.
Evaluation on crashworthiness characteristics of simple shell member. Case studies – impact on helmets – mode of collapse - inferences.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Ahmed Elmarakbi, Lukaszewicz, “Automotive Composite Structures for Crashworthiness”, John Wiley & Sons Ltd, 2014.
2. Ambrosio J A C, “Crashworthiness: Energy Management and Occupant Protection”, Springer, 2001.
3. http://www.tandfonline.com/toc/tcrs20/current.
4. https://www.journals.elsevier.com/thin-walled-structures/
5. https://www.journals.elsevier.com/international-journal-of-impact-engineering.
6. https://www.journals.elsevier.com/composite-structures.
7. https://www.journals.elsevier.com/materials-and-design/

19ME15L	FAILURE MODE AND EFFECTS ANALYSIS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Apply FMEA techniques for product improvement (K3).

Failure mode effect analysis (FMEA) – requirements of reliability - failure rate – FMEA stages – Types of FMEA - Failure - Failure mode - Failure cause and/or mechanism - Failure effect – Detection – Probability - Risk Priority Number (RPN) – Severity - Remarks / mitigation / actions.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Bilal M Ayyub, “Risk Analysis in Engineering and Economics”, 2nd Edition, CRC Press, 2014.
2. Carl Carlson, “Effective FMEAs: Achieving Safe, Reliable, and Economical Products and Processes using Failure Mode and Effects Analysis”, John Wiley & Sons, 2012.
3. Raymond J Mikulak, Robin McDermott, Michael Beauregard, “The Basics of FMEA”, 2nd Edition, CRC Press, 2008.
4. Stamatis D H, “Failure Mode and Effect Analysis”, ASQ Quality Press, 2003.
5. Kevin Otto, Kristin Wood, “Product Design Techniques in Reverse Engineering and New Product Development”, Pearson Education (LPE), 2001.

19ME16L	DESIGN OF EXPERIMENTS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Apply suitable techniques for design of experiments in an engineering product design and evaluation (K3).

Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments – Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments – Two and three factor full Factorial experiments, 2K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi’s approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Linda C Schmidt, George E Dieter, “Engineering design”, McGraw-Hill Education, 2015.
2. Jiju Antony, “Design of Experiments for Engineers and Scientists”, Elsevier, 2014.
3. Paul G Mathews, “Design of Experiments with MINITAB”, ASQ Quality Press, 2005.
4. Ronald Fisher, “The Design of Experiments”, Hafner Press, 8th Revised edition, 1972.

19ME17L	TAGUCHI METHODS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Apply Taguchi methods in design of experiments (K3).

Overview of Design of Experiments and Taguchi approach - common experiments and methods of analysis. Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design - control and noise factors, S/N ratios, parameter design, Multilevel experiments, Multi response optimization – case studies.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Krishnaiah K and Shahabudeen P, "Applied Design of Experiments and Taguchi Methods", PHI learning private Ltd., 2012.
2. Khosrow Dehnad, "Quality Control, Robust Design and the Taguchi Method", Springer, 2012.
3. Ranjit K Roy, "A Primer on the Taguchi Method", 2nd Edition, Society of Manufacturing Engineers, 2010.
4. Ranjit K Roy, "Design of Experiments using the Taguchi Approach", John Wiley & sons, Inc., 2001.
5. Nicolo Belavendram, "Quality by Design; Taguchi techniques for industrial experimentation", Prentice Hall, 1995.

19ME18L	CREATIVE AND INNOVATIVE METHODS FOR DESIGN AND DEVELOPMENT	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Apply the innovative design process and rapid prototyping process in new part developments (K3).

Design thinking – Market Research – Identifying and involving the lead user - Creating Ideal Conditions – Decision making in design process –Understand-Observe-Point of view-ideate-prototype-test– Dealing with Project Goals- using task board- Gantt Chart for time and resource planning. **Value Analysis** – Need analysis, Function Analysis, Solution, Cost Analysis.
Rapid Prototyping processes – 3D printing – metal additive manufacturing – selective laser melting technique - applications and limitations.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Christian Muller-Robertberg, "Design Thinking for Dummies", John Wiley & Sons, 2020.

2. Thomas Lockwood, “Design Thinking – Integrating Innovation, Customer Experience, Brand value”, Allworth Press, 2009.
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata McGraw-Hill Education, 4th Edition, 2009.
4. Hasso Plattner, Christoph Meinel, Larry Leifer, “Design Thinking - Understand – Improve – Apply”, 3rd Edition, Springer-Verlag Berlin Heidelberg, 2009.
5. Walter Brenner, Falk Uebernickel “Design thinking for Innovation”, Springer, 2016.

19ME19L	CREEP AND FATIGUE	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Describe the concept of creep and fatigue (K2)

Creep and fracture at high temperature: High temperature deformation-importance, creep and stress rupture tests, creep curve, different stages of creep curve, Sherby-Dorn equation, mechanisms of creep deformation, super plasticity, prediction of longtime properties, fracture at elevated temperature, design of creep resistant alloys.
Fatigue: Stress cycles, fatigue test, S-N curve, cycle stress strain curve, low cycle and high cycle fatigue, effect of mean stress on fatigue, structural features of fatigue, Fatigue crack propagation, factors affecting fatigue: surface condition and metallurgical variables.

L:15; TOTAL:15 PERIODS

REFERENCES

1. George E. Dieter, “Mechanical Metallurgy”, 3rd Edition, McGraw-Hill, 1988.
2. Thomas H. Courtney, “Mechanical Behavior of Materials”, MeGraw-Hill, 2000.
3. Marc Andre Meyers and Krishan Kumar Chawla, “Mechanical Metallurgy, Principles and Applications”, 1984.

19ME20L	NATURAL FIBER COMPOSITES	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: describe the characteristics of different natural fibers and its composites (K2).

Fundamentals of natural fiber composite materials: Natural fibers - bio diversity-extraction methods-polymer matrix - composite fabrication methods. Pre-processing methods of natural fibers: Introduction - Chemical agents used for natural fiber surface modification-treatment procedures. Characterization of natural fibers: FTIR spectrography, SEM topography and other testing methods- investigations. Applications in Automotive Industry.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Campilho R D S G, “Natural Fiber Composites”, CRC Press, 2015.
2. Alma Hodzic, Robert Shanks, “Natural Fibre Composites: Materials, Processes and Properties”, Woodhead Publishing, 2014.
3. Douglas D Stokke, Qinglin Wu, Guangping Han, “Introduction to Wood and Natural Fiber Composites”, John Wiley & Sons, 2013.
4. Ning Hu, “Composites and their properties”, Intech, 2012.
5. Adel zakiel-sonbati, “Thermoplastic-composite materials”, InTech, 2012.
6. John cuppoleeti, “Metal, ceramic and polymeric composites for various uses”, Intech, 2011.
7. Frederick T Wallenberger, Norman Weston, “Natural Fibers, Plastics and Composites”, Springer Science & Business Media, 2011.
8. BrahimAttaf, “Advances in composite materials-eco design and analysis”, Intech, 2011.
9. Pickering K, “Properties and Performance of Natural-Fibre Composites”, Elsevier, 2008.

19ME21L	**FUNCTIONAL MATERIALS FOR ENERGY CONVERSION**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Select functional materials for energy conversion and storage. (K4)

Procedure for functional material development. Review of materials developed/available. Need for functional materials, synthesis methods, energy application. Design philosophy of functional materials, Nanostructures and Advanced Materials for solar energy conversion, fuel cell and energy storage.

L:15; TOTAL:15 PERIODS

REFERENCES

1. David Munoz-Rojas, Xavier Moya, “Materials for Sustainable Energy Applications: Conversion, Storage, Transmission, and Consumption”, Pan Stanford Publishing, 2016.
2. Kilner J A, Skinner S J, Irvine S J C, Edwards P P, “Functional Materials for Sustainable Energy Applications”, Woodhead Publishing Limited, 2012.

19ME22L	**DESIGN FOR MANUFACTURABILITY**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Apply the concepts of design for manufacturability. (K3).

Review of Tolerances, Limits and Fits. Influences of materials Space factor, Size and Weight on form design. Design for machining, casting, forging and welding.

L:15; TOTAL:15 PERIODS

REFERENCES

1. David M Anderson, "Design for Manufacturability: How to Use Concurrent Engineering to Rapidly Develop Low-Cost, High-Quality Products for Lean Production", CRC Press, 2014.
2. Chitale A K, Gupta R C, "Product Design and Manufacturing", PHI Learning Pvt. Ltd., 2013.
3. David M Anderson, "Design for Manufacturability & Concurrent Engineering: How to Design for Low Cost, Design in High Quality", Design for Lean Manufacture, and Design Quickly for Fast Production, CIM Press, 2004.
4. Boothroyd G, Dewhurst P and Knight W, "Product Design for Manufacture and Assembly", Marcell Dekker, 2002.
5. Harry Peck, "Designing for Manufacture", Pitman Publishing, 1983.
6. Chitale A K and Gupta R C, "Product Design and Manufacturing", PHI 2007
7. Bralla J G, "Hand Book of Product Design for Manufacturing", McGraw Hill Publications, 2000.

19ME23L	SIX SIGMA	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the history and basics of six sigma (K2)
CO2: form a Team, using the DMAIC process to solve a problem (K3)

History and development of Six Sigma – Definition – Common principles – Fundamentals - Roles & Responsibilities – Deliverables - challenges of six sigma - Defining a Six Sigma Project –Benefits and Application.
Lean concept – Seven muda – 5S – JIT – Basic 6σ Concept – Standard Deviation - Pareto principle – voice of customer – 5why's – SIPOC Process - Building a 6σ team – DMAIC and DMADV – Case study.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Dale H Besterfiled, "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint 2012.
2. Janakiraman B and Gopal R K, "Total Quality Management -Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006
3. James R Evans and William M Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2019.
4. Oakland J S, "TQM -Text with Cases", Butterworth-Heinemann Ltd., Oxford, 3rd Edition, 2003.
5. Suganthi L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

19ME24L	AGILE MANUFACTURING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: describe the concept of agile manufacturing (K2)

Fundamentals of Agile Manufacturing, The Agile Production Paradigm, Agile Principles, Conceptual models of Agile Manufacturing, Agile Practices - Agile practice for product development - Manufacturing agile practices - Developing the agile enterprise - understanding the value of investing in people, Managing People in agile organizations - Infusing managerial principles for enabling agility. Information Technology applications in Agile Manufacturing.

L:15; TOTAL:15 PERIODS

REFERENCE

1. Devadasan, S.R., Sivakumar, V., Mohan Murugesh, R., Shalij, P, R. “Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities”, Prentice Hall India, 2012.

19ME25L	SURFACE ENGINEERING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: explain the various theories and practice on surface engineering and surface modification methods to solve the industrial practical problems. (K2)

Introduction – Surface properties, Superficial layer – Changing surface metallurgy – Wear resistant coatings and Surface treatments – Applications of coatings and surface treatments in wear and friction control – Characteristics of Wear resistant coatings – New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings. Characterization of coatings and surfaces: Measurement of coatings thickness, porosity & adhesion of surface coatings, Measurement of residual stress & stability, Surface microscopy, topography and Spectroscopic analysis of modified surfaces – Surface Texturing.

L:15; TOTAL:15 PERIODS

REFERENCES

1. G.W.Stachowiak & A.W. Batchelor , “Engineering Tribology”, Butterworth-Heinemann, UK, 2016.
2. Halling, J. (Editor), “Principles of Tribology“, Macmillian – 1984.
3. Rabinowicz.E, “Friction and Wear of materials”, John Willey & Sons, UK, 1995.
4. S.K.Basu, S.N.Sengupta & B.B. Ahuja ,”Fundamentals of Tribology”, Prentice Hall of India Pvt Ltd , New Delhi, 2005.

19ME26L	OPTIMIZATION IN SCHEDULING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Choose various objectives, constraints and parameters of scheduling environment (K3).

CO2: Apply evolutionary algorithms to scheduling problems with single and multi-objectives (K3).

Scheduling fundamentals

Single machine scheduling - Measures of performance - Shortest processing time (SPT) - Rule to minimize Mean flow time - Weighted mean flow time - Earliest Due Date - Rule to minimize maximum lateness - Model to minimize total tardiness. Branch and Bound technique – Hodgson's algorithm- Parallel processor in single machine scheduling. Application of scheduling Software.

Optimization in Scheduling

Flow shop and Job shop scheduling- Evolutionary algorithms – Johnson's algorithm. GA – application to scheduling problems - structure – Binary coded and real coded – parameters- crossover, mutation, local optimal, global optimal. Single and multi-objective optimization.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Alessandro Agnetis, Jean-Charles Billaut, StanisławGawiejnowicz, Dario Pacciarelli, AmeurSoukhal, "Multiagent Scheduling: Models and Algorithms", Springer Science & Business Media, 2014.
2. Panneerselvam R, "Production and Operations Management", PHI Learning Pvt. Ltd., 2012.
3. Jacek Błażewicz, Klaus H Ecker, Erwin Pesch, Günter Schmidt, Jan Weglarz, "Handbook on Scheduling: From Theory to Applications", Springer Science & Business Media, 2007.
4. Rajendran Saravanan, "Manufacturing Optimization through Intelligent Techniques", CRC Press, 2017.
5. Joseph Y-T Leung, "Handbook of Scheduling: Algorithms, Models, and Performance Analysis", CRC Press, 2004.

19ME27L	DESIGN A STARTUP	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: design a startup

Module 1: What is Design Thinking and Its importance for startup Creation

Innovation and Design thinking. Managing the New Product Development using Design Thinking. A Detail Analysis of Entrepreneurs vs Innovators.

Module 2: Discovery of Real-World Problems

Problem Identification Tackle Wicked Problems. Obstacles to Problem Solving. Empathy in Design Thinking. The role of empathy in the design thinking process and the tools we can use. Empathizes with Your Users. How do we learn what people want? How to employ ethnographic and analysis methods, such as interviews, focus groups, and surveys.

Module 3: Defining Problem Statement. Cause and Effect of a Problem

Module 4: What is creative thinking, critical thinking and other types of thinking

Design Thinking as a Problem-Solving tool Learn to solve problems like a designer.

Module 5: Fuzzy Front end of Innovation and Ideation

What is Ideation and Essential Ideation Techniques. Managing Fuzzy Front end of Innovation. Impact and purpose of this ideas Present the ideas in this course together with the team and show how Startups or Intrapreneurs can create impact from ideas. Measuring impact and the value created through creativity.

Module 6: Idea to Concept to PoC

Module 7: Get Started with Prototyping. Start with Low-Fi Prototype and move on to develop a MVP

Why prototyping is so important in Design Thinking. How to prototype early and fast, as well as test your prototypes so as to reduce risks and accelerate organizational learning.What is lean Startup Methodology and how to develop MVP.

Module 8: Embracing Failure

Experiment to Innovate. Inculcate a culture that embraces failure. Teach students how to “Fail fast, fail cheap, fail often and Learn Fast.

Module 9: Group Presentation

L:15; TOTAL:15 PERIODS

REFERENCES

1. Roger L Martin, “The Design of Business”, Harvard Business Review Press; 3rd Edition, 2009
2. Tim Brown, “Change by Design”, Harper Business, 2019.

19ME28L	PREDICTIVE MAINTENANCE	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply predictive modelling and classification modelling techniques for predictive maintenance (K3)

Regression model - prediction of remaining useful lifetime (RUL) - classification models - Prediction of machine and machine tool failure - Case Studies

L:15; TOTAL:15 PERIODS

REFERENCES

1. John D. Kelleher, Brian Mac Namee and Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms", MIT Press, 2015.
2. Vlad Sozonov, "The Fundamentals of Data Science", Vinco Publishing, 2019.
3. Andrew Park, "Python Machine Learning", 2020.

19ME29L	INTELLIGENT MANUFACTURING	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply intelligent manufacturing techniques to improve the product development and manufacturing process (K3).

Product development: Generative Design - Digital Twins - Optimizing production system performance and process: Increasing productivity and reliability – Quality analysis: Smart sensors for IoT applications -Computer vision-based quality control - Case Studies.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Fei Tao, Meng Zhang and A.Y.C. Nee, "Digital Twin Driven Smart Manufacturing", Elsevier, 2019.
2. Pal, S.K., Mishra, D., Pal, A., Dutta, S., Chakravarty, D., Pal, S, "Digital Twin – Fundamental Concepts to Applications in Advanced Manufacturing", Springer, 2011.
3. HirotoYasuura, Chong-Min Kyung, Yongpan Liu, Youn-Long Lin, "Smart Sensors at the IoT Frontier", Springer, 2017.
4. Sheila Anand, L. Priya, "A Guide for Machine Vision in Quality Control", CRC press, 2020.

19ME30L	ARTIFICIAL INTELLIGENCE IN PRODUCTION MANAGEMENT	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply artificial intelligence technique to improve the production management activities. (K3)

Artificial Intelligence: Inventory management, Supply chain management, risk management, predictions on sales volume, Price and Demand forecasts - Case studies.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Mary Kathryn Allen, “The Development of an Artificial Intelligence System for Inventory Management”, Council of Logistics Management, 1986.
2. Wolfgang Kersten, “Artificial Intelligence and Digital Transformation in Supply Chain Management”: Innovative Approaches for Supply Chains, 2019.
3. Hanne, Thomas, Dornberger, Rolf, “Computational Intelligence in Logistics and Supply Chain Management”, springer, 2017.
4. Saqib AzizMichael Dowling, “Machine Learning and AI for Risk Management”, Disrupting Finance, pp 33-50.
5. Archie Addo, Srini Centhala, Muthu Shanmugam, “Artificial Intelligence for Risk Management”, 2020.

NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai & Accredited by NAAC)

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REGULATIONS – 2019

CURRICULUM & SYLLABUS

B. Tech. – INFORMATION TECHNOLOGY

Accredited by NBA

B.Tech. – INFORMATION TECHNOLOGY
CURRICULUM AND SYLLABUS

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To produce technically competent and value based IT Professionals to meet the current challenges of the modern IT industry.

MISSION

- Imparting quality education with innovative components in teaching learning process.
- Conducting student centric programme to enhance communication, team spirit, leadership skills and self learning.
- Motivating the students to realize the need of ethics and human values.
- Developing a conducive environment for collaborative research.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme Educational Objectives are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to achieve:

PEO 1 : Excel in IT, ITES industries and higher education by applying the principles and practices of computing.

PEO 2 : Maintain professionalism and adapt to emerging technologies.

PEO 3 : Equip themselves as a leader and capable of managing Multidisciplinary environment.

PROGRAMME OUTCOMES (POs)

At the time of graduation, our IT graduates are expected to have:

1. Apply knowledge of mathematics, physics, chemistry, biological sciences, Engineering fundamentals and Software Development Fundamentals, Information Management and Security, Networking and web Systems to the solution of complex engineering problems in Information Technology.
2. Identify, formulate, research literature and analyze complex Information Technology problems in Software Engineering, Data Mining, Mobility Engineering, Analytic Computing, Network Management and security, reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. Design solutions for complex Information Management and Security, Networking and web System problems and design systems, components or processes that meet specified needs with appropriate considerations for environment, culture, society, public health and safety.
4. Conduct investigations of complex Information Management and Security, Networking and web System problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5. Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems in Emerging technologies, Networking and web Systems with an understanding of the limitations.
6. Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice in Healthcare and Banking and solutions to complex engineering problems in Networking and Web Systems and Emerging Technologies.
7. Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex Information Technology problems in societal and environmental contexts.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of Computer Ethics in engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of engineering management principles and economic decision making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12. Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **IT programme** is designed with total number of credits ***162 (120*** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table - I.

TABLE – 1 CATEGORY OF COURSES

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	13
2.	Basic Science courses	27
3.	Engineering Science courses	29
4.	Programme Core courses	50
5.	Programme Elective courses relevant to chosen specialization / branch	18
6.	Open Elective courses from other technical and /or emerging subject areas	9
7.	Skill Development Courses	16
8.	Mandatory courses	(non – credit)
	TOTAL	**162**

i. **Humanities and Social Sciences (HSMC)** include English, Communication Skill laboratory and Management courses

ii. **Basic Science Courses** (**BSC)** include Chemistry, Physics, Biology and Mathematics

iii. **Engineering Science Courses (ESC)** include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering

iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.

vii. **Skill Development Courses (SDC)** include the courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.

viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

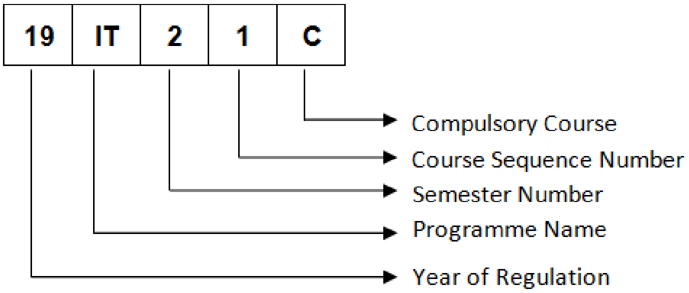
Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

TABLE – 2 QP – QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100

10,11 and 12 marks questions will be a single question and no subdivisions

FOR COURSE CODE



REGULATIONS – 2019 CURRICULUM AND SYLLABUS

SEMESTER – I

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19IT11C	Python Programming	3	0	0	3	A
6.	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
PRACTICAL COURSES								
7.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	-
8.	ESC	19IT12C	Python Programming Laboratory	0	0	4	2	-
			TOTAL	**14**	**1**	**11**	**20.5**	

SEMESTER – II

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1	HSMC	19IT21C	Professional English	2	0	0	2	B
2	BSC	19IT22C	Probability and Queueing theory	3	1	0	4	A
3	BSC	19IT23C	Physics for Information Science	2	0	0	2	B
4	BSC	19IT24C	Biology for Engineers	2	0	0	2	B
5	ESC	19IT25C	Problem Solving Techniques	3	0	0	3	A
6	ESC	19IT26C	Basic Electrical and Electronics Engineering	3	0	0	3	A
PRACTICAL COURSES								
7.	BSC	19IT27C	Physics for Information Science and Biology Laboratory Part A – Physics for Information Science Laboratory Part B – Biology Laboratory	0	0	3	1.5	-
8.	ESC	19IT28C	Problem Solving Techniques Laboratory	0	0	4	2	-
9.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
			TOTAL	**16**	**1**	**9**	**21.5**	-

SEMESTER – III

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19IT31C	Discrete Mathematics	3	1	0	4	A
2.	PCC	19IT32C	Data Structures and Algorithms	3	1	0	4	A
3.	PCC	19IT33C	Object Oriented Programming	3	1	0	4	A
4.	ESC	19IT34C	Principles of Data Communication	3	0	0	3	A
5.	HSMC	19IT35C	Professional Ethics and Human values	3	0	0	3	A
6.	ESC	19IT36C	Computer Organization and Architecture	3	0	0	3	A
PRACTICAL COURSES								
7.	PCC	19IT37C	Data Structures Laboratory	0	0	3	1.5	-
8.	PCC	19IT38C	Object Oriented Programming Laboratory	0	0	3	1.5	-
9.	HSMC	19IT39C	Communication Skills Laboratory	0	0	2	1	-
			TOTAL	**18**	**3**	**8**	**25**	

SEMESTER – IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19IT41C	Statistics and Numerical Methods	3	1	0	4	A
2.	PCC	19IT42C	Operating Systems	3	0	0	3	A
3.	PCC	19IT43C	Database Management Systems	3	0	0	3	A
4.	PCC	19IT44C	Computer Networks	3	0	0	3	A
5.	PCC	19IT45C	Algorithmics	2	0	0	2	B
6.	HSMC	19IT46C	Finance and Accounting	3	0	0	3	A
7.	MAC	19MC01C	Environmental Science and Engineering	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19IT47C	Operating Systems Laboratory	0	0	3	1.5	**-**
9.	PCC	19IT48C	Networking Laboratory	0	0	3	1.5	**-**
10.	PCC	19IT49C	Database Management Systems Laboratory	0	0	3	1.5	**-**
			TOTAL	**20**	**1**	**9**	**22.5**	

SEMESTER – V

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19IT51C	Java Programming	3	0	0	3	A
2.	ESC	19IT52C	Software Engineering	3	0	0	3	A
3.	PCC	19IT53C	Cryptography and Network Security	3	0	0	3	A
4.	PCC	19IT54C	Internet and Web Technology	3	0	0	3	A
5.	ESC	19IT55C	Embedded System	3	0	0	3	A
6.	PEC		Elective-I	3	0	0	3	-
7.	MAC	19MC02C	Constitution of India	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19IT56C	Java Programming Laboratory	0	0	3	1.5	**-**
9.	PCC	19IT57C	Cryptography and Network Security Laboratory	0	0	3	1.5	**-**
10.	PCC	19IT58C	Internet and Web Technology Laboratory	0	0	3	1.5	**-**
			TOTAL	**18**	**0**	**9**	**22.5**	

SEMESTER – VI

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19IT61C	Big Data Analytics	3	0	0	3	A
2.	PCC	19IT62C	Enterprise Mobility	3	0	0	3	A
3.	HSMC	19IT63C	Business Process Management	2	0	0	2	B
4.	PEC		Elective – II	3	0	0	3	-
5.	OEC		Elective – I (Open Elective)	3	0	0	3	-
PRACTICAL COURSES								
6.	PCC	19IT64C	Comprehension	0	0	2	1	-
7.	PCC	19IT65C	Big Data Analytics Laboratory	0	0	3	1.5	**-**
8.	PCC	19IT66C	Mobile Technologies Laboratory	0	0	3	1.5	**-**
9.	SDC	19IT67C	Product Development Laboratory	1	0	2	2	**-**
			TOTAL	**15**	**0**	**10**	**21**	

SEMESTER – VII

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PEC		Elective - III	3	0	0	3	-
2.	PEC		Elective - IV	3	0	0	3	-
3.	PEC		Elective - V	3	0	0	3	-
4.	OEC		Elective - II (Open Elective)	3	0	0	3	-
PRACTICAL COURSES								
5.	SDC	19IT71C	Project Work – I	0	0	6	3	-
6.	SDC	19IT72C	Research Paper and Patent Review – Seminar	0	0	2	1	-
			TOTAL	**11**	**0**	**8**	**15**	

SEMESTER – VIII

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PEC		Elective-VI	3	0	0	3	-
2.	OEC		Elective – III (Open Elective)	3	0	0	3	-
PRACTICAL COURSES								
3.	SDC	19IT81C	Project Work – II	0	0	12	6	-
4.	SDC	19IT82C	Internship / In-plant Training	0	0	4	2	-
			TOTAL	**6**	**0**	**16**	**14**	

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE –162

PROGRAMME ELECTIVE COURSES

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
ANALYTICS								
1.	PEC	19IT01E	Deep Learning	3	0	0	3	A
2.	PEC	19IT02E	Machine Learning	3	0	0	3	A
3.	PEC	19IT03E	Bioinformatics	3	0	0	3	A
4.	PEC	19IT04E	Data Warehousing and Data Mining	3	0	0	3	A
5.	PEC	19IT05E	Scalable Data Science	3	0	0	3	A
6.	PEC	19IT06E	Business Intelligence for IT	3	0	0	3	A
7.	PEC	19IT07E	Artificial Intelligence	3	0	0	3	A
8.	PEC	19IT08E	Reinforcement Learning	3	0	0	3	A
9.	PEC	19IT09E	Analytics Computing	3	0	0	3	A
10.	PEC	19IT10E	Web Analytics	3	0	0	3	A
11.	PEC	19IT11E	Data Science using R	3	0	0	3	A
12.	PEC	19IT12E	Soft Computing	3	0	0	3	A
ADVANCED COMPUTING								
13.	PEC	19IT13E	Social Networking	3	0	0	3	A
14.	PEC	19IT14E	Cloud Computing	3	0	0	3	A
15.	PEC	19IT15E	Information Visualization	3	0	0	3	A
16.	PEC	19IT16E	GPU Computing	3	0	0	3	A
17.	PEC	19IT17E	Multi-core Architectures	3	0	0	3	A
18.	PEC	19IT18E	Service Oriented Architecture	3	0	0	3	A
19.	PEC	19IT19E	Quantum Computing	3	0	0	3	A
20.	PEC	19IT20E	Cloud Management Security	3	0	0	3	A
21.	PEC	19IT21E	Edge and Fog Computing	3	0	0	3	A
22.	PEC	19IT22E	Virtual and Augmented Reality	3	0	0	3	A
23.	PEC	19IT23E	BlockChain Technology	3	0	0	3	A
MOBILE COMPUTING								
24.	PEC	19IT24E	Mobile communications	3	0	0	3	A
25.	PEC	19IT25E	Mobile and Ubiquitous Computing	3	0	0	3	A
26.	PEC	19IT26E	IoS programming	3	0	0	3	A
27.	PEC	19IT27E	Android programming	3	0	0	3	A
28.	PEC	19IT28E	M-commerce	3	0	0	3	A
29.	PEC	19IT29E	IoT and its Applications	3	0	0	3	A
30.	PEC	19IT30E	Digital Marketing	3	0	0	3	A
PROGRAMMING								
31.	PEC	19IT31E	Advanced Java Programming	3	0	0	3	A
32.	PEC	19IT32E	Game programming	3	0	0	3	A
33.	PEC	19IT33E	ASP .NET Frameworks	3	0	0	3	A
34.	PEC	19IT34E	DevOps (Agile)	3	0	0	3	A

35.	PEC	19IT35E	UNIX Internals	3	0	0	3	A
36.	PEC	19IT36E	Compiler Design	3	0	0	3	A
37.	PEC	19IT37E	Software testing tools	3	0	0	3	A
38.	PEC	19IT38E	Functional Programming	3	0	0	3	A
NETWORKING AND SECURITY								
39.	PEC	19IT39E	Wireless Adhoc and Sensor Networks	3	0	0	3	A
40.	PEC	19IT40E	Next Generation Networks	3	0	0	3	A
41.	PEC	19IT41E	Network Programming and Management	3	0	0	3	A
42.	PEC	19IT42E	Information Security	3	0	0	3	A
43.	PEC	19IT43E	Cyber Forensics and Ethical Hacking	3	0	0	3	A
44.	PEC	19IT44E	Information Theory and Coding	3	0	0	3	A
DATA SCIENCE								
45.	PEC	19IT45E	Introduction to Data Science	3	0	0	3	A
46.	PEC	19IT46E	Machine learning Techniques	2	0	2	3	A
47.	PEC	19IT47E	Data Engineering Concepts and Tools	2	0	2	3	A
48.	PEC	19IT48E	Web data mining	2	0	2	3	A
49.	PEC	19IT49E	Business Intelligence and analytics	3	0	0	3	A
Skill Development Course								
50.	SDC	19IT50E	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3	-

ONE CREDIT ELECTIVE COURSES

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
1.	PEC	19IT01L	Agile Development Process	1	0	0	1	C
2.	PEC	19IT02L	Computer Hardware and Trouble Shooting	0	0	2	1	-
3.	PEC	19IT03L	PHP Programming	0	0	2	1	-
4.	PEC	19IT04L	Theory of Computation	1	0	0	1	C
5.	PEC	19IT05L	Basics of Compiler Design	1	0	0	1	C
6.	PEC	19IT06L	Virtualization	1	0	0	1	C
7.	PEC	19IT07L	Social Media Application Development	1	0	0	1	C
8.	PEC	19IT08L	IoS Development	1	0	0	1	C
9.	PEC	19IT09L	E-Commerce Security	1	0	0	1	C
10.	PEC	19IT10L	Hadoop Architecture and Installation	0	0	2	1	-
11.	PEC	19IT11L	Microcontroller and Raspberry	1	0	0	1	C

			Pi					
12.	PEC	19IT12L	Programming in IOT	0	0	2	1	-
13.	PEC	19IT13L	R Programming	0	0	2	1	-
14.	PEC	19IT14L	Java Generics and Collections framework	0	0	2	1	-
15.	PEC	19IT15L	Deep Learning Algorithms	0	0	2	1	-
16.	PEC	19IT16L	Database Design and Programming with SQL	0	0	2	1	-
17.	PEC	19IT17L	Introduction to Networks	1	0	0	1	C
18.	PEC	19IT18L	Routing and Switching Essentials	1	0	0	1	C
19.	PEC	19IT19L	Scaling Networks	1	0	0	1	C
20.	PEC	19IT20L	Connecting Networks	1	0	0	1	C
21.	PEC	19IT21L	Robotic Process Automation	0	0	2	1	-
22.	PEC	19IT22L	Matlab Programming	0	0	2	1	-
23.	PEC	19IT23L	Ethics in cybersecurity	1	0	0	1	C
24.	PEC	19IT24L	Arduino Programming	1	0	0	1	C
25.	PEC	19IT25L	Mathematics for Machine Learning	1	0	0	1	C
26.	PEC	19IT26L	Real Time Systems	1	0	0	1	C
27.	PEC	19IT27L	Network Simulation with NS3	0	0	2	1	C
28.	PEC	19IT28L	Python for Data Science	0	0	2	1	-
29.	PEC	19IT29L	Node JS	0	0	2	1	-
30.	PEC	19IT30L	Introduction to NoSQL with MongoDB	0	0	2	1	-

OPEN ELECTIVE COURSES (OEC)

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
1.	OEC	19IT01N	Fundamentals of Java Programming	3	0	0	3	A
2.	OEC	19IT02N	Python Programming - Basics	3	0	0	3	A
3.	OEC	19IT03N	Introduction to Virtual and Augmented Reality	3	0	0	3	A
4.	OEC	19IT04N	Internet of Things	3	0	0	3	A
5.	OEC	19IT05N	Basic of Networking	3	0	0	3	A
6.	OEC	19IT06N	Advanced Networking	3	0	0	3	A
7.	OEC	19IT07N	Industrial Networking	3	0	0	3	A
8.	OEC	19IT08N	Data Analytics	3	0	0	3	A
9.	OEC	19IT09N	E-waste Management	3	0	0	3	A

19SH11C **TECHNICAL ENGLISH** **L T P C**
(Common to all B.E. / B.Tech. Degree Programmes) **2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply the basic language skills to understand various aspects of communication skills (K3)
CO2: express their thoughts with correct usage of language in formal writings (K3)
CO3: understand various language components and develop the pronunciation skill. (K2,S4)
CO4: make effective technical writings and interpret any pictorial representation. (K3,S4)
CO5: frame sentences and write effective reports. (K3)

UNIT I **6**

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, letter to Friend / Parent / Siblings - Greetings and Self Introduction – Situational Phrases - Tense (Present)

UNIT II **6**

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) –Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

UNIT III **6**

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

UNIT IV **6**

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

UNIT V **6**

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

Suggested Activity: Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Anderson, Paul V. "Technical Communication: A Reader - Centered Approach", 9th Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. "A Comprehensive Grammar of the English Language", Longman Inc., Newyork, 2014.

REFERENCES

1. Murphy Raymond, "Basic Grammar Practice on Tense", Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., "Engineering English", Orient Blackswan, Hyderabad, 2015.

19SH12C MATHEMATICAL FOUNDATIONS FOR ENGINEERS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make use of orthogonal transformation. (K3)
CO2: find the evolutes of various curves.(K2)
CO3: maxima and minima of real valued functions.(K3)
CO4: solve ordinary differential equations.(K2)
CO5: solve partial differential equations.(K2)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivative – Total derivative – Euler's theorem on homogeneous functions – Taylor's Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange's multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order ordinary differential equations - Equations solvable for 'p', equations solvable for 'y', equations solvable for 'x' - Solutions of higher order linear differential equations with constant coefficients – Cauchy's and Legendre's linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange's linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9th Edition, Dorling Kindersley Private Limited, 2010.

19SH13C	ENGINEERING PHYSICS (Common to all B.E. / B.Tech. Degree Programmes)	L T P C 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)

CO2: understand the principle and propagation of different types of waves (K2)

CO3: choose the appropriate Laser technique for industrial and medical applications (K2)

CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)

CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

UNIT I CRYSTALLOGRAPHY 6

Lattice, Unit cell, Bravais lattice, Lattice planes - Crystal system - Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

UNIT II WAVES 6

Simple harmonic oscillators - Damped harmonic oscillator - Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

UNIT III LASER 6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

UNIT IV FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

UNIT V QUANTUM PHYSICS 6

Black Body Radiation - Matter Waves - Heisenberg's uncertainty principle - Schrodinger's wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 11th Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", 7th Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D. J. Griffiths, "Quantum mechanics", 2nd Edition, Cambridge University Press, 2014.

REFERENCES

1. Renk, Karl.F “Basics of laser physics”, 2nd Edition, Springer international publishing, 2017.
2. H. J. Pain,Patricia Rankin “Introduction to vibration and waves”, 1st Edition, Wiley, 2015
3. K.S.Mathur, “Fundamentals of Fiber Optics”, 1st Edition, Zorba books, 2018.

19SH14C ENGINEERING CHEMISTRY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)
CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)
CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)
CO4: familiar with the various novel organic material used in electronics industry. (K2)
CO5: understand the principle, components and working of various analytical instruments. (K2)

UNIT I WATER TREATMENT 6

Hardness - Estimation of hardness of water – Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

UNIT II SURFACE CHEMISTRY AND CATALYSIS 6

Adsorption – Types - Freundlich’s adsorption isotherm – Langmuir’s adsorption isotherm – contact theory – Kinetics of surface reactions - Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications - Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

UNIT III ELECTROCHEMISTRY AND CORROSION 6

Electrode potential-Nernst Equation-reference electrode - glass electrode - measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)

Corrosion: Types of corrosion - Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

UNIT IV ELECTRONIC MATERIALS 6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidene fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, bIoSensor - chemical sensors

UNIT V ANALYTICAL TECHNIQUES 6

Spectroscopy:Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., “Engineering Chemistry”, Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20th Edition, 2018.

REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6th Edition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, “Organic Electronics: Materials, manufacturing and applications”, Wiley - VCH, 2016

19IT11C PYTHON PROGRAMMING

19IT11C	PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: develop simple Python programs. (K3)

CO2: structure simple Python programs for solving problems and decompose a Python program into functions. (K3)

CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)

CO4: understand file management concepts and develop packages in Python Programs. (K3)

CO5: design and Develop GUI Programming. (K5)

UNIT I DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode - values and data types: Variables - expressions - statements – Operators - precedence of operators – Input and Output - comments – Errors: Syntax Errors - Runtime errors - Logical Errors.

UNIT II CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) – chained conditional (if-elif-else) - Iteration: state – while – for – break – continue - pass - Fruitful functions: Function argument and its types - return values – parameters - local and global scope - function composition – recursion - Documenting Function – Classes and Inheritance - Object Oriented Programming - Class Instances – Class Methods.

UNIT III LISTS, TUPLES, DICTIONARIES 9

Strings: string slices – immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists – list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods - advanced list processing - list comprehension

UNIT IV FILES, MODULES, PACKAGES 9

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Name space

UNIT V GRAPHICAL USER INTERFACE PROGRAMMING 9

Event driven programming - TkInter introduction - Introducing callbacks - User input - Mini-case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. "Think Python: How to Think Like a Computer Scientist", by Allen B. Downey, O'Reilly Media, Inc. , 2016
2. "A Practical Introduction to Python Programming", Brian Heinold, Mount St. Mary's University, 2012.
3. "Learning to Program with Python", Richard L. Halterman, 2019, E-book
4. Dive into Python, Mark Pilgrim, Apress, 2012.

REFERENCES

1. "Exploring Python", Timothy A.Budd, Mc-Graw Hill Education (India) Private Limited, 2015.
2. "Introduction to Computer Science using python: A Computational Problem-solving Focus, Charles Dierbach, Wiley India Edition, 2015.
3. "Practical Programming: An Introduction to Computer Science using Python 3.6", Paul Gries, Jennifer Campbell and Jason Montojo, second edition, Pragmatic Programmers, LLC, 2018.
4. "Introduction to Programming in Python: An Inter-disciplinary Approach", Robert Sedgewick, Kevin Wayne, Robert Dondero, Pearson India Education Services Pvt. Ltd, 2016.

19SH15C ENGINEERING GRAPHICS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
2	0	4	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
CO2: construct the orthographic projections of points, straight lines and lamina (K2)
CO3: draw the projections of simple solids in different positions. (K3)
CO4: visualize the sectional views and surface areas of various solids. (K3)
CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P: 60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Shah M.B and Rana B.C, “Engineering Drawing”, Pearson Education, 2nd Edition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2nd Edition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, “Engineering Drawing”, Subhas Publications, 32nd Edition, 2017.

19SH16C ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

(Common to all B.E. / B.Tech. Degree Programmes)

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K3, S3)

CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium.(K3, S3)

CO3: illustrate the electrical properties of materials. (K3, S3)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster’s bridge.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. David Loyal, " Physics laboratory" 4th Edition, Cengage learning, 2013
2. Sesha Sai Kumar Vemula, "Engineering Physics lab manual" 1st Edition, LAP LAMBERT Academic Publishing, 2017

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: determine various water quality parameters. (K2, S3)
CO 2: quantify different ions by different analytical techniques. (K2, S3)
CO3: determine the rate of corrosion of mild steel plate. (K2, S3)
CO4: verify the freundlich adsorption isotherm. (K2, S3)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron (Fe^{2+}) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.
6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron (Fe^{2+}) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris "Quantitative Chemical Analysis: International Edition", W.H.Freeman, 9th Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford , P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19IT12C PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

COURSE ONTCOMES

Upon completion of this course, the students will be able to

CO1: solve Simple problems using conditional and control statement in Python.(K3)
CO2: develop user defined function for solving problems in modular approach. (K3)
CO3: enhance the program skills with lists and dictionaries. (K3)
CO4: design and develop packages and GUI application. (K5)

LIST OF EXPERIMENTS

1. **Simple Programs**
   a. To calculate the average of numbers
   b. To read two numbers and print their quotient and remainder

2. **Programs using control flow**
   a. To compute prime factors of an integer

   b. To form an integer that has the number of digits at ten's place and the least significant digit of the entered integer at one's place
   c. To get the marks of students for 5 subjects and display their grade as per the 2019 regulation.
   d. To print all numbers in a range divisible by a given number
   e. To accept three digits and print all possible combinations from the digits

3. **Programs using functions**
   a. To determine all Pythagorean triplets in the range
   b. Given a square matrix with n rows and n columns, you have to write a program to rotate this matrix such that each element is shifted by one place in a clockwise manner.
   c. To check whether a string is a palindrome or not using recursion

4. **Programs using strings**
   a. To detect if two strings are anagrams
   b. To accept a hyphen separated sequence of words as input and print the words in a hyphen-separated sequence after sorting them alphabetically

5. **Programs using lists**
   a. To find the second largest number in a list
   b. To merge two lists and sort it

6. **Programs using dictionaries**
   a. There is a robot which wants to go the charging point to charge itself.
   The robot moves in a 2-d plane from the original point (0,0). The robot can move toward up, down, left and right with given steps.
   The trace of robot movement is shown as the following:
      i. Up 5
      ii. Down 3
      iii. Left 3
      iv. Right 2

   Write a program to compute the distance between the current position after a sequence of movement and original point. If the distance is a float, then just print the nearest integer (use round() function for that and then convert it into an integer).
   b. Consider a cricket series containing five matches between india and australia read the scores of individual players of both teams and finally identity the man of the series.

7. **Programs using files**
   a. To count the number of words and number of lines in a text file
   b. That reads a text file and counts the number of times a certain letter appears in the text file

8. **Programs using modules and packages.**

9. **Case study:** GUI programming

P: 60; TOTAL: 60 PERIODS

SOFTWARE REQUIREMENTS

1. Python 3.x
2. Anaconda Navigator

19IT21C PROFESSIONAL ENGLISH L T P C
(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Integrate and apply the acquired skills in real life situation. (K3, S4)
CO 2: Write effectively in any professional contexts. (K3)
CO 3: Enhance the vital sub-functions of communication in any formal situation. (K3, A2)
CO 4: Participate actively in any informal and formal discussion. (K3, A3)
CO 5: Recall the acquired skills and apply them in their work place. (K2, S3)

UNIT I 6

Standard Abbreviations - If Conditionals - Presenting articles based on newspaper reading - Listening for specific information - Argumentative essay.

UNIT II 6

One word substitution - Rearranging the jumbled phrases of sentences – Chart Description - Business Letters for Quotations and Clarification.

UNIT III 6

Idioms and Phrases - Direct & Indirect Speech - Business Letters for Placing orders and Making Complaints - Process Description.

UNIT IV 6

Synonyms **-** Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples - Demo) - Proposal Writing.

UNIT V 6

Error Spotting (Based on Concord, Pronouns, Articles & Adverb Placement) - Job Application Letter & Resume Preparation - Circular and Minutes of the meeting - Reading Comprehension.

Suggested Activity: Career Analysis – Herein the students will be required to submit a report about their dream career / company of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Board of editors. “Fluency in English A Course book for Engineering and Technology”, Orient Blackswan, Hyderabad, 2016.
2. Bovee, Courtland, L., John V.Thill. “Business Communication Today”, 13th Edition, Pearson Education, New Delhi, 2018.

REFERENCES

1. Lester Mark and Larry Beason, “Hand book of English Grammar and Usage”, McGraw Hill Education, 1st Edition, 2017.
2. Raman, Meenakshi and Sharma, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press, New Delhi, 2014.

19IT22C PROBABILITY AND QUEUEING THEORY

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: grasp the basic concepts of probability and random variables.(K2)
CO2: find the correlation and regression of two dimensional random variables.(K2)
CO3:characterize the phenomena which evolve with respect to time in a probabilistic manner. (K3)
CO4: interpret the basic characteristic features of Markovian queues. .(K3)
CO5: utilize the concepts of Non Markovian queues and Networks.(K3)

UNIT I RANDOM VARIABLES 12

Random Variable **-** Discrete and continuous random variables - Moments - Moment generating functions and their properties; Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions .

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

UNIT III CLASSIFICATION OF RANDOM PROCESSES 12

Random process **-** Classification - Stationary process – WSS and SSS - Markov process - Markov chains – Transition probabilities - Limiting distributions - Poisson process

UNIT IV QUEUEING THEORY 12

Markovian models – Birth and Death Queueing models- Steady state results: Single and multiple server queuing models- Queues with finite waiting rooms- Finite source models- Little’s Formula

UNIT V NON-MARKOVIAN QUEUES AND QUEUE NETWORKS 12

M/G/1 queue- Pollaczek- Khintchine formula, series queues- Open and closed networks.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. O.C. Ibe, “Fundamentals of Applied Probability and Random Processes”, Elsevier, 1st Indian Reprint, 2007.
2. D. Gross and C.M. Harris, “Fundamentals of Queueing Theory”, Wiley and Sons Publication Limited, 4th Edition, 2008.

REFERENCES

1. A.O. Allen, “Probability, Statistics and Queueing Theory with Computer Applications”, Elsevier, 2nd Edition, 2005.
2. H.A. Taha, “Operations Research”, Pearson Education, Asia, 10th Edition, 2017.
3. K.S. Trivedi, “Probability and Statistics with Reliability, Queueing and Computer Science Applications”, John Wiley and Sons, 2nd Edition, 2016.

19IT23C PHYSICS FOR INFORMATION SCIENCE

L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the basics of Boolean algebra and illustrate the Boolean functions by logic gates.(K2)

CO 2: explain and design different types of adder and subtractor in combinational circuits. (K2)
CO 3: explain and design multiplexers and encoders in combinational circuits. (K2)
CO 4: illustrate the basics of synchronous sequential logic and Registers. (K2)
CO 5: classify and explain different types of memories. (K2)

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 6

Review of binary number systems - Binary arithmetic - Binary codes - Boolean algebra and theorems - Boolean functions - Simplifications of Boolean functions using Karnaugh map – Logic gates.

UNIT II COMBINATIONAL LOGIC-I 6

Design procedure - Half adder - Full Adder - Half subtractor - Full subtractor - Parallel binary adder - Parallel binary subtractor - Fast Adder - Carry Look - Ahead adder - Serial Adder/Subtractor - BCD adder- Binary Multiplier - Binary Divider.

UNIT III COMBINATIONAL LOGIC-II 6

BCD adder - BCD subtractor - Parity Checker/Generator – Multiplexer – Demultiplexer – Encoder - Priority Encoder – Decoder -BCD to Seven segment Display Decoder/Driver - LCD Display and Comparators.

UNIT IV SYNCHRONOUS SEQUENTIAL LOGIC 6

Sequential circuits - Latches – Flip-Flops - Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure. Registers – Shift Registers – Ripple counters – Synchronous Counters.

UNIT V MEMORY AND PROGRAMMABLE LOGIC 6

Memory – Introduction – Random-Access Memory – Memory Decoding – Read only memory. Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. M. Morris Mano, Michael D. Ciletti., “Digital Design”, Pearson Education, 5th Edition, 2013.
2. Salivahanan S. and Arivazhagan S., “Digital Circuits and Design”, Oxford University Press, 5th Edition, 2018.

REFERENCES

1. Thomas L. Floyd, “Digital Fundamentals”, Prentice Hall, 10th Edition, 2008.
2. Donald P Leach, Albert Paul Malvino, Goutam Saha, “Digital Principles and Applications”, Tata McGraw Hill, 6th Edition, 2008.
3. Jr. Charles H. Roth and Larry L Kinney, “Fundamentals of Logic Design” (with Companion CD-ROM), Thomson Learning, 6th Edition, 2009.
4. Raj Kamal, “Digital Systems: Principles and Design”, Prentice Hall, 1st Edition, 2009
5. D.A. Godse and A.P.Godse, “Digital Electronics”, Technical Publications, 4th Edition, 2017.

19IT24C BIOLOGY FOR ENGINEERS L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe and comprehend the fundamental concepts of cell biology. (K2)

CO2: understand the various bimolecular interactions in living organisms. (K2)
CO3: familiar with biological database. (K2)
CO4: understand the thermodynamic concepts in living organisms. (K2)
CO5: apply the molecular modeling methods in the drug design. (K2)

UNIT I CELL BIOLOGY 6

Cell as a basic unit of life-Cell organization of prokaryotic and eukaryotic cells-Structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus - Cell cycle - cell division: mitosis and meIoSis.

UNIT II BIO MOLECULAR INTERACTIONS 6

DNA and RNA-hydrophobicity and hydrophilicity-Molecular interactions: covalent and non covalent interactions – Spectroscopic methods to measure the interactions.

UNIT III BIOLOGICAL DATABASES 6

Primary and secondary sequence databases – Composite protein sequence databases - General concepts of sequence analysis - Identification of functional sequences PDB (Protein Data Bank) and NDB (Nucleic Acid Data Bank).

UNIT IV BIOCHEMICAL THERMODYNAMICS 6

First and Second laws of thermodynamics, Details of thermodynamic variables and functions. Application of thermodynamic laws in Life Science with examples.

Bioenergetics: Energy rich bonds - Coupled reactions-Group transfer - Autotrophic and Heterotrophic principle of energy transductions - Gibbs free-energy calculation for Bio-redox reactions – Thermodynamics of ligand binding – Association and dissociation constant.

UNIT V DRUG DESIGN AND MOLECULAR MODELING 6

Principles of drug development – partition coefficient (Log p): octanol - Water system - Lipinski's rule of five - structure based drug designing approaches - target identification and validation - semi-empirical calculations - single point calculations - full-geometry optimization methods - Molecular docking programs: AutoDock.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Y. Nelson, L. David, Lehninger Principles of Biochemistry, International Edition, W.H.Freeman, Macmillan Learning, New York, 7th Edition, 2017.
2. Nagata, Kazuhiro, Real-Time Analysis of Biological Interactions, Springer, Japan, 3rd Edition, 2015.
3. I. Bertini, H. B Gray, Bioinorganic Chemistry, Viva Books Private Limited, New Delhi, 4th Edition, 2014.

REFERENCES

1. B.A. Bunin, B. Siesel, G. Morales, J. Bajorath, Chemoinformatics: Theory, Practice, & Products, Springer, 2nd Edition, 2014.
2. A. Nag and B. Dey, Computer aided drug design and delivery system, McGraw-Hill, ISBN: 978-0-07-170125-9, 2011.
3. B. Wang, E.V. Anslyn, Chemosensor: Principles, Strategies, and Applications, a John Wiley & Sons, inc., Publication, 2011.

19IT25C PROBLEM SOLVING TECHNIQUES

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: develop algorithmic solutions to simple computational problems. (K3)
CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
CO 3: solve problems using array and functions. (K3)
CO 4: implement various sorting techniques. (K3)
CO 5: implement various searching techniques. (K3)

UNIT I BASICS OF PROBLEM SOLVING 9

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

UNIT II BASIC TECHNIQUES 9

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

UNIT III ARRAYS AND FUNCTIONS 9

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV SORTING TECHNIQUES 9

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

UNIT V SEARCHING TECHNIQUES 9

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Maureen Sprankle and Jim Hubbard, “Problem Solving and Programming Concepts”, Prentice Hall, 9th Edition, 2012.
2. Harsha Priya, R. Ranjeet, — “Programming and Problem Solving Through C Language”, Firewall/Laxmi Publications (P) Ltd., New Delhi, 2015.

REFERENCES

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, 2nd Edition, Oxford University Press, 2013.
2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner‘s Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

19IT26C BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the concepts of basic electrical circuits (K2)
CO2: describe the working principles of electrical machines and instruments (K2)
CO3: outline the functions of the component of low voltage electrical installations (K2)
CO4: explain the characteristics and applications of semiconductor devices (K2)
CO5: recall the different logic principles used in digital circuits(K2)

UNIT I CONCEPTS OF DC AND AC ELECTRICAL CIRCUITS 9

Electrical Circuit Elements – Ideal and Practical Sources – Electrical Quantities: Voltage, Current, Power and Energy – Ohms Law – Kirchoffs Laws – analysis of simple circuit with DC excitation- AC Circuits Fundamentals – Single Phase Circuits and Three Phase Circuits – Power and Power Factor.

UNIT II ELECTRICAL MACHINES 9

DC Machines: Types – Construction – Working Principles – Need for Starters - Speed control of DC motors.
AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Starting and Speed Control of Induction Motors.
AC Synchronous Generators: Construction – Working Principle.
Transformers: Single Phase and Three Phase Transformers – Auto Transformers-Construction – Working Principle.

UNIT III INSTRUMENTS AND ELECTRICAL INSTALLATION 9

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.
Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Operation, Characteristics and Applications: PN Junction Diode - Rectifiers - Zener Diode – Regulators - Bipolar Junction Transistor –CE Amplifier - FET – Opto-Electronic Devices – LEDs – Photo Diodes.

UNIT V DIGITAL ELECTRONICS 9

Binary Number System – Logic Gates – Boolean Algebra – Adders - Flip Flops – Shift Registers – Counters – ADC and DAC.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. D.P. Kothari and I.J. Kothari, “Basic Electrical and Electronics Engineering”, Tata McGraw Hill, 1st Edition, 2014.
2. P.S. Bimbhra, “Electrical Machinery”, Khanna Publishes, 7th Edition, 2011.
3. Thomas L. Floyd, “Digital Fundamentals”, 10thEdition, Pearson Education Inc, New Delhi, 2009.
4. A.K. Sawhney, “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai and Co, 2004.

REFERENCES

1. D.C. Kulshreshtha, “Basic Electrical Engineering”, Tata McGraw Hill, Revised 1st Edition, 2011.

2. L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
3. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
4. V.D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
5. E.O. Doebelin, “Measurement Systems – Application and Design”, Tata McGraw Hill, 2003.
6. David Bell, “Electronic Devices and Circuits”, Prentice Hall Private Limited, 2007.
7. M. Morris Mano, “Digital Design”, Pearson Education, 4th Edition, 2007.

19IT27C	PHYSICS FOR INFORMATION SCIENCE AND BIOLOGY LABORATORY	L T P C 0 0 3 1.5

PART A PHYSICS FOR INFORMATION SCIENCE LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: design and implement various applications using gates.(K3,S3)

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation of code converters.
3. Design and implementation of binary adder / subtractor using logic gates.
4. Verification of Flip flops.
5. Design and implementation of Shift registers.
6. Design and implementation of Ripple counters.
7. Design and implementation of Up/Down counters.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. William Kleitz, “Digital Electronics: A Practical Approach”, Prentice Hall, 3rd Edition, 1992.
2. G.L.Squires, “ Practical Physics” Cambridge University Press, 4th Edition, 2001

PART B BIOLOGY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: identify the various biomolecules by suitable chemical analysis. (K3, S3)
CO 2: quantify the amount of acid by pH metric method. (K3, S3)
CO3: estimate the retention factor and log P value of paracetamol and aspirin. (K2, S3)
CO4: draw the structure of different types of drugs using Gaussian and Chem Draw soft ware. (K3, S3)
CO5: identify the molecular interactions of drug with biomolecules. (K3, S3)

LIST OF EXPERIMENTS

1. Qualitative analysis of biomolecules.
2. Estimation of acid by pH metric method.
3. Calculation of retention factor of amino acids.
4. Determination of (log P) value for paracetamol and aspirin.
5. Low energy conformation of medicinally important compounds using Gaussian soft ware.
6. Draw the chemical structure of important drugs using Chem Draw software.

7. Identification of interactions between drug and biomolecules using Auto Dock software.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Biology.

REFERENCES

1. P.Worsfold, A.Townshend, C.Poole, M.Miro, Encylopedia of Analytical science Elsevier, 3rd Edition, 2018.
2. A.I. Vogel, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education Limited, England, 8th Edition, 2015.

19IT28C PROBLEM SOLVING TECHNIQUES LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: solve simple and Complex problems. (K3)
CO 2: solve sorting and searching problems. (K3)

LIST OF EXERCISES

Programs using simple logics and switch cases

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

Programs using Control Structures

5. Perform the following operations:
    a. Generate Pascal's triangle.
    b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.
7. Compute Sine series and Cosine series.
8. Find the 2's complement of a binary number.

Programs using Arrays

9. Perform the following operations:
    a. Matrix addition.
    b. Transpose of a matrix.
    c. Matrix multiplication by checking compatibility

Programs to manipulate Strings

10. Perform the following operations on a string:
    a. Insert a sub-string into main string at a given position.
    b. Delete n characters from a given position in a string.
    c. Check whether the given string is palindrome or not.
    d. Replace a character of string either from beginning or ending or at a specified location.

Programs using Functions

11. Perform the following operations: (Use recursive functions)
    a. Find the factorial of a given integer.
    b. Find the GCD (Greatest Common Divisor) of two given integers.
    c. Solve the Towers of Hanoi problem.

Programs using sorting and searching techniques

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

P: 60; TOTAL: 60 PERIODS

Software Requirement: Turbo C / Python

19GN01C INNOVATION THROUGH DESIGN THINKING

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)
CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS 15

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS 30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, “Design Thinking: The Handbook”, WS Professional, 2020
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving”, Penguin Random House, 2020
3. D.M. Arvind Mallik, “Design Thinking for Educators”, Notion Press, 2019
4. Michael Lewrick, “The Design Thinking Playbook”, Wiley, 2019
5. Kathryn Christopher, “Design Thinking in Engineering”, Kendall Hunt Publishing Company, 2019
6. Robert Curedale, “Design Thinking Process & Methods” 5th Edition, Design Community College Inc, 2019
7. David Lee, “Design Thinking in the Classroom”, Ulysses Press, 2018
8. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, “The Little Booklet on Design Thinking: An Introduction”, 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, “Design Thinking: New Product Development Essentials”, Wiley-Blackwell, 2016
11. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies - presentation	10 Hours

Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions 20 Hours

Evaluating the students‘ activities through their presentations

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19IT31C **DISCRETE MATHEMATICS** **L T P C**
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: check the validity of the arguments. (K2)
CO 2: understand the concepts of Sets, Relations and Functions. (K2)
CO 3: perform the principles of counting and solve recurrence relations. (K3)
CO 4: interpret the basic concepts of graphs. (K2)
CO 5: Find all Spanning Trees of a graph and understand the concepts of colouring of graphs. (K3)

UNIT I MATHEMATICAL LOGIC 12

Propositional Logic – Equivalences and Implications – Normal forms –Predicate Calculus and Quantifiers - Rules of inference – Proof methods and Strategies - Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT II SETS, RELATIONS AND FUNCTIONS 12

Basic Definitions - Set operations – Laws of set theory – Relations – Properties of relations - Partial Ordering Relation - Equivalence Relation - Matrices of relations - Closure of relations – Functions - Bijective functions - Inverse and Compositions of functions.

UNIT III COMBINATORICS 12

Mathematical induction - Strong induction and well ordering -The basics of counting –The pigeonhole principle - Permutations and combinations – Recurrence relations - Solving linear recurrence relations – Generating functions - Inclusion and exclusion principle.

UNIT IV GRAPH THEORY 12

Graphs and their properties - Special types of graphs – Matrix representation of graphs and graph isomorphism- connectivity, Cut vertex and cut edge - Euler and Hamiltonian graphs.

UNIT V GRAPH COLOURING AND TREES 12

Graph Colouring - Colouring Vertices, Colouring Edges - Perfect Graph, properties - Trees – Some properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree – Rooted and Binary Trees - Spanning Trees.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Kenneth H.Rosen, “Discrete Mathematics and its Applications (with Combinatorics and Graph Theory)”, 6th Edition, Special Indian Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi (5th Reprint, 2008).
2. Trembly J.P and Manohar. R. “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Company Limited, New Delhi, 35th Reprint 2008.
3. Narsingh Deo, “Graph Theory with Applications to Engineering and Computer Science”, Dover Publications Inc., 2016.

REFERENCES

1. Ralph .P. Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2002.
2. J.A. Bondy U.S.R. Murty, “Graph Theory”, Springer, 2008.

19IT32C DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply the concepts of array and linked list for solving problems. (K3)
CO 2: apply stack and queue data structures to solve problems. (K3)
CO 3: apply tree data structure concepts to solve any computing problems. (K3)
CO 4: analyze the various hashing techniques and heaps and apply them to solve problems. (K3)
CO 5: apply graph data structure concepts to solve problems. (K3)

UNIT I LINEAR DATA STRUCTURES – ARRAY & LIST 12

Introduction – Abstract Data Types - Arrays: Operations - searching and sorting on arrays - Linear search - binary search on a sorted array - Bubble sort – Selection sort - Insertion sort - Merge Sort - Quick sort - Counting sort - Radix sort – Heap sort - bucket sort – Singly Linked Lists – Dubly Linked Lists – Circular Linked Lists - Applications of Linked Lists

UNIT II LINEAR DATA STRUCTURES – STACK & QUEUE 12

Recursion - Stack ADT: Representation - Operations – Applications: Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT: Operations – Circular Queue – Priority Queue – Applications of Queues.

UNIT III TREE DATA STRUCTURES 12

Introduction - Tree representation and other tree parameters – Tree traversal - Application of binary trees in Huffman coding - Expression trees - Binary search trees - Balanced binary search trees

UNIT IV HASHING AND BINARY HEAP 12

Hashing: Introduction - properties of good hash functions - collisions - open and closed hashing - Priority Queues: Binary heaps with application to in-place sorting – Binomial Heaps – Disjoint Sets

UNIT V GRAPH DATA STRUCTURES 12

Introduction - Representations (Matrix and Adjacency List) - Traversal techniques: Depth First Search, Breadth First Search (Stacks and Queues) – Prim's and Kruskal's Algorithm for Minimum Spanning Tree - Single Source Shortest Path algorithm - Biconnectivity

L: 45; T:15; TOTAL: 60 PERIODS

TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2016.

REFERENCES

1. Debasis Samanta, "Classic Data Structures", 2nd Edition, Prentice Hall, 2012.
2. Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford University Press, 2019.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D.Ullman, "Data Structures and Algorithms", Pearson Education, 2012.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, 2008.
5. Richard Gilberg, Behrouz Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2004.

19IT33C OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: list and use object oriented programming concepts. (K2)
CO 2: explain the fundamentals of C++. (K2)
CO 3: define the advanced features of C++. (K2)
CO 4: solve simple problems in file handling using C++. (K3)
CO 5: define the fundamental concepts in java. (K3)

UNIT I INTRODUCTION TO OOPS CONCEPTS 12

OOPs concepts – Inheritance - Polymorphism - Encapsulation - Abstract – Interface – constructor - Destructor

UNIT II C++ FUNDAMENTALS 12

Overview of C++ – Class – Object – Variable – method – Data types – Operators – Control statements – Storage classes – Recursion

UNIT III C++ ADVANCED FEATURES 12

Virtual Function – Exception Handling – Array and its simple problems – String – Simple problems on string inbuilt functions – Friend Function – Namespace

UNIT IV C++ FILE HANDLING 12

File handling – Writing – Reading – Delete – Rename – Simple problems on using File – Templates

UNIT V JAVA FUNDAMENTALS 12

Overview of JAVA : Class, Object, Variables, Methods – Constants – Data types – Expressions – Branching and Looping statements – Simple programs.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Balagurusamy.E., "Object Oriented Programming with C++", Sixth Edition, TMH, 2013.
2. Balagurusamy.E., "Programming with Java", Sixth Edition, TMH,2019.

REFERENCES

1. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", Second Edition, TMH, 2013.
2. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, 11th Edition, 2018.

WEB REFERENCES

1. http://www.geeksforgeeks.org/c-plus-plus/
2. http://www.geeksforgeeks.org/java/
3. https://www.javatpoint.com/cpp-tutorial
4. https://www.javatpoint.com/java-tutorial

19IT34C PRINCIPLES OF DATA COMMUNICATION

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: describe the basic concepts of Analog Communications. (K1)
- CO 2: analyze and compare various digital modulation schemes. (K2)
- CO 3: describe the concepts of data communication standards and connectionless protocols. (K1)
- CO 4: illustrate the fundamentals of data communication codes. (K2)
- CO 5: illustrate the concept of Spectrum and access techniques in wireless communication. (K2)

UNIT I FUNDAMENTALS OF ANALOG COMMUNICATION 9

Principles of amplitude modulation, AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM Voltage distribution, AM power distribution, Angle modulation - FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation, Frequency analysis of angle modulated waves. Bandwidth requirements for Angle modulated waves.

UNIT II DIGITAL COMMUNICATION 9

Introduction, Shannon limit for information capacity, digital amplitude modulation, frequency shift keying (FSK), phase shift keying (PSK)- binary phase shift keying (BPSK) - QPSK, Quadrature Amplitude modulation (QAM), bandwidth efficiency.

UNIT III INTRODUCTION TO DATA COMMUNICATION 9

Introduction – History of Data communications, Standards Organizations for data communication – Layered Network architecture- data communication circuits – Serial and Parallel Data Transmission –Data Communication Network.

UNIT IV DATA COMMUNICATION CODES 9

Introduction –Data communication codes, Bar codes, Error control, Error Detection – Redundancy checking – Checksum – LRC - CRC, Error correction – Retransmission - Forward Error Correction (FRC), Line control Unit.

UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES 9

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques, wireless communication - Cellular architecture - frequency reuse, Universal Mobile Telecommunications system (UMTS).

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2013.
2. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons. 2007.
3. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2012.

REFERENCES

1. H.Taub, D L Schilling, G Saha, "Principles of Communication", 3rd Edition, 2007.
2. B.P.Lathi, "Modern Analog And Digital Communication systems", 3rd Edition, Oxford University Press, 2007
3. B.Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2007.
4. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
5. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, PHI, 2002.

19IT35C PROFESSIONAL ETHICS AND HUMAN VALUES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
CO2: Expose awareness on professional ethics. (K2)
CO3: Analyze the engineering ethical breach from past study. (K2)
CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)
CO5: Discuss about the global issues with regard to ethics. (K2)

UNIT I HUMAN VALUES 9

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike W Martin and Roland Schinzinger, “Ethics in Engineering”, 4th Edition, McGraw-Hill, New York 2017.
2. Govindarajan M, Natarajan S and Senthil Kumar VS, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2013.

REFERENCES

1. John R Boatright, “Ethics and the Conduct of Business”, 4th Edition, Pearson Education, New Delhi, 2017.
2. Charles D and Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2012.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, “Engineering Ethics - Concepts and Cases”, Fourth Edition, Wadsworth Thompson Learning, United States, 2005.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford 2001.

19IT36C COMPUTER ORGANIZATION AND ARCHITECTURE

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: describe the internal structure and operation of digital computer. (K2)
CO 2: explain the instruction execution and programming sequences. (K2)
CO 3: apply pipelining concept for instruction execution. (K3)
CO 4: explain the types of memory systems. (K2)
CO 5: summarize the different I/O mechanisms. (K2)

UNIT I COMPUTER SYSTEM AND MACHINE INSTRUCTIONS 9

Comparison of Computer Organization & Architecture -Computer Types -Functional units – Basic operational concepts – Bus structures – Software- Performance –Memory location and addressing- Instructions and instruction sequencing – Addressing modes–Assembly language(8085)-Basic I/O Operation.

UNIT II BASIC PROCESSING AND CONTROL UNIT 9

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control.

UNIT III PIPELINING AND PARELLEL PROCESSING 9

Basic concepts – Parallel processing –Instruction pipeline - Data hazards – Instruction hazards – Influence on instruction sets – data path and control consideration–Super scalar operation.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Secondary storage devices.

UNIT V COMPUTER PHERIPHERALS AND I/O ORGANIZATION 9

I/O Devices- Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces-PCI, SCSI, USB.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5th Edition, Tata McGraw Hill, 2017.
2. Morris Mano. M ,”Computer System Architecture” 3rd Edition, Pearson Education, 2014

REFERENCES

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, 5th Edition, Elsevier, 2016.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 10th Edition, Pearson Education, 2016.
3. John P. Hayes, “Computer Architecture and Organization”, 3rd Edition, Tata McGraw-Hill, 2017.
4. V.P. Heuring, H.F. Jordan, T.G.Venkatesh “Computer Systems Design and Architecture”, 2nd Edition, Pearson Education, 2008.

19IT37C DATA STRUCTURES LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply data structure concepts for solving computing problems. (K3)

LIST OF EXPERIMENTS

1. Implement sorting algorithms such as Merge sort, Quick sort, and Heap sort and analyze its complexities.
2. Implementation of singly linked lists.

3. Represent a polynomial as a linked list and write functions for polynomial addition.
4. Convert infix to postfix expression using Stack.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement insertion in AVL trees
8. Implement hashing with open addressing methods.
9. Implement Prim's algorithm and Kruskal's Algorithm using priority queues to find MST of an undirected graph
10. Implement Dijkstra's algorithm to find the shortest path.

P: 45; TOTAL: 45 PERIODS

19IT38C OBJECT ORIENTED PROGRAMMING LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: implement object oriented programming features using C++. (K3)
CO 2: develop simple programs using java. (K3)

LIST OF EXPERIMENTS

C++

1. Programs Using Functions
   - Functions with default arguments
   - Implementation of Call by Value, Call by Address and Call by Reference
2. Simple Classes for understanding objects, member functions and Constructors
   - Classes with primitive data members and constant data members
   - Classes with static member functions
   - Constructor and Destructor
3. C++ programs to demonstrate
   - Structure data types
   - Enumeration
   - Inline functions
   - Copy constructor
   - Friend function
4. Programs using inheritance.

5. Compile time Polymorphism.
    - Operator Overloading including Unary and Binary Operators.
    - Function Overloading
6. C++ program to demonstrate pure virtual function implementation.

JAVA

7. Simple Java applications using
    - instance of classes and objects
8. Java Program to demonstrate
    - the use of nested class
    - array of objects

P: 45; TOTAL: 45 PERIODS

19IT39C COMMUNICATION SKILLS LABORATORY L T P C

(Common to all B.E. / B.Tech., Programmes) **0 0 2 1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Listen and respond effectively to interact at different situations fluently (K2, S3)

CO2: Excel appropriately in professional contexts. (K3,S4)

CO3: Acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3, S4)

UNIT I

Lab session: Listening and responding to audio files

Practice session: Mini Presentation related to Business English & Picture description.

UNIT II

Lab session: Role Play – News Reader.

Practice session: Resume Preparation.

UNIT III

Lab session: Listening to audio files related to soft skills.

Practice session: Practicing Power point presentation, Group discussion.

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Dutt P. Kiranmai and Rajeevan Geeta, “Basic Communication Skills”, Foundation Books, 2013.
2. Comfort, Jeremy, et al. “Speaking Effectively, Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge: Reprint 2011.
3. Rizvi.M.Ashraf, “Effective Technical Communication”, The MC Graw Hill Education Private Limited, Companies, New Delhi, 2010.

19IT41C STATISTICS AND NUMERICAL METHODS L T P C

3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Calculate the various measures of dispersion.(K3)
CO2: Apply the concept of testing of hypothesis for small and large samples (K3)
CO3: Apply the basic concepts of classifications of design of experiments (K3)
CO4: Use numerical techniques to interpolate, solve algebraic equation, differentiation and integration.(K3)
CO5: Solve differential equations using numerical methods.(K3)

UNIT I STATISTICS 12

Central tendencies - Mean, median, mode - Measures of Dispersion – Mean deviation, and Quartile deviation–Moments – Skewness –Kurtosis - Correlation and Regression .

UNIT II TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table for independent of attributes – Goodness of fit.

UNIT III DESIGN OF EXPERIMENTS 12

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design – 22 factorial design.

UNIT IV NUMERICAL SOLUTION OF EQUATIONS, NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Solution of Algebraic and transcendental linear equations - Newton - Raphson Method- Solution of simultaneous equations – Gauss Elimination method – Gauss Seidel method – Interpolation – Newton’s forward and backward formulae - Numerical Differentiation – Newton’s forward difference and backward difference formula – Numerical integration - Single and double integration using Trapezoidal and Simpson’s rules.

UNIT V NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS 12

Taylor’s Series Method - Euler’s Method – Runge Kutta fourth order Method – Predictor - corrector Methods - Milne’s Method - Solution of one dimensional heat equation by explicit and implicit methods - Two dimensional Laplace and Poisson equations – Liebman’s Iteration Process

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Richard A. Johnson, Irwin Miller, John Freund, “Miller & Freund's Probability and Statistics for Engineers,” Pearson Education Limited, Global Edition, 9th Edition, 2017 (For units 1 and 2).
2. Grewal, B.S., “Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB”, 10th Edition, Khanna Publishers, New Delhi, 2014 (For units 3, 4 and 5).

REFERENCES

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2013.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill Edition, 2017.
3. Arnold O. Allen, "Probability, Statistic and Queueing Theory with Computer Science Applications", 2nd Edition, Elsevier a division of Reed Elsevier India Private limited, New Delhi, 2012
4. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7th Edition, Tata McGraw- Hill, New Delhi, 3rd Edition, 2016.
5. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi, 2007.

19IT42C OPERATING SYSTEMS

L T P C
3 0 0 3

PRE- REQUISITE:

- Machine architecture.
- Problem solving techniques.
- Programming concepts
- Computer architecture and organization

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the various services of an operating system. (K2)
CO 2: solve process scheduling, synchronization and deadlock problems. (K3)
CO 3: illustrate the various storage management techniques. (K2)
CO 4: summarize the various I/O techniques. (K2)
CO 5: describe protection methods in operating system. (K2)

UNIT I INTRODUCTION 9

Introduction to operating systems –Types of OS - operating system structures – Process, Memory and storage management - Distributed System - system calls. Process Management: Processes. Threads: Multi-threading models – Threading issues. Case Study: IPC in Linux.

UNIT II PROCESS MANAGEMENT 9

CPU Scheduling: Scheduling algorithms. Process Synchronization: The critical-section problem – Semaphores – Classic problems of synchronization- Critical region-Monitors- Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Case study: Process scheduling in Linux.

UNIT III STORAGE MANAGEMENT 9

Memory Management- Swapping- Continuous Memory allocation – Paging- Segmentation - Demand paging - Virtual Memory: Background- Page replacement – Thrashing.

UNIT IV I/O MANAGEMENT 9

Mass Storage Structure: Disk Structure, Disk Scheduling, and Disk Management –swap space management – File System Mounting - File System Interface: File concept, Access methods, Directory Structure.

UNIT V PROTECTION AND SECURITY 9

Principles of protection – Access matrix – Implementation of Access matrix – Access Control – Revocation of access rights – Program threats – System and network threats – User authentication- Firewalling to Protect Systems and Networks. Case Study: Tripwire file system.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, 9th Edition, Wiley India Pvt. Ltd, 2013.

REFERENCES

1. Andrew S. Tanenbaum, “Modern Operating Systems”, 4th Edition, Pearson Education, 2014.
2. Harvey M. Deital, “Operating Systems”, 3rd Edition, Pearson Education, 2014.
3. Gary Nutt, “Operating Systems”, 3rd Edition, Pearson Education, 2004.

19IT43C DATABASE MANAGEMENT SYSTEMS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: explain the role of a database management system in an organization. (K1)
- CO2: design E-R models for simple database application scenarIoS and normalize databases to reduce cost due to redundancy constraints. (K3)
- CO3: implement the concept of a database transaction and related database facilities, including concurrency control, backup and recovery. (K2)
- CO4: demonstrate the database Indexing and storage mechanisms for effective query processing. (K2)
- CO5: explain different types of databases in emerging information systems (K2)

UNIT I RELATIONAL DATABASES 9

Purpose of Database System - Views of data - Database Architecture - Database users and Administrator – Structure of relational databases- Relational Model -Keys --Relational Algebra –SQL fundamentals

UNIT II DATABASE DESIGN 9

Data Models - Entity Relationship model - E-R Diagrams - Functional Dependencies –Non loss Decomposition–Functional Dependencies –First, Second, Third Normal Forms, Dependency Preservation –Boyce/Codd Normal Form -Multi-valued Dependencies and Fourth Normal Form –Join Dependencies and Fifth Normal Form

UNIT III TRANSACTION MANAGEMENT 9

Transaction Concepts - ACID Properties - Transaction States -A Simple Transaction Model – Serializability - Two Phase Commit - Concurrency - Need for Concurrency - Lock Based Protocols - Two Phase Locking – Failure Classification -Transaction Recovery -Deadlock.

UNIT IV DATA STORAGE AND QUERYING 9

File Organization - Indexing and Hashing - B+ tree Index Files - B tree Index Files - Query Processing Overview - Catalog Information for Cost Estimation - Selection Operation - Sorting - Join Operation-Query Optimization –Transformation of Relational expressions.

UNIT V RECENT TRENDS 9

Overview: Distributed Databases -Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Schema less database: NoSQL Database.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2013.

REFERENCES

1. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 6th Edition, Pearson / Addision wesley, 2016.
2. Raghu Ramakrishnan, “Database Management Systems”, 4th Edition, Tata McGraw-Hill, 2006.
3. Shashank Tiwari, Professional NoSqlǁ, Wiley, 2011.
4. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2012.

19IT44C COMPUTER NETWORKS L T P C
3 0 0 3

PRE- REQUISITE

- C or Java programming
- Course in probability

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe the functionalities of physical and datalink layer (K1)
CO 2: Explain the routing algorithms for the given network (K2)
CO 3: Develop simple applications using sockets (K2)
CO 4: Implement the application layer protocol for the given application (K2)
CO 5: Analyze the various issues involved in transition from IPv4 to IPv6 (K2)

UNIT I PHYSICAL AND DATALINK LAYER 9

Data Communication – Network models – OSI model – TCP/IP model – Layers – Physical layer –Topology – Transmission media - Datalink layer – Error Detection and correction – Parity – LRC – CRC – Hamming code – Flow Control – Sliding window– Ethernet – IEEE 802.11 – FDDI – Bridges

UNIT II NETWORK LAYER 9

Circuit switching vs. packet switching – IP addressing – Internet Protocol – ARP – IGMP – ICMP – OSPF – RIP- Distributed Bellman-Ford algorithm

UNIT III TRANSPORT LAYER AND ELEMENTARY SOCKETS 9

Process to process delivery – TCP and UDP – segment format – services and features – Congestion control and avoidance – QoS – Sockets – Address structures – Elementary TCP UDP Sockets and functions – Iterative Server – Concurrent Server - I/O multiplexing. Congestion control-TCP variants -Reno, Tahoe, Vegas, Compound and CUBIC

UNIT IV APPLICATION LAYER 9

Domain Name System (DNS) – Dynamic DNS - E-mail – Message transfer agent:SMTP, Message access agent: IMAP, POP3 – File Transfer Protocol - Anonymous FTP – Simple Network Management Protocol – RMON

UNIT V IPv6 9

IPv6 Introduction – Packet format – Extension Headers - IPv6 addressing - Address Representation – IPv6 Protocol – I2B - B2B- ICMPv6 Protocol - Transition from IPV4 to IPV6 – Dual Stack - Tunneling – Header Translation -– Advantages of Ipv6 - strategies - use of IP addresses

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Kurose and Ross, "Computer Networking - A top-down approach", 7th Edition, Pearson, 2017
2. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill, 5th Edition, 2017.
3. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kauffmann Publishers Inc., 3rd Edition, 2011.

REFERENCES

1. Ying-Dar Liu, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw-Hill, 2011
2. William Stallings, “Data and Computer Communication”, Pearson Education, 9th Edition, 2014

a. Andrew S. Tannenbaum, “Computer Networks”, Pearson Education, 5th Edition, 2013.

3. D.E. Comer, “Internetworking with TCP/IP Vol- III”, (BSD Sockets Version), Pearson Education, 2nd Edition, 2003.
4. W. Richard Stevens, “Unix Network Programming Vol-I”, Pearson Education, 4th Edition, 2000.

WEB REFERENCES

1. http://nptel.ac.in/courses/106105081/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Computer%20networks/New_index1.html
3. Nptel Video references
4. http://compnetworking.about.com/od/basicnetworkingconcepts/a/network_types.htm
5. http://www.protocols.com/pbook/tcpip1.htm
6. http://cnp3book.info.ucl.ac.be/network/network/
7. http://docs.oracle.com/cd/E23824_01/html/821-1453/ipv6-troubleshoot-2.html
8. http://searchsecurity.techtarget.com/tip/Get-ready-for-IPv6-Five-security-issues-to-consider
9. http://www.highteck.net/EN/Application/Application_Layer_Functionality_and_Protocols.htm

19IT45C ALGORITHMICS L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: analyze the asymptotic performance of algorithms. (K3)
CO 2: derive and solve recurrences describing the performance of dynamic programming and divide and-conquer algorithms. (K3)

CO 3: find optimal solution by applying various methods. (K3)
CO 4: apply number theoretic algorithms to solve computing problems. (K3)
CO 5: find optimal solution by applying approximation algorithms. (K3)

UNIT I INTRODUCTION 6

Role of algorithms in computing - Analyzing algorithms - Designing algorithms - Asymptotic notation - Efficiency of algorithms - Notion of time and space complexity - Amortized analysis.

UNIT II DIVIDE & CONQUER AND DYNAMIC PROGRAMMING 6

Introduction - Strassen's algorithm for matrix multiplication - The substitution method for solving recurrences - Elements of dynamic programming – Warshall's and Floyd's algorithm for shortest path – optimization problems - Optimal binary search trees.

UNIT III GREEDY ALGORITHMS 6

Minimum Spanning Trees – Dijkstra's algorithm – Scheduling – Huffman code – Knapsack problem.

UNIT IV NUMBER-THEORETIC ALGORITHMS 6

Elementary number theoretic notions - Solving modular linear equations - The Chinese remainder theorem - RSA public-key cryptosystem - Primality testing - Integer factorization

UNIT V APPROXIMATION ALGORITHMS 6

Introduction – n-Queens Problem – Hamiltonian Circuit Problem – Subset-Sum problem Assignment Problem – Graph coloring problem – 0-1 Knapsack problem - Travelling Salesman Problem.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, 2009.
2. Anany Levitin, "Introduction to The Design & Analysis of Algorithms", Second Edition, Pearson Education, 2016.

REFERENCES

1. Richard Neapolitan, "Foundations of Algorithms", Fifth Edition, Jones and Bartleft Publishers, 2015.
2. Parag H.Dave, Himanshu B.Dave, "Design and Analysis of Algorithms", Pearson Education, 2008.
3. Brassard Gills, Bratley Paul, "Fundamentals of Algorithmics", Prentice Hall India Pvt.Ltd., 2001.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2006.
5. Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3, Pearson Education, 2009.
6. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

19IT46C	**FINANCE AND ACCOUNTING**	**L T P C**
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO 1: Explain the basic concepts and process of accounting and finance. (K2)
CO 2: Describe the financial status of an organization. (K2)
CO 3: Identify the concepts and operations of CVP analysis for decision making (K3)

CO 4: Apply techniques like budgetary control and capital budgeting for planning and Controlling in an organization. (K3)
CO 5: Explain the application of accounting software. (K2)

UNIT I INTRODUCTION TO ACCOUNTING 9

Introduction and Definition - Accounting concepts and conventions - Final Accounts - Preparation of Trading, Profit and Loss Account and Balance Sheet.

UNIT II ANALYSIS AND INTERPRETATION OF FINANCIAL STATEMENTS 9

Meaning and importance - Comparative statement, Common size statement - Trend analysis and accounting ratIoS - latest trend in presenting financial data.

UNIT III ACCOUNTING FOR DECISION MAKING 9

CVP Analysis - Relevant Costs and Revenue for Decision Making - Pricing Decisions - Operational Decisions - Exploring New markets - Make or buy decisions.

UNIT IV ACCOUNTING FOR PLANNING AND CONTROLLING 9

Budgets, Budgetary Control – Meaning – Importance and applications - Capital budgeting - Meaning – Importance - steps in capital budgeting - Information needed - Methods of evaluating capital budgeting decisions.

UNIT V COMPUTERIZED ACCOUNTING SYSTEM 9

Meaning - Concept - Comparison between Manual and Computerized Accounting - Sourcing of Accounting Software - Accounting Packages.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. V. K. Gupta, R. L. Gupta, “Financial Accounting” 3rd Edition, S.Chand, New Delhi, 2016.
2. Dr.V.R.Palanivelu, “Accounting for Management”, 3rd Edition, University science press New Delhi, 2013.
3. Manoj Bansal, Ajay Sharma, “Computerized Accounting System”, 1st Edition, Sahitya Bhawan Publications, Agra, 2019.

REFERENCES

1. S. N. Maheshwari, Suneel K. Maheshwari, Sharad K. Maheshwar, “Financial Accounting”, 2nd Edition, Vikas Publishing House, 2018.
2. Peter Atrill, Eddie McLaney “Financial Accounting for Decision Makers” 7th Edition, Pearson Education, 2013.
3. Dr.Alok Dwivedi, Prof.C.M.Tembhurnekar, “Computerized Accounting”, 1st Edition, Sai Jyoti Pulication, Nagpur, 2016.

19MC01C ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C QP
3 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the students will be able to

Upon completion of this course, the students will be able to

CO 1: explain the structure and function of ecosystem. (K2)
CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)
CO 3: explain the causes and effects of pollution. (K2)

CO 4: describe social issues related to the environment and the environment act. (K2)
CO 5: identify the nutrients in food and impact of metals on human health. (K2)

UNIT I ENVIRONMENT AND ECOSYSTEMS 9
Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

UNIT II BIODIVERSITY AND NATURAL RESOURCES 9
Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over-exploitation – deforestation – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

UNIT III ENVIRONMENTAL POLLUTION 9
Causes, effects and control measures of air pollution, water pollution, noise pollution and nuclear hazards – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9
Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; Environment laws: environmental (protection) act 1986-the wild life (protection) act 1972.

UNIT V FOOD AND HUMAN HEALTH 9
Carbohydrates, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, cadmium, mercury and chromium on human health.

TEXT BOOKS

1. Miller G. and Spoolman S, “Environmental Science”, 14th Edition, Brooks / Cole Publishing Co., 2012.
2. Maczulak A.E., “Environmental Engineering”, Facts on file Inc., 2009
3. Han D, “Concise Environmental Engineering”, Ph.D. & Ventus Publishing ApS, 2012

REFERENCES

1. Weller K. “Environmental Science and Biological Engineering”, 1st Edition, WIT Press, 2015
2. Strange C. “Environmental Science and production” Nason Trest Publisher, 2010

19IT47C OPERATING SYSTEMS LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES
Upon completion of this course, the students will be able to
CO 1: implement the various Linux commands and system calls. (K3)
CO 2: develop programs for process handling and memory management methods.(K3)

LIST OF EXPERIMENTS

1. Basic Linux commands such as ls, cd, mkdir, cp,rm, mv, more, lpr, man, grep, sed, etc.

2. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
4. Write C programs to simulate UNIX commands like ls, grep, etc.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
7. Develop application using Inter Process communication (using shared memory, pipes or message queues)
8. Deadlock avoidance using semaphore.
9. Implement Threading & Synchronization Applications
10. Implement the Producer – Consumer problem using semaphores (using UNIX system calls).
11. Implement various memory management schemes.
12. Implement any file allocation technique (Linked, Indexed or Contiguous)

P: 45; TOTAL: 45 PERIODS

19IT48C	**NETWORKING LABORATORY**	**L T P C**
		0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Implement error correction techniques and develop socket programming (K2)
CO2: Simulate networks and analyze traffic using various tools (K2)

LIST OF EXPERIMENTS:

1. Implement error correction & detection techniques.
2. Configure a network topology with distance vector routing protocols using CISCO Packet Tracer
3. Implementation of ARP/RARP
4. Implementation of socket programs using TCP/UDP
5. Simulation of sliding window protocols
6. Implement connection/connectionless oriented concurrent server
7. Implement multicasting protocols
8. Sniff and Analyse packet capture & network traffic
9. Configure spanning tree protocol using CISCO Packet Tracer
10. Configuring Point-to-point protocol authentication using PAP and CHAP.

SUGGESTED SOFTWARE TOOLS/UTILITIES:

- KaliLinux
- CISCO Packet Tracer
- NetSim

P: 45; TOTAL: 45 PERIODS

19IT49C DATABASE MANAGEMENT SYSTEMS LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: develop a set of queries in SQL and PL/SQL to handle typical user inquiries for information extraction from the database. (K2)
CO 2: design and develop an application. (K3)

LIST OF EXPERIMENTS

1. Creation and Modification of relations
2. Integrity constraint enforcement
3. Nested Queries & Join Queries
4. Creation and Updation of Views
5. Exercises using PL/SQL
6. Nosql
7. High level programming language extensions (Control structures, Procedures and Functions).
8. Creation of Triggers
9. Cursor management
10. Database Design and implementation (Mini Project).

REFERENCES

1. Ivan Bayross, Commercial Application Development Using ORACLE Developer 2000, BPB Publications, 2000.
2. ORACLE PL/SQL Programming – Scott Urman BPB Publications

LAB EQUIPMENTS

Hardware and Software required for a batch of 30 students:

Hardware:

- 30 Personal Computers

Software:

- Front end: VB/C#/JAVA
- Back end: Oracle 11g, my SQL, DB2
- Platform: Windows 7
- Oracle server could be loaded and can be connected from individual PCs.

P: 45; TOTAL: 45 PERIODS

19IT51C JAVA PROGRAMMING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: define the basic OOP concepts using java. (K2)
CO 2: explain the principles of GUI, AWT and swing concepts. (K2)
CO 3: implement error handling and file handling using java. (K3)
CO 4: apply multithreading and concurrency control techniques. (K3)
CO 5: describe the collection framework and lambda expressions in java. (K3)

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming – Inheritance – Polymorphism - Abstract – Interface - Encapsulation – Constructor – Access specifiers – Static members – Packages in JAVA – Math class – String: StringBuffer - StringBuilder

UNIT II GUI, AND AWT SWING 9

GUI – AWT Basics – Event Handling – AWT Hierarchy – Components – Swing Introduction – JFC – Swing Hierarchy – Components – Simple Programs

UNIT III EXCEPTION AND FILE HANDLING 9

Exceptions Handling – Try, Catch and Finally blocks - Exception hierarchy - File – FileWriter – FileReader - BufferWriter – BufferReader – InputStream – OutputStream.

UNIT IV MULTITHREADING AND CONCURRENT PROGRAMMING 9

Thread –Thread lifecycle – Working on Mult-thread – Runnable interface – Thread Priority synchronization – Concurrent Programming – Need of Concurrent Programming – Basic steps for Concurrency.

UNIT V COLLECTION GENERIC AND LAMBDA EXPRESSION 9

Wrapper classes – Collection framework: Set – List – Map - Generic Programming – Basic Generic concept – Lambda Expressions – Simple programs

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, 11th Edition, 2018
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume - I Fundamentals", 10th Edition, Prentice Hall, 2016.

REFERENCES

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

WEB REFERENCES

1. http://www.geeksforgeeks.org/java/; https://www.javatpoint.com/java-tutorial

19IT52C SOFTWARE ENGINEERING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the principles of software development process (K1)
CO2: describe the importance of requirements and cost estimation techniques. (K2)
CO3: elicit the role of software design concepts. (K2)
CO4: describe the role of software testing and maintenance. (K2)
CO5: summarize the principal approaches of software management. (K2)

UNIT I INTRODUCTION 9

Software Engineering - Software Process - Generic process model - Prescriptive process model - Agile development - Agile Process - Extreme Programming - Other agile Process models - Software engineering Knowledge - core principles - Principles that guide each framework Activity

UNIT II REQUIREMENTS AND COST ESTIMATION 9

Requirements Engineering - Establishing the Groundwork - Eliciting Requirements - Negotiating, validating Requirements - Software cost estimation: Introduction – Software cost factors – Software cost estimation techniques – Staffing level estimation – Estimating software maintenance costs.

UNIT III SOFTWARE DESIGN CONCEPTS 9

Abstraction – Modularity – Software architecture – Cohesion, coupling – Various design concepts and notations – Real time and distributed system – Design – Documentation – Data flow oriented design – Jackson system development – Design for reuse – Programming standards.

UNIT IV SOFTWARE TESTING AND MAINTENANCE 9

Strategic Approach to software Testing - Strategic Issues - Strategies for Conventional Software - Validating Testing - System Testing - Software Maintenance - Software Supportability – Reengineering- Business Process Reengineering - Software Reengineering.

UNIT V MANAGING SOFTWARE PROJECT 9

Project Management Concepts – Software Measurement – metrics for software quality – resources – Estimation - Decomposition technique - project scheduling - Risk identification – risk projection - The RMMM plan.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Roger S Pressman, "Software Engineering – A Practitioner‟s Approach", 8th Edition, Tata McGraw Hill Education, 2019.
2. Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education, 2014.

REFERENCES

1. Richard Fairley, "Software Engineering Concepts", Indian Edition, Tata Mc Graw Hill Education, 2014.
2. Hans Van Vliet, "Software Engineering: Principles and Practices", 3rd Edition, John Wiley and Sons, 2008.

19IT53C CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

PRE REQUISTES

- Discrete Mathematics
- Number Theory

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply conventional encryption techniques for solving problems. (K3)
CO 2: explain the algorithms of symmetric encryption techniques. (K2)
CO 3: apply asymmetric-Key Cryptographic techniques (K3)
CO 4: apply data integrity and authentication techniques (K3)
CO 5: explain the security mechanisms of various cryptographic applications (K2)

UNIT I FUNDAMENTAL CONCEPTS 9

OSI Security architecture - Security Services, Mechanisms and attacks - Network Security Model - Classical Encryption techniques (Substitution/transposition) - Basic Concepts in Number Theory - Divisibility and the Division Algorithm - Euclidean Algorithm - Modular Arithmetic - Groups, Rings and Fields.

UNIT II SYMMETRIC CIPHERS 9

Block Cipher Principles - Data Encryption Standard (DES) - Advanced Encryption Standard (AES) - Modes of operation of Block Ciphers - Pseudo random number generators - RC5 Stream Cipher - Key Management: Secret Sharing of private key.

UNIT III ASYMMETRIC CIPHERS 9

Prime Numbers - Fermat's and Euler's Theorem - Testing for Primality - Chinese Remainder Theorem - Discrete Logarithms - Principles of Public-Key Cryptosystems - RSA Algorithm - Diffie-Hellman Key Exchange - ElGamal Cryptosystem - Elliptic Curve Cryptography - Key Management: Distribution of Public Key.

UNIT IV DATA INTEGRITY ALGORITHMS 9

Cryptographic Hash Functions - The Merkle Damgard Construction - Applications - Secure Hash Algorithm - SHA3 - Birthday Attack - Message Authentication Codes - Security of MACs- Digital Signatures - ElGamal Digital Signature Scheme - Digital Signature Standard (DSS).

UNIT V RECENT TRENDS AND APPLICATIONS 9

Identity Based Encryption - Homomorphic Encryption - Provable security - X.509 Certificates – Kerberos - Data protection in the cloud - Transport Level Security - Wireless Network Security - Pretty Good Privacy - IP Security - UNIX Password Encipherment - Protecting ATM Transactions.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. William Stallings, “Cryptography and Network Security Principles and Practice”, 7th Edition, Pearson Education, 2016.
2. Alan G. Konheim, “Computer Security & Cryptography”, 1st Edition, John Wiley & Sons, 2007.

REFERENCES

1. Behrouz A. Foruzan and Debdeep Mukhopadhyay, “Cryptography and Network Security”, 3rd Edition, Tata McGraw-Hill Education, 2015.
2. Atul Kahate, “Cryptography and Network Security”, 4th Edition, Tata McGraw-Hill Education, 2019.

3. Douglas Stinson, "Cryptography Theory and Practice", 4th Edition, Chapman & Hall / CRC, 2019.
4. Wade Trappe, Lawrence C Washington, “Introduction to Cryptography with coding theory”, 2nd Edition, Pearson Education, 2005.

19IT54C INTERNET AND WEB TECHNOLOGY L T P C 3 0 0 3

COUSRE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: design web pages using HTML and CSS and build dynamic web page with validation using client side scripting. (K3)
CO 2: Use web services to develop interactive web applications. (K3)
CO 3: develop server side programs using Servlets. (K3)
CO 4: develop server side programs using JSP. (K3)
CO 5: construct simple web pages in AJAX and to represent data in XML format. (K3)

UNIT I WEB ESSENTIALS 9

Web Essentials – The Internet - Basic Internet Protocols - World Wide Web – HTTP – Web Clients – Web Servers - Markup Languages: HTML, XHTML – CSS – JavaScript -Introduction to Angular JS

UNIT II WEB SERVICES 9

Web Service Concepts - Writing a Java Web Service - Writing a Java Web Service Client - Describing Web Services: WSDL - Representing Data Types: XML Schema - Communicating Object Data: SOAP - UDDI

UNIT III SERVLETS 9

Java Servlets - Architecture – Overview - A Servlet - Generating Dynamic Content - Life Cycle - Parameter Data Sessions - Cookies - URL Rewriting - Other Capabilities - Data Storage Servlets and Concurrency Databases and Java.

UNIT IV JSP 9

JSP: Basic – JSP and Servlets - Running JSP Applications - JavaBeans Classes and JSP - Tag Libraries and Files - Database Connectivity

UNIT V XML AND AJAX 9

XML: Basic XML - Document Type Definition - XML Schema DOM and Presenting XML - XML Parsers and Validation - XSL and XSLT Transformation - News Feed (RSS and ATOM) - AJAX: Ajax Client Server Architecture - XML Http Request Object-Call Back Methods – JSON - MVC Paradigm - Google Apps Script

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective", Pearson, 2012.

2. Paul Deitel, Harvey Deitel and Abbey Deitel, “Internet & World Wide Web: How to Program”, 5th Edition, Pearson, 2012.

REFERENCES

1. Chuck Musciano, Bill Kennedy “HTML & XHTML: The Definitive Guide”, 6th Edition, O'Reilly Media, 2007.
2. Ethan Cerami, “Web Services Essentials - Distributed Applications with XML-RPC, SOAP, UDDI & WSDL, 1st Edition, O'Reilly, 2002.
3. Robert W. Sebesta, "Programming the World Wide Web", 8th Edition, Pearson, 2015.
4. Tyler Jewell, David Chappell, “Java Web Services”, 1st Edition, O'Reilly, 2002.
5. Marty Hall, Larry Brown, “Core Web Programming, 2nd Edition, Pearson, 2009.
6. Jayson Falkner, Kevin Jones, “Servlets and Java Server Pages: The J2EE Technology Web Tier”, Addison Wesley, 2003.
7. Steven Holzner," AJAX: A beginner's guide" ,Mc Graw Hill,2009

19IT55C EMBEDDED SYSTEM

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: describe the architecture and functionalities of processor. (K2)
CO 2: discuss the Memory and interrupt handling in ARM processor. (K2)
CO 3: outline the importance of Multi-tasking in embedded systems. (K2)
CO 4: develop basic programs using embedded C. (K3)
CO 5: illustrate the design of distributed embedded system. (K2)

UNIT I INTRODUCTION 9

Introduction to microprocessors – Features – Architecture - Challenges of Embedded Systems – Embedded system design process - Embedded processors – 8051 - Microcontroller, ARM processor – Architecture, Instruction sets

UNIT II MEMORY AND INTERRUPT HANDLING 9

Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Design Examples: Cell Phones –Digital Still cameras.

UNIT III MULTIPROCESS AND SCHEDULING POLICIES 9

Multiple tasks and processes – Context switching – Scheduling policies – Inter process communication mechanisms – Design Examples: Compact Discs and DVDs.

UNIT IV EMBEDDED PROGRAMMING 9

Programming embedded systems in assembly and C – Meeting real time constraints – Object-oriented programming with C- Multi-state systems and function sequences.

UNIT V DISTRIBUTED EMBEDDED SYSTEM 9

Distributed embedded architecture – Networks for Embedded system – Network based design – Internet-Enabled Systems – Vehicles as Networks – Sensor Networks – Design Example: Elevator Controller.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, 3rd Edition, Morgan Kaufmann Publishers, 2012.
2. Michael J. Pont, “Embedded C”, Pearson Education, 2008.

REFERENCES

1. Shibu K.V, “Introduction to Embedded Systems “, McGraw Hill Education, 2014.
2. Jonathan W.Valvano, “Embedded Microcomputer Systems: Real Time Interfacing”, 3rd Edition, Cengage Learning, 2012.
3. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, McGraw-Hill Higher Education, 2015.
4. Lyla.B.Das, “Embedded Systems: An Integrated Approach”, Pearson Education, 2013.
5. David E.Simon, “An Embedded Software Primer”, Pearson Education, Dorling Kindersley Pvt. Ltd, 2000.

WEB RESOURCE

1. https://www.coursera.org/learn/interface-with-arduino

19MC02C CONSTITUTION OF INDIA

L T P C
3 0 0 0

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the salient features of the Indian Constitution. (K2)
CO2: discuss the structure and functions of parliament. (K2)
CO3: elaborate the structure and functions of state legislature. (K2)
CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
CO5: discuss the foreign policy of India. (K2)

UNIT I INDIAN CONSTITUTION 9

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM 9

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM 9

Features of Federal System - Administrative Relationship between Union and States -

Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT IV THE JUDICIARY 9

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS 9

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, "Introduction to the Constitution of India", Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.
3. Shukla V N, "Constitution of India", Eastern Book Company Ltd., New Delhi, 2011.

19IT56C	JAVA PROGRAMMING LABORATORY	L T P C
		0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: implement classical problems using java programming. (K2)
CO2: develop a mini project using java features. (K3)

LIST OF EXPERIMENTS

JAVA PROGRAMS

1. Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method.
2. Write a JAVA program to implement constructor overloading and method overloading.
3. Write a JAVA program to implement Single Inheritance and multi level Inheritance.
4. Write a JAVA program to implement Interface.
5. Write a JAVA program that describes exception handling mechanism. Runtime Polymorphism:
6. Write a JAVA program that implements Runtime polymorphism.
7. Write a JAVA program for creation of illustrating throw and finally.
8. Write a JAVA program for creation of Java Built-in Exceptions and User Defined Exception.
9. Write a program to implement the concept of threading by extending Thread Class.

10. Write a program to implement the concept of threading by implementing Runnable Interface.
11. Write a program to implement the concept of Exception Handling using predefined exception.
12. Write a program to implement the concept of Exception Handling by creating user defined exceptions.
13. Write a JAVA program to build a Calculator in Swings.

MINI PROJECT

Develop a mini project for any application using Java concepts

P: 45; TOTAL: 45 PERIODS

19IT57C CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: solve cryptographic problems using symmetric, asymmetric and data integrity techniques.

CO2: evaluate security techniques used to protect system and user data using network security tools.

LIST OF EXPERIMENTS

1. Perform encryption and decryption using the following algorithms (Substitution)
   a. Ceaser Cipher
   b. Affine Cipher
   c. Playfair Cipher
   d. Hill Cipher
2. Perform encryption and decryption using the following algorithms (Transposition)
   a. Rail fence technique
   b. Simple Columner
3. Implement Simplified DES algorithm.
4. Implement RSA algorithm.
5. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
6. Implement the Signature Scheme - Digital Signature Standard.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA
8. Automated Attack and Penetration Tools
   Exploring N-Stalker, a Vulnerability Assessment Tool
9. Defeating Malware
   i) Building Trojans ii) Rootkit Hunter
10. Analyze HTTP traffic using wireshark

P: 45; TOTAL: 45 PERIODS

LIST OF HARDWARE REQUIREMENTS & SOFTWARE REQUIREMENTS

SOFTWARE REQUIREMENTS

- C/Java or equivalent compiler GnuPG

HARDWARE REQUIREMENTS

- Standalone desktops (or) Server supporting 30 terminals or more

PRE REQUISTES

- C/Java
- Mathematical Logic

19IT58C INTERNET AND WEB TECHNOLOGY LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design interactive web pages using Scripting languages. (K3)
CO2: create applications using XML and AJAX. (K3)

LIST OF EXPERIMENTS

1. Create a web page using HTML with all types of CSS.
2. Writing client side scripts for validating web form controls using JavaScript.
3. Create web application using AngularJS.
4. Create the application using Web Services.
5. Write programs in Java using Servlets: a) to invoke servlets from HTML forms. b) Session Tracking.
6. Write programs using Servlets and Databases
7. Write programs using JSP and Databases
8. Programs using XML –Schema –XSL.
9. Programs using AJAX

P: 45; TOTAL: 45 PERIODS

19IT61C BIG DATA ANALYTICS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1: discuss big data tools and its analysis techniques (K2)
CO 2: describe Graph analytics and NoSQL databases (K2)
CO 3: Analyze data by utilizing clustering and classification algorithms (K4)
CO 4: apply different mining algorithms and recommendation systems for large volumes of data. (K3)
CO 5: Perform analytics on data streams. (K3)

UNIT I INTRODUCTION TO BIG DATA 9

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data

Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model

UNIT I GRAPH ANALYTICS AND NO SQL DATABASES 9

Using Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Choosing Graph Analytics - Graph Analytics Use Cases - Graph Analytics Algorithms and Solution Approaches - Technical Complexity of Analyzing Graphs- Features of a Graph Analytics Platform - Considerations: Dedicated Appliances for Graph -. NoSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Sharding –- Hbase

UNIT III SUPERVISED AND UNSUPERVISED LEARNING 9

Supervised Learning - Unsupervised Learning-Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose and Cautions .- Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes‘ Theorem – Naïve Bayes Classifier- principal component analysis –Linear Dimensionality Reduction

UNIT IV ASSOCIATION AND RECOMMENDATION SYSTEM 9

Advanced Analytical Theory and Methods: Association Rules – Overview – Apriori Algorithm – Evaluation of Candidate Rules – Applications of Association Rules – Finding Association& finding similarity – Recommendation System: Collaborative Recommendation- Content Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT V STREAM MEMORY 9

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, 2nd Edition, Cambridge University Press, 2014.
2. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph” 1st Edition, Morgan Kaufmann/El sevier Publishers, 2013.

REFERENCES

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.
2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.

3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers", CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

19IT62C **ENTERPRISE MOBILITY** **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the basic programming concepts to Android application development. (K2)
CO 2: describe the concepts of Android platform. (K2)
CO 3: describe the methodology of deployment of various components for Android application. (K2)
CO 4: develop mobile applications using various mobile platforms. (K3)
CO 5: describe the enterprise scale requirements of mobile applications. (K2)

UNIT I ANDROID INTRODUCTION 9

Android – History & Version – Architecture – Core Building blocks – Emulator – Installation – Android Studio – Internal Details – R.java – Screen Orientation – Android Widgets – Activity – Intents – simple programs

UNIT II ANDROID FRAGMENTS, MENU SERVICE AND STORAGE 9

Android – Fragments – Menu – Service – SQLite – XML & JSON – Multimedia: Audio, Video – Simple programs

UNIT III ANDROID SPEECH TELEPHONY AND CAMERA 9

Android – Speech: TextToSpeech – Telephony: Get call State, Simple caller Talker, Phone call, Send SMS, Send email, Camera: By Intent and By API – Android Wifi.

UNIT IV MOBILE APPLICATION DEVELOPMENT 9

Mobile platforms – Android, IoS, Windows mobile, Symbian. Mobile application designing – Mobile application technology, architecture and designing considerations. Mobile programming - Android, IoS, Windows mobile.

UNIT V TECHNOLOGY CONSIDERATIONS IN MOBILITY 9

Mobile security – Enterprise mobile management and security, mobile management and security solutions, implementing mobile security by developers, mobility entering the cyber warfare. Mobile NFC – standards and modes of operation, NFC versus existing wireless mobile, applications of NFC, Popular mobile solutions in the market.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Jithesh Sathyan, Anoop N, Navin Narayan, Shibu Kizhakke Vallathai, “A Comprehensive Guide to Enterprise Mobility”, CRC Press, 2016.
2. Zak Ruvalcaba and Anne Boehm, “Murachs HTML5 & CSS3”, 3rd Edition, Mike Murach & Associates Inc, 2015.
3. John Horton, “Android Programming for Beginners”, 1st Edition, Packt publishing, 2015.
4. Zigurd Mednieks, Laird Dornin, G.Blake Meike & Masumi Nakamura, “Programming Android”, 2nd Edition, O’ Reilly Media, 2012.

REFERENCES

1. Dawn Griffiths and David Griffiths, “Head first Android Development”, O’Reilly Media, 2015.
2. Nicholas C. Zakas, “Professional Javascript For Web Developers”, Third Edition, Wiley India Pvt Ltd, 2012.
3. Greg Shackles, “Mobile Development with C#: Building Native IOS, Android, and Windows Phone Applications (Paperback)”, O'Reilly Media Publishers, 2012.
4. Sumi Helal, Raja Bose, Wengdong Li, “Mobile Platforms and Development Environments (Paperback)”, Morgan & Claypool Publishers, 2012.
5. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Pearson Education, 2007.
6. Herbert Schildt, “Java The Complete Reference”, 10th Edition, Tata McGraw Hill Publishing Company Limited, 2017

WEB REFERENCE

1. https://www.javatpoint.com/android-tutorial

19IT63C BUSINESS PROCESS MANAGEMENT L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course the students will be able to

- CO 1: define the required processes and able to identify process improvement opportunities / strategies. (K2)
- CO 2: plan a BPM strategy for an organization. (K3)
- CO 3: propose business solutions in written and verbal forms for process innovation and redesign Projects. (K2)
- CO 4: explain the role of Information Technology and other resources in BPM. (K2)
- CO 5: synthesis the principles of organizational strategy and process design. (K2)

UNIT I INTRODUCTION TO BUSINESS PROCESS MANAGEMENT 6

Ingredients of Business Process, BPM Life Cycle, Process Identification – The context of process identification, Definition of the process architecture, process selection.

UNIT II PROCESS MODELING 6

Essential Process Modeling – First Steps with BPMN, Branching and merging, Business Objects, Resources, Process decomposition, Process model reuse.

UNIT III ADVANCED PROCESS MODELING 6

Rework and repetition, Handling events, Handling exceptions, Process and Business rules. Process Discovery - The setting of process discovery, process discovery methods, process modeling methods.

UNIT IV QUALITATIVE AND QUANTITATIVE PROCESS ANALYSIS 6

Value added analysis, waste analysis, stakeholder analysis and issue documentation, root cause analysis. Flow analysis, Queues, Simulation.

UNIT V PROCESS AWARE INFORMATION SYSTEM 6

Types of Process Aware Information System, Advantages of Introducing a BPMS, Challenges of Introducing a BPMS. Process implementation with executable models.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, “Fundamentals of Business Process Management”, 2nd Edition, Springer, 2018.
2. Akhil Kumar, “Business Process Management”, 1st Edition, Routledge, 2018.

REFERENCES

1. Carl F. Lehmann, “Strategy and Business Process Management: Techniques for Improving Execution, Adaptability, and Consistency”, CRC Press, 2016.
2. John Jeston, Johan Nelis, “Business Process Management”, 3rd Edition, Routledge, 2014.
3. Van der Aalst, Wil, “Process Mining: Data Science in Action”, 2nd Edition, Springer 2016.

19IT64C COMPREHENSION
Common to B.E/ B.Tech programme

L	T	P	C
0	0	2	1

Assessment procedure and pattern may be structured and well defined as follows.

No.of Assessments : **Three**

Continuous Assessment Test 1 - (50 Marks)	**- Duration : 90 Min –**	**Passing Requirements**
General Apps Questions (Ratio/Quans / DI…)	- 20 Marks	- 7 Marks
Core fundamental Subject Question (Data Structures, Database Management Systems, Digital Systems)	- 20 Marks	- 7 Marks
Programming (C, C++ Language)	- 10 Marks	- 4 Marks

Continuous Assessment Test 2 - (50 Marks)	**- Duration : 90 Min –**	**Passing Requirements**
General Apps Question (Age, train , analytical, verbal…)	- 20 Marks	- 7 Marks
Core Fundamental Subject Questions (Operating Systems, Computer Networks,	- 20 Marks	- 7 Marks

Software Engineering)			
Programming (Java)	-	10 Marks	- 4 Marks

Continuous Assessment Test 3 - (50 Marks) **- Duration : 90 Min – Passing Requirements**

General Apps Questions	-	20 Marks	- 7 Marks
Core Subject Questions	-	20 Marks	- 7 Marks
Programming	-	10 Marks	- 4 Marks

- The candidate may be declared pass in this course if he/she satisfies the minimum passing requirement in two CAT
- Best two among the three test may be considered for grading in the marksheet.

P: 30; TOTAL: 30PERIODS

19IT65C BIG DATA ANALYTICS LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: set up multi-node Hadoop Clusters and integrated infrastructure of R and Hadoop. (K3)

CO 2: Apply classification and clustering algorithms. (K3)

List of Experiments

- Installation of Apache Hadoop and MapReduce.
- Installation of clustered Hadoop and MapReduce.
- Develop MapReduce programs.
- Classification using SVM.
- Implement data mining clustering algorithms.
- Big Data processing with Hive.
- Query Processing using Hive and Beeswax.
- Data Visualization using R
- Mini Project.

Software: R and Hadoop Integrated Programming Environment

P: 45; TOTAL: 45 PERIODS

19IT66C MOBILE TECHNOLOGIES LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: develop Android mobile applications using Layout. (K3)

CO2: Develop mobile application with SQLite & Firebase. (K3)

LIST OF EXPERIMENTS

1. Develop mobile applications that use User Interface Components
2. Develop an application using Layout Managers and event listeners.
3. Develop a mobile application for loading images to the SD card
4. Develop mobile applications using SQLITE
5. Develop mobile applications using external database.
6. Implement an application that creates an alert upon receiving a message.
7. Write a mobile application that creates alarm clock
8. Firebase cloud connectivity
9. Android Multimedia Player
10. Mini project

Software: ADT bundle, XCODE

P: 45; TOTAL: 45 PERIODS

19IT67C PRODUCT DEVELOPMENT LABORATORY L T P C
1 0 2 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)
CO2: verify the functionality of the concept through prototyping (K4)

UNIT I NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION 20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

UNIT II PROTOTYPING AND DEMONSTRATION 25

Prototype development and demonstration - cost estimation - product documentation

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Michael G Luchs, Scott Swan, Abbie Griffin, “Design Thinking: New Product Development Essentials from the PDMA”, Willey, 2015
2. Christian Muller-Roterberg, “Design Thinking”, Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata Mc Graw Hill Education, 4th Edition, 2011.
4. George E Dieter, Linda C Schmidt, “Engineering Design”, Mc-Graw Hill International Edition, 5th Edition, 2013.
5. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2013

Mentor Activities

- Forming multidisciplinary/interdisciplinary batches among the students

- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students’ activities through demonstration and presentations

End semester Assessments can be made through

- Product demonstration and presentation

Other points

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four
- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

19IT71C PROJECT WORK – I

L T P C
0 0 6 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify an innovate or creative idea / concept / solution to a problem (K3)
CO2: perform the detailed literature survey related to concept / idea (K2)
CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modeling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

P: 45; TOTAL: 45 PERIODS

19IT72C RESEARCH PAPER AND PATENT REVIEW - SEMINAR

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the emerging technology / research development in the engineering Field (K2)
CO2: acquaint with the concepts published in reputed journals on their area of interest (K2)
CO3: examine patents and procedures available in the data base.(K3)

CO4: effectively communicate the contents to the target audience and handle the questions with confidence (K3)
CO5: Check for patent plagiarism (K2)

The Students will make a technical presentation on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

P: 30; TOTAL: 30 PERIODS

19IT81C PROJECT WORK – II L T P C

0 0 12 6

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO1: design and develop the working model (K3)
CO2: work independently to complete the project along with team members (K2)
CO3: demonstrate the results and documents the report (K4)

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus / small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

P: 180; TOTAL: 180 PERIODS

19IT82C INTERNSHIP / IN-PLANT TRAINING L T P C

0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO1: acquire the knowledge of different industrial / organizational activities (K2)
CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department
2. A report should be submitted after the successful completion of internship / in-plant training.

P: 60; TOTAL: 60 PERIODS

19IT01E DEEP LEARNING

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the basics of deep learning. (K2)
CO2: implement various deep learning models. (K2)
CO3: realign high dimensional data using reduction techniques. (K2)
CO4: discuss optimization and generalization in deep learning. (K2)
CO5: enumerate deep learning applications. (K2)

UNIT I INTRODUCTION 9

Introduction to Machine Learning - Linear models (SVMs and Perceptrons - Logistic Regression) - Intro to Neural Nets: What a shallow network computes - Training a network: loss functions - Back Propagation and Stochastic gradient descent - Neural Networks as Universal Function Approximates.

UNIT II DEEP NETWORKS 9

History of Deep Learning - A Probabilistic Theory of Deep Learning - Backpropagation and regularization, Batch normalization - VC Dimension and Neural Nets - Deep Vs Shallow Networks - Convolutional Networks - Generative Adversarial Networks (GAN) - Semi-Supervised Learning.

UNIT III DIMENSIONALITY REDUCTION 9

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures - AlexNet - VGG - Inception - ResNet - Training a Convnet: Weights initialization, Batch Normalization, Hyperparameter Optimization.

UNIT IV OPTIMIZATION AND GENERALIZATION 9

Optimization in Deep Learning – Non-convex optimization for deep networks - Stochastic Optimization Generalization in Neural Networks - Spatial Transformer Networks - Recurrent networks - LSTM -Recurrent Neural Network Language Models - Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

UNIT V CASE STUDY AND APPLICATIONS 9

Imagenet- Detection - Audio WaveNet - Natural Language Processing Word2Vec - Joint Detection BioInformatics - Face Recognition - Scene Understanding - Gathering Image Captions.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

REFERENCES

1. Cosma Rohilla Shalizi, “Advanced Data Analysis from an Elementary Point of View”, Cambridge University Press, 2015.
2. Li Deng & Dong Yu, “Deep Learning: Methods and Applications, Now Publishers”, 2014.
3. Michael Nielsen, “Neural Networks and Deep Learning”, Determination Press, 2015.

19IT02E **MACHINE LEARNING** **L T P C**
3 0 0 3

PRE REQUISTE

- Bigdata Analytics
- Python
- Maths

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: distinguish between supervised, unsupervised and semi-supervised learning. (K2)
CO2: apply the machine learning strategy for any given problem. (K3)
CO3: identify the learning algorithm for any given problem. (K2)
CO4: define the importance of dimensionality reduction in machine learning. (K2)
CO5: describe the systems that use the appropriate graph models. (K3)

UNIT I INTRODUCTION 9

Learning – Types of Machine Learning – Supervised Learning –Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis –Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT III TREE AND PROBABILISTIC MODELS 9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbour Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS 9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.

UNIT V GRAPHICAL MODELS 9

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods – Microsoft Azure- AWS

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning & Pattern Recognition Series, 2015.

REFERENCES

1. Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2014.
2. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.
3. Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, First Edition, Wiley Publishers, 2014.
4. Ethem Alpaydin, “Introduction to Machine Learning”, Adaptive Computation and Machine Learning Series, Third Edition, MIT Press, 2014.

19IT03E BIOINFORMATICS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: comprehend the importance of bioinformatics. (K2)
CO2: describe the databases and data mining tools for bioinformatics. (K2)
CO3: state the role of data warehousing, data mining and machine learning in bioinformatics applications. (K2)
CO4: explain various modelling techniques for bioinformatics. (K2)
CO5: apply Perl programming for Bioinformatics problems. (K3)

UNIT I INTRODUCTION 9

Need for Bioinformatics technologies - An Overview of Bioinformatics Technologies - Structural bioinformatics: Organization - Primary Resource - Secondary Resources – Applications – Future scope.

UNIT II DATABASES AND TOOLS 9

Description and Organization of Sequence - Structure and Other databases - Need for tools - Knowledge discovery - Industry trends and data mining tools - Data submission tools - Data analysis tools - Prediction tools and modeling tools.

UNIT III DATAWAREHOUSING DATAMINING AND MACHINE LEARNING IN BIOINFORMATICS 9

Data warehousing: Bioinformatics data – Data warehouse architecture – Data quality - Data mining: Biomedical data analysis – DNA data analysis - Machine learning: Neural network architecture and applications in bioinformatics - Bioinformatics for the Health sector - A case study.

UNIT IV MODELING FOR BIOINFORMATICS 9

Hidden Markov modeling for biological data analysis – Sequence identification – Sequence classification – Multiple alignment generation – Comparative modeling – Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

UNIT V TOOLS FOR BIOINFORMATICS 9

Bio-algorithms and Tools – Identifying genes, Overview of sequence annotation. Gene prediction methods – Human variation and disease identification, Visualizing and comparing nucleic acids and Protein Introduction to Phylogenetic analysis definition, concepts of tree, steps in constructing Phylogenetic analysis. Introduction to microarray.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Orpita Bosu and Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", First Edition, Oxford University press, New Delhi, 2007.
2. Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.

REFERENCES

1. Harshawardhan P.Bal, "Bioinformatics principles and applications", Tata Mc-Graw Hill Publishing Company Ltd, New Delhi, 2007.
2. Kenneth Baclawski, Tianhua Niu, "Bioinformatics", Jaico Publishing House, Delhi, 2007.
3. Lukas K. Beehler and Hooman H. Rashidi, "Bioinformatics basics Applications in biological science and medicine", Taylor and Francis Group, 2005.
4. Tindall, J., "Beginning Perl for Bioinformatics: An introduction to Perl for Biologists" First Edition, O'Reilly Media, 2001.

19IT04E DATA WAREHOUSING AND DATA MINING L T P C

3 0 0 3

PRE REQUISITE

- Database management system concepts.
- Problem solving techniques.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: define a Data warehouse system and perform business analysis with OLAP tools. (K2)
CO2: explain the suitable pre-processing and visualization techniques for data analysis. (K2)
CO3: describe the frequent pattern and association rule mining techniques for data analysis. (K2)
CO4: select appropriate classification and clustering techniques for data analysis. (K2)
CO5: discuss the working principles of Weka tool. (K2)

UNIT I BUSINESS ANALYSIS AND OLAP 9

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT II DATA MINING INTRODUCTION 9

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT III DATA MINING FREQUENT PATTERN ANALYSIS 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT IV CLASSIFICATION AND CLUSTERING 9

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT V DATA MINING TOOLS 9

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, RAPID Miner and ETL tool- The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Jiawei Han and Micheline Kamber,Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsevier Science & Technology, 2012.

REFERENCES

1. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill Edition, Thirty fifth Reprint, 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier Science and Technology, Second Edition, 2005.

19IT05E SCALABLE DATA SCIENCE

L T P C
3 0 0 3

PRE REQUISITE

- Data Analytics

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: discuss the fundamentals of probability and machine learning. (K2)
CO2: summarize the memory efficient data structure for scalable data analysis. (K2)
CO3: describe variant analysis for data processing. (K2)
CO4: discuss the hadoop ecosystem. (K2)
CO5: explain optimization using machine learning. (K2)

UNIT I PROBABILITY AND BASICS OF MACHINE LEARNING 9

Introduction - Probability: Concentration inequalities- Linear algebra: PCA, SVD Optimization: Basics, Convex, Machine Learning: Supervised, generalization, feature learning, clustering.

UNIT II MEMORY EFFICIENT DATA STRUCTURES 9

Memory-efficient data structures: Hash functions, universal / perfect hash families - Bloom filters - Sketches for distinct count Misra-Gries sketch, Count Sketch, Count-Min Sketch, Approximate near neighbors search: Introduction, kd-trees, LSH families, MinHash for Jaccard, SimHash for L2.

UNIT III VARIANT ANALYSIS 9

Approximate near neighbors search: Extensions, multi-probe, b-bit hashing, Data dependent variants, Randomized Numerical Linear Algebra Random projection, Randomized Numerical Linear Algebra CUR Decomposition, Sparse RP, Subspace RP, Kitchen Sink.

UNIT IV MAPREDUCE AND HADOOP 9

Map-reduce and related paradigms Map reduce - Programming examples - (page rank, k-means, matrix multiplication), Big data: computation goes to data. + Hadoop ecosystem Map-reduce and related paradigms - Scala + Spark - Distributed Machine Learning.

UNIT V OPTIMIZATION 9

Distributed Machine Learning and Optimization: Introduction, ADMM, applications and Clustering.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Woodruff, David P, "Sketching as a tool for numerical linear algebra", Foundations and Trends in Theoretical Computer Science, 2014.
2. Mahoney, Michael W, "Randomized algorithms for matrices and data", Foundations and Trends in Machine Learning, 2011.

REFERENCES

1. J. Leskovec, A. Rajaraman and JD Ullman, “Mining of Massive Datasets”, Cambridge University Press, Second Edition, 2014.
2. Muthukrishnan.S, “Data streams: Algorithms and applications”, Foundations and Trends in Theoretical Computer Science, 2005.
3. Jimmy Lin, Chris Dyer, Morgan and Claypool, “Data-Intensive Text Processing with MapReduce”, 2010.
4. Tom White, “Hadoop: The definitive Guide”, Fourth Edition, Oreilly Press, 2015.
5. Stephen Boyd, Neal Parikh, Eric Chu, Borja Peleato, and Jonathan Eckstein, “Distributed optimization and statistical learning via the alternating direction method of multipliers”, Now Publishers Inc, Volume 3, 2011.

WEB RESOURCES

1. https://swayam.gov.in/nd1_noc19_cs61/preview

19IT06E BUSINESS INTELLIGENCE FOR IT

L T P C
3 0 0 3

PRE-REQUISITE

- Big Data Analytics
- Business Process Management

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the foundation for Business Intelligence (BI). (K2)
CO2: discuss the relationship of data mining with the BI environment. (K2)
CO3: describe text and web mining approaches in BI. (K2)
CO4: implement BI techniques. (K2)
CO5: apply the techniques in the context of a business problem. (K3)

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE 9

A framework for Business Intelligence - Business intelligence architectures: Cycle of a business intelligence analysis - Major tools and techniques of BI - Development of a business intelligence system – Ethics and business intelligence link.

UNIT II KNOWLEDGE DELIVERY 9

The business intelligence user types – Standard reports Interactive Analysis and Ad Hoc Querying – Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications – Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards. Geographic Visualization – Integrated Analytics – Considerations: Optimizing the Presentation for the Right Message.

UNIT III DECISION SUPPORT AND BUSINESS INTELLIGENCE 9

Changing Business Environments and Computerized Decision Support – Managerial Decision Making - Computerized Support for Decision Making - An Early Framework for Computerized Decision Support –The Concept of Decision Support Systems (DSS) - Case Studies: Giant Food Stores Prices the Entire Store.

UNIT IV TEXT MINING AND BI IMPLEMENTATION 9

Text Mining: Concepts and Definitions - Applications - Process –Tools - Implementing BI – Overview – BI and Integration Implementation – Connecting BI System to Database and other Enterprise Systems – On-Demand BI – Issues of Legality, Privacy, and Ethics – Emerging Topics in BI.

UNIT V FUTURE OF BUSINESS INTELLIGENCE 9

Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Mining Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Efraim Turban, Ramesh Sharda, Jay E.Aronson, David King, “Business Intelligence: A Managerial Approach”, Fourth Edition, Pearson Education, 2019.
2. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.

REFERENCES

1. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2013.
2. David Loshin, “Business Intelligence: The Savvy Manager‟s Guide”, Morgan, Kaufman Publishers, Second Edition, 2012.
3. Rajiv Sabherwal, Irma Becerra-Fernandez “Business Intelligence Practices, Technologies, and Management”, Wiley Publications, 2011.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, TataMcGraw Hill Publishing Company Ltd, 2008.

19IT07E ARTIFICIAL INTELLIGENCE

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the various characteristics of intelligent agents. (K2)

CO2: discuss the different search strategies in AI. (K2)
CO3: represent knowledge in solving AI problems. (K2)
CO4: describe various software agents. (K2)
CO5: identify appropriate AI technique for various applications. (K2)

UNIT I INTRODUCTION 9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS 9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT IV SOFTWARE AGENTS 9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2017.
2. Ivan Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES

1. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2017.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach", Jones and Bartlett Publishers, Inc, First Edition, 2008.
3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
5. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

19IT08E **REINFORCEMENT LEARNING** **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the basics of Reinforcement learning using dynamic programming. (K2)
CO2: outline the markov process using linear model. (K2)
CO3: discuss distance models for RL. (K2)
CO4: describe tree and rule models for RL. (K2)
CO5: apply reinforcement learning techniques for real life problems. (K3)

UNIT I INTRODUCTION 9

Origin and history of Reinforcement Learning research, Dynamic Programming (Value iteration, Policy iteration, and Q-learning) - Probability Primer- Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

UNIT II LINEAR MODELS 9

Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

UNIT III DISTANCE-BASED MODELS 9

Overview of dynamic programing for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

UNIT IV TREE AND RULE MODELS 9

Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

UNIT V PREDICTION AND EVALUATION METHODS 9

Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

. **L: 45 TOTAL: 45 PERIODS**

TEXT BOOKS

1. Richard Sutton and Andrew Barto, “Reinforcement Learning: An Introduction”, Second Edition, 2018, The MIT Press,Cambridge.
2. Csaba Szepesvari, “Algorithms for Reinforcement Learning”, Morgan & Claypool Publishers, Series Edition, 2010.

REFERENCES

1. Ethem Alpaydin, “Introduction to Machine Learning”, Adaptive Computation and Machine Learning Series, Third Edition, MIT Press, 2014.
2. Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, First Edition, Wiley Publishers, 2014.

19IT09E ANALYTICS COMPUTING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the descriptive statistics and probability distributions. (K2)
CO2: describe the continuous and discrete probability distributions. (K2)
CO3: describe the machine learning approaches. (K2)
CO4: summarize the association rule mining and big data. (K2)
CO5: explain the clustering methods for data analysis. (K2)

UNIT I DESCRIPTIVE STATISTICS 9

The Role of Statistics in Engineering - Descriptive Statistics: Sampling Distributions and Point Estimation of Parameters - Statistical Intervals - Tests of Hypotheses.

UNIT II PROBABILITY DISTRIBUTIONS 9

Probability Distributions: Discrete Random Variables- Continuous Random Variables - Joint Probability Distributions – Regression.

UNIT III MACHINE LEARNING 9

Introduction to Machine Learning - Supervised Learning - Support Vector Machines -- Neural Networks -Deep Learning.

UNIT IV ASSOCIATION RULE MINING AND BIG DATA 9

Supervised Learning: Associative Rule Mining - Big Data - Hadoop – HIVE.

UNIT V CASE STUDY AND APPLICATIONS 9

Clustering Analysis - Introduction to Experimentation and Active Learning - An Introduction to Online Learning - Reinforcement Learning.

L: 45;TOTAL: 45 PERIODS

TEXT BOOK

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The elements of statistical learning - DataMining Inference and Prediction”, Second Edition, Springer Verlag New York Inc, 2015

REFERENCES

1. Montgomery, Douglas C., and George C. Runger, “Applied statistics and probability for engineers”, Fifth Edition, John Wiley & Sons, 2010.
2. Edward Capriolo, Dean Wampler, Jason Rutherglen, “Programming Hive”, O'Reilly Kindle Edition, 2012.
3. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, Kindle Edition, 2012.

19IT10E WEB ANALYTICS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: discuss the fundamentals of web analytics. (K2)
CO2: describe the heuristic data capture using optimal tools. (K2)
CO3: discuss e-commerce web and blog analysis. (K2)

CO4: enumerate the usage of search engine optimization. (K2)
CO5: describe email and multichannel marketing. (K2)

UNIT I INTRODUCTION 9

Web analytics fundamentals – present and future- data collection- click stream data- research data-competitive data.

UNIT II HEURISTIC DATA CAPTURE 9

Heuristic evaluation - customer centricity - data capturing - optimal web analysis tool.

UNIT III E-COMMERCE WEB ANALYSIS 9

Creating foundational reports - E-commerce website- data capturing- business outcomes- Blog measurement.

UNIT IV SEARCH ANALYTICS 9

site search analytics-search engine optimization-SEO efforts- analyzing PPC metrics and evaluation, AWS and case studies.

UNIT V EMAIL AND MULTICHANNEL MARKETING 9

Email marketing- multichannel marketing- google analytics-tracking and analysis-competitive intelligence and web2.0 analytics - data segmentation.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Avinash Kaushik, “Web Analytics: An Hour a Day”, First Edition, 2007.

REFERENCES

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity”, First edition, 2009.
2. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Third edition, 2012.
3. Justin Cutroni, “Google Analytics: Understanding Visitor Behavior”, Paperback, 2010.

19IT11E DATA SCIENCE USING R

LT P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO 1: apply the basics of R programming with its datatypes. (K3)
CO 2: apply the functional programming and data manipulation statements in R. (K3)
CO 3: identify packages to implement machine learning techniques in R. (K2)
CO 4: explore concepts of object oriented programming in R. (K3)
CO 5: implement graphics and create new packages with R. (K3)

UNIT I INTRODUCTION TO DATA SCIENCE & R 9

Introduction to Data Science – Data Science Lifecycle - Introduction – R environmental setup – Installation – RStudio – Programming with R – R as a calculator – Dealing with Missing Values – Using R Packages – Expression – Data Types – Data Structures – Control Structures – Functions – Lazy Evaluation – Recursive Functions – Exercises.

UNIT II DATA MANIPULATION AND FUNCTIONAL PROGRAMMING 9

Creating a R Markdown – YAML – Markdown language – R Code in Markdown documents – Data Manipulation – Data Import and Export – Manipulation data with dplyr – Vectorizing

Functions – Apply Family – Infix operator – Replacement Functions – Function with arguments & return – Filter, Map and Reduce.

UNIT III MACHINE LEARNING 9
Dealing with large dataset – Sampling – Regression – Linear Regression – Logistic Regression – Evaluating and Validating Models – Cross Validation – Classification – Decision Trees– Neural Network – Support Vector Machine – Unsupervised Learning - Clustering - Association Rule Mining.

UNIT IV CLASS AND OBJECTS 9
Immutable objects and Polymorphic functions – Data structures – Classes Introduction: Why Classes? - Programming with New Classes - Inheritance and Inter-class Relations - Virtual Classes - Creating and Validating Objects - Programming with S3 Classes – Class Hierarchies - Exercises.

UNIT V DATA VISUALIZATION AND PACKAGES 9
XY Plot – Graphics Package – ggplot2 - Package concept and tools – Creating an R package – Description – Namespace – Roxygen – Adding data to Package - Documentation for Packages – Building an R Package.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Thomas Mailund, "Beginning Data Science in R – Data Analysis, Visualisation and Modelling for the Data Scientist", Apress Publication, 2017.
2. John Chambers, "Software for Data Analysis: Programming with R ", Springer; First Edition. 2008.

REFERENCES

1. Torsten Hothorn, Brian S. Everitt, "A Handbook of Statistical Analyses Using R", Chapman and Hall/CRC; Second edition, 2009
2. Thomas Lumley, "Complex Surveys: A Guide to Analysis Using R", Wiley Series in survey methodology, 2010.
3. Nicholas J. Horton, Ken Kleinman," Using R and RStudio for Data Management, Statistical Analysis, and Graphics", CRC Press, Second Edition, 2015 .
4. John Maindonald, W. John Braun,"Data Analysis and Graphics Using R: An Example-Based Approach", University Press, Cambridge, Third Edition, 2010.
5. John M. Quick," Statistical Analysis with R", Packt Publishing , 2010.
6. K.G.Srinivasa, G.M.Siddesh, Chetan Shetty, "Statistical Programming in R", Oxford University Press, New Delhi, 2017.

19IT12E SOFT COMPUTING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: discuss the fundamentals of soft computing. (K2)
CO2: describe the ANN models. (K2)
CO3: explain fuzzy systems and its applications. (K2)
CO4: enumerate the usage of genetic algorithms in optimization. (K2)
CO5: describe neuro-fuzzy modeling. (K2)

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Back propagation Neural Networks – Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network – Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines – Spike Neuron Models.

UNIT III FUZZY SYSTEMS 9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification – Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning – Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles -Encoding- Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion -Mutation Operator – Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. N.P.Padhy, S.P.Simon, “Soft Computing with MATLAB Programming”, Oxford University Press, 2015.
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications “, PHI Learning Pvt. Ltd., 2017.

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ”Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2002.
2. Kwang H.Lee, ”First course on Fuzzy Theory and Applications”, Springer, 2005.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.

19IT13E SOCIAL NETWORKING L T P C
3 0 0 3

COURSE OUTCOMES

Upon the completion of the course, the students should be able to

CO1: develop semantic web related simple applications. (K3)
CO2: represent knowledge using ontology.(K2)

CO3: explain the data extraction and mining of social networks.(K2)
CO4: discuss the prediction of human behavior in social communities.(K2)
CO5: describe the applications of social networks.(K2)

UNIT I INTRODUCTION 9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNITII MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - MultiRelational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.
2. BorkoFurht, “Handbook of Social Network Technologies and Applications”, First Edition, Springer, 2010.
3. David Easley, Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning about a Highly Connected World”, First Edition, Cambridge University Press, 2010.

REFERENCES

1. GuandongXu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition, Springer, 2011.

2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.
5. https://nptel.ac.in/courses/106/106/106106169/

19IT14E CLOUD COMPUTING L T P C

3 0 0 3

PREREQUISITE

- Operating Systems
- Networking
- Database Management Systems

COURSE OUTCOMES

Upon completion of the course, the students should be able to

CO1: explain the main concepts, key technologies, and limitations of cloud computing. (K2)
CO2: discuss the key and enabling technologies that help in the development of cloud. (K2)
CO3: develop the ability to understand and use the architecture of cloud. (K2)
CO4: explain the concepts of resource management and scheduling in cloud computing. (K2)
CO5: describe the cloud technologies using Hadoop. (K2)

UNIT I INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics - Elasticity in Cloud – On-demand Provisioning.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV CLOUD RESOURCE MANAGEMENT AND SCHEDULING 9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Scheduling Algorithms for Computing Clouds–Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – MapReduce – Virtual Box –– Google App Engine – Programming Environment for Google App Engine –– Open Stack – Case study: AWS, VMWare

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

19IT15E INFORMATION VISUALIZATION

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COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: explain principles of visual perception. (K2)
CO2: describe the data analysis using time-series. (K2)
CO3: discuss multivariate analysis for data processing. (K2)
CO4: discuss and design information dashboard. (K2)
CO5: describe visualizing data process.(K2)

UNIT I CORE SKILLS FOR VISUAL ANALYSIS 9

Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

UNIT II TIME-SERIES RANKING AND DEVIATION ANALYSIS 9

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – displays – best practices.

UNIT III DISTRIBUTION CORRELATION AND MULTIVARIATE ANALYSIS 9

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques & best practices.

UNIT IV INFORMATION DASHBOARD DESIGN 9

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

UNIT V VISUALIZING DATA PROCESS 9

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files forUse with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

L: 45; TOTAL : 45 PERIODS

TEXT BOOKS

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

REFERENCES

1. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
2. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.
3. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
4. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", Second Edition, Analytics Press, 2013.
5. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.

19IT16E GPU COMPUTING L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: describe GPU Architecture. (K2)
CO2: develop programs using CUDA. (K3)
CO3: enumerate the various programming issues. (K2)
CO4: develop simple programs using OpenCL. (K3)
CO5: identify efficient parallel programming patterns to solve problems. (K2)

UNIT I GPU ARCHITECTURE 9

Evolution of GPU architectures – Understanding Parallelism with GPU –Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

UNIT II CUDA PROGRAMMING 9

Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III PROGRAMMING ISSUES 9

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT IV OPENCL BASICS 9

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT V ALGORITHMS ON GPU 9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Shane Cook, "CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, "Heterogeneous computing with OpenCL", Third Edition, Morgan Kauffman, 2015.

REFERENCES

1. Nicholas Wilt, "CUDA Handbook: A Comprehensive Guide to GPU Programming", Addison – Wesley, 2013.
2. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison – Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors – A Hands-on Approach", Third Edition, Morgan Kaufmann, 2016.

WEB REFERENCES

1. http://www.nvidia.com/object/cuda_home_new.html
2. http://www.openCL.org

19IT17E MULTI-CORE ARCHITECTURES

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COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: describe the core concept of multiprocessors. (K2)
CO2: write the program for Parallel Processors. (K3)
CO3: develop programs using OpenMP and MPI. (K3)
CO4: compare and contrast programming for serial processors and programming for parallel processors. (K3)
CO5: analyze the case studies related to open MP and MPI. (K3)

UNIT I MULTI-COREPROCESSORS 9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design- NVIDIA kepler- Architecture.

UNIT II PARALLEL PROGRAM CHALLENGES 9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OPENMP 9

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation.

UNIT V PARALLEL PROGRAM DEVELOPMENT 9

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011

REFERENCES

1. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata Mc-Graw Hill, 2003.
2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
3. Gerassimosbarlas "Multi core and GPU programming an integrated approach", Springer, 2015.

19IT18E SERVICE ORIENTED ARCHITECTURE

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COURSE OUTCOMES

Upon completion of the course the students will be able to

CO1: identify how the components are interrelated in SOA. (K2)

CO2: develop a simple web services using SOA principles. (K3)

CO3: apply various activity management and a series of composition techniques for SOA. (K3)

CO4: implement the various services using J2EE. (K3)

CO5: apply various web service specification standards. (K3)

UNIT I SOA AND BUSINESS PROCESS MANAGEMENT CONCEPTS 9

Service Oriented Enterprise – Service Oriented Architecture (SOA) – SOA and Web Services – Multichannel Access – Business Process management – Extended Web Services Specifications – Overview of SOA – Concepts – Key Service Characteristics – Technical Benefits – Business Benefits-Microservices architecture-Emergence of MSA Service

UNIT II SOA AND WEB SERVICES 9

Web Services Platform – Service Contracts – Service-Level Data Model – Service Discovery – Service-Level Security – Service-Level Interaction patterns – Atomic Services and Composite Services – Proxies and Skeletons – Communication – Integration Overview – XML and Web Services - .NET and J2EE Interoperability – Service- Enabling Legacy Systems – Enterprise Service Bus Pattern – Creating simple web services.

UNIT III SOA AND MULTICHANNEL ACCESS 9

Multi-Channel Access – Business Benefits – SOA for Multichannel Access – Tiers – Business Process Management – Concepts – BPM - SOA and Web Services – WS- BPEL – Web Services Composition-Case Study Tools: BMC Software's AppSight.

UNIT IV JAVA WEB SERVICES ARCHITECTURE 9

Java Web Service Developer pack– JAXP- Architecture-SAX-DOM-XSLT-JDOM-JAX RI – JAX-RPC-Service Model - JAX RPC and J2EE - JAXM – JAXM Architecture –JAXR - Registries and Repositories – JAXR Architecture – JAXR Information Model - JAXB – Architecture – Developing with JAXB - XML to Java mapping – JAXB API - Validation with JAXB – Customizing JAXB-Case Study Tool:Mindreef's SOAP scope Server.

UNIT V EXTENDED WEB SERVICES SPECIFICATION 9

Metadata Management - Metadata Specification - Policy – Metadata exchange – Web Services Security -Core concepts – Challenges - Threads and Remedies – Message Level Security – Data Level Security – Advanced Messaging – Reliable Messaging - Notification – Transaction Management - Protocols and Specification – Transaction Specification.

L: 45 TOTAL: 45 PERIODS

TEXTBOOKS

1. Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, First Edition, Pearson Education, 2005.
2. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, “Java Web Services Architecture”, Elsevier, 2003.

REFERENCES

1. Thomas Erl, “Service Oriented Architecture”, Pearson Education, 2005.
2. Frank Cohen, “Fast SOA”, Elsevier, 2007.
3. Scott Campbell, Vamsi Mohun, “Mastering Enterprise SOA”, Wiley, 2007.
4. Eric Pulier, Hugh Taylor, “Understanding Enterprise SOA”, Dreamtech Press, 2007.
5. Jeff Davies, “The Definitive Guide to SOA”, Apress, 2007.
6. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services”, Pearson Education, 2004.

WEB REFERENCES

1. http://www.servicearchitecture.com/webservice/articles/serviceoriented_architecture_soa_definition.html
2. http://www. W3.orh/TR/soap12-part1/
3. http://www.w3.org/TR/ws-arch/
4. http://www.whatissaoa.com/
5. http://www.ibm.com/developerworks/webservices/library/ws-soadl/
6. http://xml.coverpages.org/Burdett-WSChoreographyJune032003.pdf
7. http://download.oracle.com/javaee/1.4/tutorial/doc/JAXR2.html
8. http://java.sun.com/developer/technicalArticles/xml/jaxb/
9. http://java.ociweb.com/mark/JavaUserGroup/JAXB.pdf
10. http://java.sun.com/xml/downloads/jaxrpc.html

19IT19E QUANTUM COMPUTING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the student will be able to

CO1: describe the quantum computing and quantum physics. (K2)
CO2: elicit the fundamentals of quantum circuits. (K2)
CO3: compare the quantum information and cryptography. (K2)
CO4: describe the quantum algorithms and error correction techniques. (K2)
CO5: enumerate the noise and error correction techniques in quantum computing. (K2)

UNIT I INTRODUCTION TO QUANTUM COMPUTATION AND PHYSICS 9

Quantum bits – Bloch sphere representation of a qubit, multiple qubits–Hilber space–Probabilities and measurements, entanglement, density operators and correlation – basics of quantum mechanics – Measurements in bases other than computational basis.

UNITII QUANTUM CIRCUITS 9

Quantum algorithms- Single qubit operation – multiple qubit gates – controlled qubit operations-universal quantum gates- design of quantum circuits.

UNIT III QUANTUM INFORMATION AND CRYPTOGRAPHY 9

Quantum operation-Example of quantum noise and quantum operation-Comparison between classical and quantum information theory – Bell states – Quantum teleportation – Quantum Cryptography – no cloning theorem.

UNIT IV QUANTUM ALGORITHMS 9

Classical computation on quantum computers– Relationship between quantum and classical complexity classes– Deutsch's algorithm– Deutsch's-Jozsa algorithm– Shor factorization, Grover search.

UNIT V NOISE AND ERROR CORRECTION 9

Graph states and codes – Shor code- Theory of Quantum error correction –constructing quantum codes- stabilizer code- fault-tolerant computation.

L: 45; TOTAL : 45 PERIODS

TEXT BOOK

1. Nielsen M.A,Chuange I.L, "Quantum Computation and Quantum Information", Cambridge University Press,2013.

REFERENCES

1. Benenti G., Casati G. and Strini G., "Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics", World Scientific, 2014.
2. Pittenger A. O.," An Introduction to Quantum Computing Algorithms", 2002.

19IT20E CLOUD MANAGEMENT SECURITY

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: define the basic cloud concepts. (K2)
CO2: explain the security challenges in cloud. (K2)
CO3: define cloud policy and governance, compliance and legal considerations. (K2)

CO4: classify risk, audit, assessment and infrastructure security in cloud. (K2)
CO5: describe the importance of data security in cloud. (K2)

UNIT I INTRODUCTION TO CLOUD COMPUTING 9

Delivery models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) - Cloud types (public, private, hybrid) - Explaining the Jericho Cloud Cube Model.

UNIT II SECURITY CHALLENGES 9

Introduction - Virtualization and multi-tenancy - Risk assessment for cloud migration - Unique SaaS challenges and Cloud Access Security Brokers (CASBs).

UNIT III POLICY AND GOVERNANCE COMPLIANCE AND LEGAL CONSIDERATIONS 9

Internal policy needs - Contract requirements for security - Service-level agreements - Governance models for the cloud - Compliance challenges for the cloud - Legal and geographic jurisdiction - Privacy concerns.

UNIT IV RISK AUDIT ASSESSMENT AND INFRASTRUCTURE SECURITY FOR THE CLOUD 9

Risk management - Auditing the cloud – Remote – Onsite - CloudAudit A6 - Patch and configuration management - Change management - Network and virtualization security - Application security for SaaS, PaaS, and IaaS.

UNIT V DATA SECURITY IN THE CLOUD 9

Encryption types and availability - Key management and encryption architectures - Data/information lifecycle – Retention – Disposal – Classification.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Raj Kumar Buyya , James Broberg, andrzej Goscinski, “Cloud Computing:”, Wiley 2013
2. Raj Kumar buyya, Christian Vecchiola, “Mastering Cloud Computing”, 2013.
3. Arshdeep Bahga, Vijay Madisetti, “Cloud Computing”, University Press, 2014
4. Dave shackleford, “Virtualization Security”, SYBEX a wiley Brand 2013.

REFERENCES

1. Mark C. Chu-Carroll “Code in the Cloud”,CRC Press, 2011.
2. K Chandrasekharan “Essentials of cloud computing”, CRC Press, 2015.
3. John W. Rittinghouse, James Ransome, “Cloud Computing”, CRC Press, 2009
4. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy”, OREILLY 2011.

19IT21E EDGE AND FOG COMPUTING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO 1: explore the fundamentals and management in fog computing. (K2)
CO 2: use the design of fog architecture. (K2)
CO 3: design new services with fog computing. (K3)
CO 4: apply different real time applications in fog. (K3)
CO 5: design mobile fog applications with 5G network. (K3)

UNIT I FOG COMPUTING 9

Fog Computing Fundamentals in the Internet-of-Things - IoT Resource Estimation Challenges and Modeling in Fog - Tackling IoT Ultra Large Scale Systems: Fog Computing in Support of Hierarchical Emergent Behaviors.

UNIT II FOG REFERENCE ARCHITECTURE 9

OpenFog Reference Architecture - Areas of Opportunity - Use Cases for Fog - Pillars of Open Fog RA - Reference Architecture Overview: Functional Viewpoint - Deployment Viewpoint - OpenFog Architecture Description – Perspectives - Node View - System Architecture View - Software Architecture View.

UNIT III SERVICES OF FOG LAYER 9

Self-Aware Fog Computing in Private and Secure Spheres– Urban IoT Edge Analytics - The Present and Future of Privacy-Preserving Computation in Fog Computing.

UNIT IV APPLICATION USE-CASES 9

Control-as-a-Service in Cyber-Physical Energy Systems overFog Computing - Leveraging Fog Computing for Healthcare IoT. Programming with iFogSim.

UNIT V FOG COMPUTING IN 5G NETWORKS 9

Fog computing in 5G networks: an application perspective -Fog computing on 5G networks - Smart traffic light system - Mobile gaming - Smart homes - Distributed camera networks - software-defined networking and network functions virtualisation in 5G emerging mobile computing.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Amir M. Rahmani,PasiLiljeberg, Jürgo-SörenPreden, Axel Jantsch, “Fog Computing in theInternet of Things: Intelligence at the Edge”, Springer, 2018.
2. Evangelos Markakis, George Mastorakis, Constandinos X. Mavromoustakis and EvangelosPallis, “Cloud and Fog Computing in 5G Mobile Networks Emerging advances and applications” IET 2017.

REFERENCES

1. OpenFog Consortium Architecture Working Group, “OpenFog Reference Architecture for Fog Computing”, www.OpenFogConsortium.org.
2. Zaigham Mahmood, “Fog Computing: Concepts, Frameworks and Technologies”, Springer, 2018.

19IT22E VIRTUAL AND AUGMENTED REALITY

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate an understanding of the underlying enabling technologies of Virtual Reality systems. (K3)
CO2: Explain the computing architecture needed for Virtual Reality. (K2)
CO3: Demonstrate the concepts of augmented reality. (K3)
CO4: Identify augmented reality contents and interactions. (K2)
CO5: Describe hardware and software used in augmented reality. (K2)

UNIT I VIRTUAL REALITY FUNDAMENTALS 9

Elements of Virtual Reality Experience - Components of a VR system - Evolution of VR. Input Devices - Position trackers, Gesture Interfaces, Manipulation Interfaces. Output Devices - Visual Displays: Properties, Monitor Based, Projection Based, Head Based, See-through head based, Hand Held VR Displays Aural Displays: Properties, Head based and Stationary aural devices Haptic Displays: Human haptic system, Tactile type, force type.

UNIT II COMPUTING ARCHITECTURES, VR DESIGN ISSUES 9

Visual representation in VR, Aural representation in VR, Haptic representation in VR – Visual Rendering System – Aural Rendering System -Haptic Rendering System – PC Graphics Accelerators and Architecture – Multipipeline synchronisation – collocated rendering pipelines – distributed VR environment – VR Haptic Interface software – Creating a VR application – Designing a VR experience -VR health and safety issues – VR and Society

UNIT III AUGMENTED REALITY CONCEPTS 9

Augmented Reality –Introduction – Physical world augmentation – Relationship between augmented reality and other technologies. Augmented Reality Concepts – How augmented reality works – two step process of augmented reality application – related concepts – Ingredients of augmented reality experience.

UNIT IV AUGMENTED REALITY CONTENT AND INTERACTION 9

Content – Creating visual content – 3D objects – 2D images – visual elements. Interaction in Augmented Reality –interaction in real world – manipulation – navigation –multi person augmented reality application – subjective vsobjective point of view.

UNIT V AUGMENTED REALITY HARDWARE AND SOFTWARE 9

Major hardware components for Augmented Reality System – Sensors – Processors – Displays - Augmented Reality Systems. Major software components for Augmented Reality – Software used to create content for augmented reality application.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. William R. Sherman, Alan B. Craig, “Understanding Virtual Reality: Interface, Application, and Design”, Morgan Kaufmann Publishers (Elsevier) U.S./India, Second Edition, 2017..
2. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, Wiley India, Second Edition, 2003.
3. Alan B. Craig, “Understanding Augmented Reality- Concepts and Applications”, Morgan Kaufmann, First Edition, 2013.
4. RaghavSood, “Pro Android Augmented Reality”, First Edition, Apress, 2012.
5. Furht, Borko, “Handbook of Augmented Reality”, First Edition, Springer, 2011.

REFERENCES

1. Tony Parisi, “Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web and Mobile”, O’Reilly, First Edition, 2016.
2. Greg Kipper and Joseph Rampolla, “Augmented Reality: An Emerging Technologies Guide to AR”, Morgan Kaufmann, First Edition, 2012.

19IT23E BLOCKCHAIN TECHNOLOGY

L T P C
3 0 0 3

PRE REQUISTES

- Data Structures and Algorithms
- Object-Oriented Programming
- Database Management System and Operating Systems

COURSE OUTCOMES

Upon completion of the course the students will be able to

CO1: Explain the emerging abstract models for Blockchain technology landscape. (K2)
CO2: Explain design principles of Bitcoin and Ethereum. (K2)
CO3: discuss the transactions usingHyperledger Fabric. (K2)
CO4: Familiarize the functional/operational aspects of Blockchain data structure. (K2)
CO5: Explain the concepts of Mining and Consensus in Blockchain technology. (K2)

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Introduction to Blockchain : Basics, History, Architecture, Conceptualization - Basic Crypto Primitives - Byzantine Generals Problem - Types of Blockchain – Blockchain Implementations - Blockchain Collaborative Implementations - Blockchain Components and Concepts - Blockchain in Practical Use Today - Case Study: SecureVote.

UNIT II BITCOIN AND ETHEREUM 9

Introduction to Bitcoin - How Bitcoin Works: Transactions, Blocks, Mining, and the Blockchain - Bitcoin Transactions - Constructing a Transaction - Bitcoin Mining – Mining Transactions in Blocks - Consensus in Bitcoin - Spending the Transaction – Bitcoin Addresses - The Bitcoin Network - Ethereum - Case Study: AgriDigital - Ethereum, Consensus – Mechanisms - Smart Contracts - Metamask Setup - Ethereum Accounts.

UNIT III TRANSACTIONS AND HYPERLEDGER FABRIC 9

Introduction - Transaction Lifecycle - Transaction Structure - Transaction Outputs and Inputs- Transaction Scripts and Script Language - Standard Transactions - Introduction to Hyperledger: Hyperledger Fabric – Transaction Flow - Membership and Identity Management - Hyperledger Fabric Network Setup - Fabric Demo on IBM Blockchain Cloud.

UNIT IV BLOCKCHAIN DATA STRUCTURE 9

Introduction - Structure of a Block - Block Header - Block Identifiers: Block Header Hash and Block Height - The Genesis Block - Linking Blocks in the Blockchain - Merkle Trees – Merkle Trees and Simplified Payment Verification (SPV) - Blockchain Security - Case Study: Origin Chain.

UNIT V MINING AND CONSENSUS 9

Introduction - Decentralized Consensus - Independent Verification of Transactions – Mining Nodes - Aggregating Transactions into Blocks - Constructing the Block Header - Mining the Block - Successfully Mining the Block - Validating a New Block - Assembling and Selecting Chains of Blocks - Consensus Attacks.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media, Inc., ISBN: 978-1-449-37404-4, 2014.

3. Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain”, O’Reilly Media, Inc., ISBN: 978-1-491-95438-6, 2017.

REFERENCES

1. Nick Furneaux, Investigating Cryptocurrencies: Understanding, Extracting, and Analyzing Blockchain Evidence, John Wiley &amp; Sons, Inc., 2018.
2. Joseph J. Bambara, Paul R. Allen, “Blockchain: A Practical Guide to developing Business, Law, and Technology Solutions, McGraw-Hill Education, 2018.
3. Xiwei Xu, Ingo Weber, Mark Staples, “Architecture for Blockchain Applications”, Springer, ISBN 978-3-030-03034-6, 2019.
4. Melanie Swan, Blockchain : Blueprint for a New Economy, O’Reilly Media, Inc., ISBN: 978-1-491-92049-7,2015.
5. Tiana Laurence, “Blockchain”, Second Edition, Wiley Publications, ISBN 978-1-119-55501-8, 2019.

WEB REFERENCES

1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric.
2. Hands-On Blockchain with Hyperledger - https://www.packtpub.com/big-data-and-business-intelligence/hands-blockchain-hyperledger.

19IT24E	**MOBILE COMMUNICATIONS**	**L T P C**
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COURSE OUTCOMES:

Upon completion of the course the students will be able to

CO1: explain the basics of mobile telecommunication system.(K2)
CO2: illustrate the generations of telecommunication systems in wireless network. (K2)
CO3: discuss the architecture of Wireless LAN technologies. (K2)
CO4: determine the functionality of network layer and Identify a routing protocol for Ad-hoc networks.(K3)
CO5: explain the functionality of Transport and Application layer.(K2)

UNIT I INTRODUCTION 9

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT II MOBILE TELECOMMUNICATION SYSTEM 9

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture.

UNIT III WIRELESS NETWORKS 9

Wireless LANs and PANs – IEEE 802.11 Standard – system Architecture -Protocol Architecture–MAC-HIPERLAN-– Blue Tooth- Wi-Fi – WiMAX.

UNIT IV MOBILE NETWORK LAYER 9

Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing– Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT V MOBILE TRANSPORT AND APPLICATION LAYER 9

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2014.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.

REFERENCES

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications - Analog and Digital Systems", Second Edition, Tata Mc Graw Hill Edition ,2006.
4. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

19IT25E MOBILE AND UBIQUITOUS COMPUTING

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COURSE OUTCOMES

Upon completion of the course the students will be able to

CO1: explain the basic architecture and concepts of Third Generation Communication systems. (K2)
CO2: explain the 4G Telecommunication System Principle. (K2)
CO3: discuss the basics of ubiquitous computing. (K2)
CO4: outline the need of wearable computing. (K2)
CO5: explain the concepts of HCI in ubiquitous computing. (K2)

UNIT I INTRODUCTION 9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture - WML scripts and applications. Data networks – SMS –EDGE – Hybrid Wireless Networks – ATM – WirelessATM.

UNIT II OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM 9

Introduction - LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core - LTE Requirements. LTE - Advanced - OFDMA – Introduction - OFDM Principles - LTE Uplink—SC.

UNIT III BASICS OF UBIQUITOUS COMPUTING 9

Introduction, Overview – Challenges networking Basics – NFC, Wireless LAN-Location in ubiquitous computing: Personal assistants – Location aware computing – Location tracking – Architecture – Location based service and applications – Location based social networks (LBSN), LBSN Recommendation.

UNIT IV WEARABLE COMPUTING 9

Glass and Augmented Reality – Eye-Tracking, – Digital Pen and Paper Mobile social networking & crowd sensing – Event based social network.

UNIT V MOBILE AFFECTIVE COMPUTING 9

Application domains for ubiquitous computing: Illustration of some existing application domains for ubiquitous computing -Human Activity and Emotion Sensing – Health Apps – Mobilep2p computing-Smart Homes and Intelligent Buildings– Mobile HCI.

L: 45; TOTAL: 45 ERIODS

TEXT BOOKS

1. Ian Colman, Jun Han, and Muhammad AshadKabir, "Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications", Springer, 2016.
2. J.Schiller,"Mobile Communication", Addison Wesley, Second Edition,2004
3. John Krumm,"Ubiquitous Computing Fundamentals", CRC Press, 2010.

REFERENCES

1. JuhaKorhonen, "Introduction to 4G Mobile Communications", Artech House Publishers, 2014.
2. M.Bala Krishna, Jaime Lloret Mauri, "Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networksll", CRC 2016.

19IT26E IoS PROGRAMMING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course the students will be able to

CO1: explain the basics of IoS programming. (K2)
CO2: explain the user interfaces in XCODE. (K2)
CO3: outline the views and gestures in IoS. (K2)
CO4: describe the table and navigation in IoS. (K2)
CO5: describe the swift programming using IoS. (K2)

UNIT I UNDERSTANDING IoS PROGRAMMING 9

Learning about Xcode- view and class files- designing user interface- IBoutlet variable creation-Apple framework UI-Xcode editor- Xcode navigation and appearance.

UNIT II XCODE UI 9

Working with controllers- transition between multiple controllers- Navigation controller- adding user interface objects- using common interface objects.

UNIT III IMAGE VIEW AND GESTURE IN IoS 9

Using Image Views-text view- button switches and segment controllers- gestures tap, pinch and rotation- using alerts and pickers-constraints and stack view.

UNIT IV TABLE VIEW AND NAVIGATION VIEW 9

Table view- indexing-collection view-navigation controller-tab bar- tool bar-page view controller.

UNIT V SWIFT PROGRAMMING 9

Swift for Object oriented App development-OS X Notes APP- user interface and icloud.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Wallace Wang,"Beginning iPhone Development with Swift 5: Exploring the ioS SDK", Fifth Edition, Apress, June 2019.
2. Paris Buttfield-Addison, Jon Manning, Tim Nugent, "Learning Swift: Building Apps for OS X and IoS", O'Reilly Media, First Edition,2016.

WEB REFERENCES

1. https://www.raywenderlich.com/
2. https://www.appcoda.com/ios-programming-course/
3. https://www.hackingwithswift.com/read
4. https://developer.apple.com/develop/
5. https://books.apple.com/us/book/the-swift-programming-language-swift-3-1/id881256329

19IT27E ANDROID PROGRAMMING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course the students will be able to:

CO1: design and validate web pages using HTML and JavaScript. (K3)
CO2: explain the fundamentals of android development lifecycle. (K2)
CO3: outline the android development components. (K2)
CO4: explain the GUI in android development. (K2)
CO5: describe the services in android development. (K2)

UNIT I INTRODUCTION 9

Development in Web Standards – Markup Languages :HTML5 – Client- Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax Variables and Data Types-Statements- Operators- Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers- Event programming in Java.

UNIT II MOBILE APPLICATION DEVELOPMENT 9

Mobile Applications Development – Understanding the Android Software Stack – Android Application Architecture –The Android Application Life Cycle – The Activity Life Cycle Creating Android Activity – Views– Layout – Creating User Interfaces with basic views– linking activities with Intents.

UNIT III ANDROID FRAMEWORK OVERVIEW 9

Android Application Components–Android Activities: Defining the UI– Android Services: Processing in the Background–Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for ComponentsAndroid Manifest XML: Declaring Your Components.

UNIT IV GRAPHICAL USER INTERFACE SCREEN WITH VIEWS 9

Displaying Text with TextView– Retrieving Data from Users– Using Buttons– Check Boxes and Radio Groups, Getting Dates and Times from Users–Using Indicators to Display Data to Users–Adjusting Progress with SeekBar– Working with Menus using views.

UNIT V MOBILE APPLICATION DEVELOPMENT SERVICES 9

Services-Broadcast Receivers – Adapters – Data Storage– Retrieval and Sharing.-Location based services- Development of simple mobile applications.

L: 45 TOTAL: 45 ERIODS

TEXT BOOKS

1. Barry A. Burd, "Android Application Development For Dummies All in One", Wiley Publications, 2015.
2. Ed Burnette, "Hello, Android: Introducing Google's Mobile Development Platform", Third Edition, Pragmatic Programmers, 2012.

WEB REFERENCES

1. Android Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. Windows Phone Dev Center : http://developer.windowsphone.com
4. BlackBerry Developer : http://developer.blackberry.com
5. https://developer.android.com/guide/components/fundamentals

19IT28E M-COMMERCE L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: explain the underlying economic mechanisms and driving forces of E-Commerce. (K2)
CO2: discuss the critical building blocks of M-Commerce. (K2)
CO3: outline the infrastructure of M-Commerce Services. (K2)
CO4: enumerate the security challenges of M- commerce. (K2)
CO5: explain various business application services of M-Commerce. (K2)

UNIT I E-COMMERCE 9

Electronic Commerce Framework – Electronic Commerce and Media Convergence –Anatomy of E-Commerce Applications – Consumer Application -Electronic Commerce organization application.

UNIT II INTRODUCTION TO M – COMMERCE 9

M-Commerce – Framework – Business Models – Impact of M-Commerce – Services– Applications – Technology of M-Commerce – Mobile Payments Mode – Types –Security & Privacy Issues.

UNIT III M - COMMERCE: PAYMENTS & SERVICES 9

Overview of M-Commerce - M-commerce and Technology Acceptance Model(TAM) -M-commerce and trust - concept of m-payment - importance of m-commerce and m-payment in global business - Innovativeness, trust, demographic characteristics on mobile services

UNIT IV M- COMMERCE: SECUIRTY 9

SWOT Analysis of M-commerce – Fraudulent Activities through M-commerce – Security& Its prevention – mobile payments for conducting M-commerce –Architecture and transaction model in securing M-commerce – Regulatoryframeworks of M-commerce - Security risks of M-commerce – Comparative analysis of M-commerce and E-commerce

UNIT V BUSINESS APPLICATIONS AND SERVICES 9

Mobile Information Services–Directory Services– Banking and Trading– E-Tailing and E-Ticketing–Entertainment– Business Applications and Services– Next Generation M-commerce Scenarios– Personalization– Location-Based Services.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Ravi Kalakota, B.Andrew Whinston, “Frontiers of Electronic Commerce”, Ninth Edition, Pearson Education, 2009.
2. Sushila Madan, JyotiBatra Arora, “Securing Transactions and Payment Systems for M-Commerce”, Business Science Reference (an imprint of IGI Global), 2016.

REFERENCE

1. Norman Sadeh, “M-Commerce: Technologies, Services and Business models”, John Wiley & Sons, 2002.
2. Karabi Bandyopadhyay, “Mobile Commerce”, PHI Learning Private Limited, 2013
3. Paul May, “Mobile Commerce: Opportunities, Applications and Technologies of Wireless Business”, Cambridge University Press, 2001.
4. Dr.Pandey , Saurabh Shukla “E-commerce and Mobile commerce Technologies” Sultan Chand ,2011
5. E.Brian Mennecke, J.Troy Strader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IRM press, 2003.

19IT29E IoT AND ITS APPLICATIONS

L T P C
3 0 0 3

PREREQUISITES

- Basic courses on communication
- Computer Networks
- Embedded Systems

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1: explain and demonstrate various components of Internet of Things (IoT). (K2)
CO2: analyze basic protocols and Enabling Technologies of IoT in the modern world. (K2)
CO3: realize the revolution of Cloud and Fog Computing for the IoT. (K2)
CO4: evaluate a variety of existing and developing architecture technologies for IoT. (K3)
CO5: describe and evaluate different applications of the IoT. (K2)

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UNIT I INTERNET OF THINGS: AN OVERVIEW 9

Introduction- Internet of Things Definition Evolution - IoT Architectures - Resource Management - IoT Data Management and Analytics - Communication Protocols - Internet of Things Applications – Security - Identity Management and Authentication – Privacy - Standardization and Regulatory Limitations.

UNIT II INTERNET OF THINGS: PROTOCOLS AND ENABLING TECHNOLOGIES 9

6LoWPAN and RPL – IEEE 802.15.4 and ZigBee - Bluetooth and BLE – AMQP – CoAP – MQTT - REST Architectures - Enabling technologies of IoT - Internet in IoT – RFID Technology - Wireless Sensor Networks: Technology Overview – M2M – Web of Things - Unit Internet of Things.

UNIT III CLOUD AND FOG COMPUTING FOR IOT 9

Cloud Computing – Amazon Web Services for IoT – Cloud Storage Models - Big Data Processing Pattern - Big Stream - Big Stream and Security – Data Analytics for IoT - Fog Computing and the IoT - The Role of the IoT Hub.

UNIT IV IOT IN PRACTICE 9

Hardware for the IoT - Software for the IoT - Vision and Architecture of a Testbed for the Web of Things - Wearable Computing for the IoT: Interaction Patterns with Smart Objects in RESTful Environments - Effective Authorization for the Web of Things.

UNIT V IOT APPLICATIONS 9

The Smart Grid – Electric Vehicle Charging – Domain Specific IoTs: Home Automation – Cities – Environment – Agriculture – Industry – Health & Lifestyle.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri “Internet of Things - Architectures, Protocols and Standards”, Wiley Publications, 2018, ISBN 9781119359678.
2. Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things - Principles and Paradigms”, Morgan Kaufmann Publication, 2016, ISBN: 978-0-12-805395-9.

REFERENCES

1. Oliver Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, Wiley Publications, 2018, ISBN: 978-81-265-5765-3.
2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, University Press, 2018, ISBN: 978-8173719547.

3. Hakima Chaouchi, “The Internet of Things: Connecting Objects to the Web”, Wiley-ISTE, 2010, ISBN: 9781848211407.
4. Huansheng Ning, “Unit and Ubiquitous Internet of Things”, CRC Press, Taylor & Francis Group, 2013.
5. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, “Internet of Things (IoT) in 5G Mobile Technologies”, Springer Publication, ISBN 978-3-319-30911-8. 2016.

19IT30E DIGITAL MARKETING L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: define the basic concepts of Digital Marketing. (K2)
CO2: develop insight on Current Trends - Digital and Social Statistics (Infographics). (K2)
CO3: explain the Digital Marketing Platforms like Facebook, Twitter, YouTube, etc.(K2)
CO4: describe the basics of Search Engine Optimization (SEO) and Mobile Marketing. (K2)
CO5: describe the various strategies involved in Marketing products and Services Digitally. (K2)

UNIT I INTRODUCTION TO DIGITAL MARKETING 9

Evolution of Digital Marketing from traditional to modern era, Role of Internet;Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.

UNIT II INTERNETMARKETING AND DIGITAL MARKETING 9

Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC. Search Engine Advertising - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation. Display marketing- Types of Display Ads - Buying Models - Programmable Digital Marketing - Analytical Tools - YouTube marketing.

UNIT III SOCIAL MEDIA MARKETING ROLE OF INFLUENCER MARKETING TOOLS AND PLAN 9

Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy. Facebook Marketing - Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools. Linkedin Marketing - Introduction and Importance of Linkedin Marketing, Framing Linkedin Strategy, Lead Generation through Linkedin, Content Strategy, Analytics and Targeting. Twitter Marketing- Introduction to Twitter Marketing, how twitter Marketing is different than other forms of digital marketing, framing content strategy, Twitter Advertising Campaigns.

UNIT IV INTRODUCTION TO SEO SEM WEB ANALYTICS 9

Introduction and need for SEO, How to use internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - Introduction to SEM. Web Analytics - Google Analytics & Google AdWords; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code.

UNIT V MOBILEMARKETING, TRENDS IN DIGITAL ADVERTISING 9

Trends in digital advertising. Mobile Marketing- Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics. E-Mail marketing. Social Media and online consumer engagement. Introduction to social media metrics.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Seema Gupta, “Digital Marketing”, First Edition McGraw Hill Education, 2018.
2. Damian Ryan, Calvin Jones, “Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation”, Second Edition, Kogan Page Publishers, 2012.

REFERENCES

1. Puneet Singh Bhatia, “Fundamentals of Digital Marketing”, First Edition,Pearson, 2017.
2. Ian Dodson, “The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns”, Wiley, 2016.

WEB REFERENCE

1. https://learndigital.withgoogle.com/digitalunlocked
2. https://digitalskills.fb.com/en-in/
3. https://www.hubspot.com/digital-marketing
4. https://onlinecourses.swayam2.ac.in/ugc19_hs26

19IT31E ADVANCED JAVA PROGRAMMING

L T P C
3 0 0 3

PRE REQUISTE

- Problem Solving Techniques
- Java
- Computer Networks
- Internet and Web Technology

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: develop dynamic web applications using servlets. (K3)
CO2: extend dynamic web applications using JSP. (K3)
CO3: implement structs actions and action mappings. (K3)
CO4: configure the spring framework as part of the project. (K3)
CO5: explain distributed and network programs using java. (K2)

UNIT I SERVLETS 9

Servlet Overview and Architecture – Interface Servlet - Servlet Life Cycle – Handling HTTP get Requests – Handling HTTP post Requests – Redirecting Requests.

UNIT II JAVA SERVER PAGES 9

Introduction – Java Server Pages Overview – JSP Tags – JSP Lifecycle - A First JavaServer Page Example – Implicit Objects – Scripting – Standard Actions – Directives.

UNIT III STRUTS 2 9

struts2: Features, architecture, action class, configuration, interceptors – struts2 validation: custom validation and bundled validation.

UNIT IV SPRING FRAMEWORK 9

spring modules - spring in eclipse - dependency injection - dependency AOP spring - spring JDBC template - spring MVC: MVC curd example, File upload example, validation – MVC form tag library - spring remoting.

UNIT V DISTRIBUTED AND NETWORK PROGRAMMING 9

RMI: Stub and Skeleton - Creating a Simple RMI application - RMI application with database– Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URLclasses – configuring the connection

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Paul J. Deitel, Harvey Deitel, "Java How To Program, Late Objects Version", Tenth Edition, 2014.
2. H. M.Deitel, P. J. Deitel, S. E. Santry, "Advanced Java 2 Platform How To Program", Second Edition, Prentice Hall, 2002.

REFERENCES

1. Herbert Schildt, "Java the Complete Reference", Eleventh Edition, Tata McGraw Hill Publishing Company Limited, 2018.
2. Hortsmann and Cornell, "Core Java: Advanced features", Eighth Edition, Volume II, 2013.
3. Ed Roman, "Mastering Enterprise JavaBeans and the Java 2 Platform", Enterprise Edition, Wiley Publishing Inc, 2004.

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19IT32E GAME PROGRAMMING L T P C
3 0 0 3

PRE REQUISTE

- Multimedia Computing

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: discuss the concepts of Game design and development. (K2)
CO2: design the processes, and use mechanics for game development. (K3)
CO3: explain the Core architectures of Game Programming. (K2)
CO4: use Game programming platforms, frame works and engines. (K2)
CO5: create interactive Games. (K3)

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9

3D Transformations – Quaternions - 3D Modeling and Rendering - Ray Tracing – Shader Models – Lighting – Color – Texturing - Camera and Projections - Culling and Clipping - Character Animation - Physics-based Simulation - Scene Graphs.

UNIT II GAME ENGINE DESIGN 9

Game engine architecture - Engine support systems - Resources and File systems – Gameloop and real-time simulation - Human Interface devices - Collision and rigid body dynamics- Game profiling.

UNIT III GAME PROGRAMMING 9

Application layer - Game logic - Game views - managing memory - controlling the main loop - loading and caching game data - User Interface management - Game event management.

UNIT IV GAMING PLATFORMS AND FRAMEWORKS 9
2D and 3D Game development using Flash – DirectX – Java – Python – OpenGL – Game engines – Unity – DX Studio.

UNIT V GAME DEVELOPMENT 9
Developing 2D and 3D interactive games using DirectX or Python – Isometric and TileBased Games - Puzzle games - Single Player games - Multi Player games.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike Mc Shaffrfy and David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, “Game Engine Architecture”, CRC Press / A K Peters, 2009.
3. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” Second Edition, Morgan Kaufmann, 2006.

REFERENCES

1. Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, Second Edition Prentice Hall / New Riders, 2009.
2. Eric Lengyel, “Mathematics for 3D Game Programming and Computer Graphics”, Third Edition, Course Technology PTR, 2011.
3. Jesse Schell, “The Art of Game Design: A book of lenses”, First Edition, CRC Press, 2008.

19IT33E ASP.NET FRAMEWORKS L T P C 3 0 0 3

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Describe about the basics of .NET Framework and C# Framework(K2)
CO2: Describe the architecture and razor pages in ASP. NET(K2)
CO3: Describe the web service layers in ASP.NET Framework(K3)
CO4: Describe the grid view control in ADO.NET(K3)
CO5: Use advanced concepts related to Web Services, WCF, and WPF in project development.(K2)

UNIT 1 INTRODUCTION TO .NET FRAMEWORK AND C# FRAMEWORK 9
Functional Programming-Event Programming and GUI-Limitations of Conventional Programming Technologies before .NET-What is .NET - .NET Platform Explore NET Framework 4.7- Understand Commonanguage Runtime- Garbage Collection-Role of CTS and CLS- Base Class Libraries-Difference between Managed Code and Unmanaged Code- Basics of C# -Nameof Expression-Null Conditional Operator-Expression Bodied Methods- String interpolation-Tuples-Local functions

UNIT II ASP.NET MVC, RAZOR PAGES (PRESENTATION LAYER) 9
Introduction to MVC Models-Introduction to MVC Controllers-Introduction to MVC Views- Creating MVC Models using Entity Framework- Creating a Data Repository- Customizing Entities-Writing Controllers and Actions-Adding Action Filters with Controllers- Creating Views with Razor Syntax-Using HTML Helpers

UNIT III WEB API & REST PRINCIPLE (SERVICE LAYER) 9

Creating a Web API that Supports CRUD Operations, Using Web API with ASP.NET Web Forms, Calling a Web API from a .NET Client- Restful APIs, Scaffolding, Error Handling.

UNIT IV ENTITY FRAMEWORK 6.0 9

Generating and Querying an Entity Data Model (EDM)- Creating Database First-Model First and Code First Entity Data Models-Customizing the Entity Data Model-Create CRUD Database Applications using SqlDataReader-SqlDataAdapter-DataSet-DataRow and DataColumn-Create Database Applications with Stored Procedures- XML and ADO.NET Communication-CreateGridView-Working with FormView, ListView, DetailsView, DataList, Chart Control and DataPager controls-Bound Fields and Customized Template Columns.

UNIT V ADVANCED .NET 9

Introduction to Windows Presentation Foundation (WPF)- Window Communication Foundation and its Application

L: 45 TOTAL: 45 PERIODS

TEXTBOOKS

1. Matthew Macdonald and Robert Standefer, “ASP.NET Complete Reference”, 1st Edition, Mc Graw Hill, 2002
2. Andrew Troelsen, Philip Japikse,” C# 6.0 and the .NET 4.6 Framework”, 7th Edition, Apress, 2015

REFERENCES

1. Vijay Mukhi, “C# The Basics”, 1st Edition,BPB Publications ,2001
2. Christian Nagel, “Professional C# .Net”, 7th Edition, Wrox Publication, 2018
3. https://www.tutorialspoint.com/asp.net/index.htm
4. https://www.javatpoint.com/asp-net-tutorial

19IT34E DEVOPS (AGILE) L T P C
3 0 0 3

PRE REQUISTES

- Linux Basics
- Python

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: discuss the different actions performed through Version control tools like Git & Git Huband. (K2)
CO2: perform Continuous Integration using Jenkins by building and automating test cases using Maven.(K3)
CO3: develop microservices based application using Dockers & Containers. (K3)
CO4: install Ansible and configure ansible roles and to write playbooks and finally executead-commands using Ansible. (K3)
CO5: explain how to continuously monitor application specific tasks using various plugins and implement NagIoS Commands. (K2)

UNIT I INTRODUCTION TO DEVOPS, AWS, GIT & GITHUB 9

Devops Essentials - Introduction To Amazoncloud - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Maven Plugin management.

UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

UNIT V DOCKERS AND CONTAINERS 9

Virtualization vs Containerization, Introduction to Docker, Docker Architecture, Docker Fundamentals, Docker Images & Distribution, Searching for images in docker repository, Pulling images from docker repository, Executing docker images pulled from repository, Create, Start, Stop and Remove Containers, Sharing Data in your Docker Host with Container, Saving Images and containers as Tar File for Sharing.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. James Turnbull, “The Docker Book: Containerization is the new virtualization”, Kindle Edition, 2014.
3. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014.

REFERENCES

1. James Turnbull, Sid Orlando, “The Art of Monitoring”, Kindle Edition, 2016.
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.

19IT35E UNIX INTERNALS L T P C
3 0 0 3

PREREQUISITES

- Computer Organization and Architecture
- Operating System

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: explain the UNIX operating system working principles. (K2)
CO2: describe the UNIX programs using file system calls. (K2)
CO3: explain the structure and file allocation techniques. (K2)
CO4: define the various process scheduling approaches. (K2)
CO5: explain the memory and I/O management concepts. (K2)

UNIT I OVERVIEW 9

General Overview of the System: History – System Structure – User Perspective – Operating System Services – Assumptions about Hardware. Introduction to the Kernel: Architecture of the UNIX Operating System – Introduction to System Concepts. The Buffer Cache: Buffer Headers – Structure of the Buffer Pool – ScenarIoS for Retrieval of a Buffer – Reading and Writing Disk Blocks – Advantages and Disadvantages of the Buffer Cache.

UNIT II FILE SUBSYSTEM 9

Internal Representation of Files: Inodes – Structure of a Regular File – Directories – Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.

UNIT III SYSTEM CALLS FOR THE FILE SYSTEM 9

Open – Read – Write – File and Record Locking – Adjusting the Position of File I/O – Lseek – Close – File Creation – Creation of Special Files – Changing Directory, Root Owner, Mode – stat and fstat – Pipes – Dup – Mounting and Unmounting File Systems – Link – Unlink.

UNIT IV PROCESSES 9

Process States and Transitions – Layout of System Memory – TheContext of a Process – Saving the Context of a Process – Manipulation of the Process Address Space - Sleep. Process Control : Process Creation – Signals – Process Termination – Awaiting Process Termination – Invoking Other Programs – User Id of a Process – Changing the Size of a Process - Shell – System Boot and the INIT Process– Process Scheduling.

UNIT V MEMORY MANAGEMENT AND I/O 9

Memory Management Policies: Swapping – Demand Paging. The I/O Subsystem: Driver Interface – Disk Drivers – Terminal Drivers– Streams – Inter Process Communication.

L: 45 TOTAL: 45 PERIODS

TEXTBOOK

1. Maurice J. Bach, "The Design of the Unix Operating System", First Edition, Pearson Education, 2015.

REFERENCES

1. John Lion, "Lion's Commentary on UNIX", Sixth Edition, Peer-to-Peer Communications, 2004.
2. Goodheart.B, Cox.J, "The Magic Garden Explained: The Internals of UNIX System", Prentice Hall of India, 1994.
3. Daniel P. Bovet & Marco Cesati, "Understanding the Linux Kernel", O'REILLY, Shroff Publishers & Distributors Pvt. Ltd, 2000.
4. Uresh Vahalia, "Unix Internals: The New Frontiers", Pearson Education, 2000.

19IT36E COMPILER DESIGN L T P C
3 0 0 3

PRE REQUISTE

- Problem Solving Techniques
- Data Structures
- Computer Architecture

COURSE OUTCOMES:

Upon completion of the course the students will be able to

CO1: explain the various phases of a prototype compiler. (K2)
CO2: apply lexical rules and grammars for a programming language. (K2)
CO3: describe various parsing techniques. (K2)
CO4: explain memory allocation and symbol table. (K2)
CO5: apply various types of intermediate code generation for various constructs. (K2)

UNIT I INTRODUCTION TO COMPILER 9

Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors encountered in Different Phases-The Grouping of Phases-Compiler Programming Language basics.

UNIT II LEXICAL ANALYSIS 9

Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens–Finite Automata – Converting Regular expression to DFA–Minimization of DFA-Language for Specifying Lexical Analyzers - LEX.

UNIT III SYNTAX ANALYSIS 9

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar, Top-Down Parsing – General Strategies Recursive Descent Parser – Predictive Parser – LL(1) Parser-Shift Reduce Parser–LR Parser- LR(0) Item Construction of SLR Parsing Table –Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer–YACC.

UNIT IV SYNTAX DIRECTED TRANSLATION AND RUN TIME ENVIRONMENT 9

Syntax Directed Definitions–Evaluation Orders for Syntax Directed Definitions–Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

Run-Time Environment: Source Language Issues–Storage Organization–Storage Allocation–Parameter Passing–Symbol Tables–Dynamic Storage Allocation.

UNIT V CODE OPTIMIZATION AND CODE GENERATION 9

Principal Sources of Optimization – Peep-hole optimization – DAG – Optimization of Basic Blocks – Global Data Flow Analysis – Efficient Data Flow Algorithm – Issues in Code Generation – Design of a simple Code Generator

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles, Techniques and Tools”, Second Edition, Pearson Education, 2015.

REFERENCES

1. K.Muneeswaran, “Compiler Design”, Oxford University Press 2013.
2. Steven S. Muchnick, “Advanced Compiler Design and Implementation, “Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.

19IT37E SOFTWARE TESTING TOOLS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- CO1: explain the fundamental concepts in software engineering. (K2)
- CO2: discuss the software testing process. (K2)
- CO3: generate test cases using WinRunner tool. (K3)
- CO4: explain and work on QuickTestPro and selenium testing tool. (K3)
- CO5: apply Load Runner and Test Director tools for testing projects. (K3)

UNIT I SOFTWARE ENGINEERING EVALUATION 9

Software Development Process Models - Requirements Management - Software Design - Coding and Unit Testing - Integration Testing - System testing - Installation and Acceptance - Customer Support / Maintenance.

UNIT II SYSTEM TESTING PROCESS 9

System testing Process - System Test Commencement - System Test Planning - Test Design - Test Execution - Test Reporting and Defect Tracking.

UNIT III WINRUNNER 9

Introduction to WinRunner - checkpoints in WinRunner - Data Driven and Batch Testing - Improve Test Automation in WinRunner - GUI Mapping - Web test Option in WinRunner.

UNIT IV QTP & SELENIUM 9

QuickTestPro Introduction - Edit Test Scripts - Improving Test Automation in QTP - Data Driven and Batch Testing - Web Test Options in QTP – Selenium: Selenium Ide - Overview Of Selenium Webdriver - Testing Framework for Selenium.

UNIT V LOADRUNNER AND TESTDIRECTOR 9

LoadRunner: Introduction to Performance Testing - VuserScript Creation Using LoadRunner - VuserScript Execution and Results Analysis - TestDirector: Site Administrator - Understanding TestDirector.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Ali Mili, Fairouz Tchier, “Software Testing Concepts and Operations”, Wiley, 2015.
2. Nageshwar Rao Pusuluri, “Software Testing Concepts and Tools”, Dreamtech Press, 2008.

REFERENCES

1. Dr. K.V.K.K. Prasad, “Software Testing Tools: Covering WinRunner, Silk Test, LoadRunner, JMeter, TestDirector and QTP with case studies”, 2009.

WEB REFERENCES

1. http://sqa.fyicenter.com/winrunner_tutorial/index.html
2. https://www.tutorialspoint.com/qtp/index.html
3. https://www.wisdomjobs.com/e-university/selenium-tutorial-476.html
4. https://www.tutorialspoint.com/loadrunner_online_training/index.asp
5. https://www.wisdomjobs.com/e-university/loadrunner-tutorial-170.html
6. http://www.etestinghub.com/testdirector.php

19IT38E FUNCTIONAL PROGRAMMING

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: write simple Programs using functional programming. (K2)
CO 2: implement List with functional programming. (K2)
CO 3: apply Haskell in various Data structures. (K3)
CO 4: analyze the efficiency of Haskell Programming. (K3)
CO 5: create functional programming with Monads. (K3)

UNIT I INTRODUCTION 9

Functional programming-Introduction-Function Types-Function composition-Example-Haskell Platform Expression, Types and values-Session with GHCi-Names and operators-Evaluation-Types and Type classes-Printing Values-Modules-Haskell Layout-Numbers-type class NUM-numeric type classes-computing floors-Natural Numbers.

UNIT II LIST 9

List notation - Enumerations - List comprehensions - Some basic operations - Concatenation - concat, map and filter -zip and zip With - Common words, completed –A simple Sudoku solver- Specification - Lawful program construction Pruning the matrix of choices - Expanding a single cell.

UNIT III DATA STRUCTURE WITH HASKELL 9

Functional Vs Imperative Data Structure-Strict Vs Lazy Evaluation-List-Binary Search Trees-Left list Heaps-Binomial Heaps-Red Black Trees-Techniques of Amortized Analysis-Queues-. Drawing Primitive Shapes,Sierpinski’s Triangle,Snow-flake,Coordinate Systems.

UNIT IV PROOFS AND EFFICIENCY 9

Induction over natural numbers - Induction over lists - The function foldr - The function foldl - The function scanl - The maximum segment sum -Lazy evaluation-Controlling space-Controlling time- Analysing time- Accumulating parameters –Tupling-Sorting.

UNIT V IMPERATIVE FUNCTIONAL PROGRAMMING 9

The IO monad- More monads- The State monad - The ST monad- Mutable arrays - Immutable arrays-Parsers as monads -Basic parsers - Choice and repetition-Grammars and expressions-Showing expressions.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Richard Bird, “Thinking Functionally With Haskell”, Cambridge University Press, 2015
2. Chris Okasaki,” Purely Functional Data Structures”, Cambridge University Press, 2014

REFERENCES

1. Simon Thompson Haskell: “The Craft of Functional Programming”, Third Edition,2011
2. Graham Hutton, “Programming in Haskell”, Cambridge University Press, 2007.
3. Bryan O'Sullivan, Don Stewart, and John Goerzen, “Real World Haskell”, O'Reilly Media, 2008.
4. Miran Lipovača, “Learn You a Haskell for Great Good! A Beginner's Guide”, No Starch Press, 2011.
5. Richard Bird, “Introduction to Functional Programming using Haskell”, second edition, Prentice-Hall International, 1998

19IT39E WIRELESS ADHOC AND SENSOR NETWORKS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: Identify different issues in wireless ad hoc and sensor networks. (K2)
CO2: analyze protocols developed for ad hoc and sensor networks. (K3)
CO3: identify and understand security issues in ad hoc and sensor networks. (K2)
CO4: describe the importance of QoS in wireless sensor network. (K2)
CO5: identify the attacks and suitable defense mechanism in sensor networks. (K2)

UNIT I MAC & ROUTING IN AD HOC NETWORKS 9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols.

UNIT II TRANSPORT & QOS IN AD HOC NETWORKS 9

TCP‟s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model.

UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – ContentionBased protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols.

UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS 9

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Inc., 2005.

REFERENCES

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, “Ad Hoc Mobile Wireless Networks”, Auerbach Publications, 2008.

2. Carlos De MoraisCordeiro, Dharma Prakash Agrawal, “Ad Hoc and Sensor Networks: Theory and Applications” Second Edition, World Scientific Publishing, 2011.
3. WaltenegusDargie, Christian Poellabauer,” Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley and Sons, 2010.
4. Xiang-Yang Li, “Wireless Ad Hoc and Sensor Networks: Theory and Applications”, Seventh Edition, Cambridge university Press, 2008.

19IT40E NEXT GENERATION NETWORKS L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: explain the 4G networks and LTE. (K2)
CO2: design systems for the requirements of the recent standards. (K2)
CO3: outline the concept of fiber access technologies. (K2)
CO4: discuss the mobile IP networks and routing. (K2)
CO5: describe the mobile ad hoc networks and routing. (K2)

UNIT I INTRODUCTION 9

Introduction to 1G/2G/3G/4G Terminology - Evolution of Public Mobile Services - Motivation for IP Based Wireless Networks - Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G Advanced Features and Roadmap Evolutions from LTE to LTEA - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with Small World Properties – 5G Roadmap – Ten Pillars of 5G.

UNIT II REVIEW OF ACCESS TECHNOLOGIES 9

Phone-Line modem– cable-access ISDN– Emerging Broad band Technologies–Cable DSL–Fiber and Wireless– Standards for access network.

UNIT III FIBER ACCESS TECHNOLOGIES 9

Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison, Broadband PON , Gigabit-Capable PON.

UNIT IV MOBILE - IP NETWORKS 9

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V MOBILE AD–HOC NETWORKS 9

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV) – Reactive routing : Dynamic Source Routing (DSR) – Ad hoc On-Demand Distance Vector Routing (AODV) – Hybrid Routing: Zone Based Routing (ZRP).

L:45; TOTAL :45 PERIODS

TEXT BOOKS

1. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, “Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach”, John Wiley & Sons, 2014.
2. Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, 2014.
3. Niel Ransom and Albert A. Azzam, “Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS", McGraw Hill, 1999.
4. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, Wiley, 2015.

REFERENCES

1. Walter J Woralski, “ADSL and DSL Technologies”, McGraw Hill Computer Communication Series, Second Edition, Oct 2001.
2. William Webb, “Introduction to Wireless Local Loop Broadband and Narrow Band System”, Mobile Communication Series, Artech House Publishers, Second Edition 2000.
3. C.Siva Rama Murthy and Mohan Gurusamy, “WDM Optical Networks – Concepts, Design and Algorithms”, Prentice Hall of India Pvt. Ltd, New Delhi , 2002.
4. Ian F. Akyildiz, Jiang Xie and ShantidevMohanty, “A Survey of mobility Management in Next generation All IP- Based Wireless Systems”, IEEE Wireless Communications Aug 2004.
5. Yin Zhang, Min Chen, “Cloud Based 5G Wireless Networks – Springer Briefs in Computer Science”, Springer, 2016.

19IT41E NETWORK PROGRAMMING AND MANAGEMENT L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1: explain the basics of computer networks and the inter-process communication. (K2)
CO2: elaborate the client server sockets and some of its widely used protocols. (K2)
CO3: narrate the client and server side network programming concepts and its applications. (K3)
CO4: explain the basics of network management concepts and its types. (K2)
CO5: discuss the various network management protocols and tools. (K2)

UNIT I INTRODUCTION TO NETWORK PROGRAMMING 9

Basic Network Concepts – Streams – Multi-threading - Inter-thread and Inter-process Communication - Internet Addresses - URLs and URIs – HTTP – URLConnections.

UNIT II SOCKETS FOR CLIENTS AND SERVER 9

Using Client Sockets - Constructing and Connecting Client Sockets - Setting Client Socket Options - Using ServerSockets - Constructing Server Sockets – Server Socket Options - Support for Communication-Based Services.

UNIT III CLIENT–SERVER NETWORK PROGRAMMING 9

Client-Side: Introduction - Web Documents Classification - Static Documents - Active Documents, Server-Side: Introduction - Non-Java Server-Side Network Programming Solutions – JavaServlets - Java Server Pages.

UNIT IV NETWORK MANAGEMENT OVERVIEW 9

Requirements for the Management of Networked Systems - IP Network Management - Network Management Issues - Network Management Architecture – Challenges of IT Managers - Passive and Active Network Monitoring - MPLS Network Management.

UNIT V NETWORK MANAGEMENT PROTOCOLS AND TOOLS 9

SNMP – RMON – System Utilities for Management – Network Statistics Management Systems – MIB Engineering – NMS Design – Mobile Wireless Networks - Network Management Applications.

L: 45; TOTAL :45 PERIODS

TEXT BOOKS

1. Elliotte Rusty Harold, “Java Network Programming”, Fourth Edition, O’Reilly Media, Inc, ISBN: 978-1-449-35767-2, 2013.
2. Mani Subramanian, “Network Management: Principles and Practice”, Second Edition, Pearson Education, ISBN: 978-81-317-2759-1, 2010.

REFERENCES

1. Bogdan Ciubotaru, Gabriel-Miro Muntean, “Advanced Network Programming – Principles and Techniques: Network Application Programming with Java”, Springer, ISBN 978-1-4471-5291-0, 2013.
2. Adrian Farrel, “Network Management Know It All”, Morgan Kaufmann Publishers, ISBN 978-0-12-374598-9, 2009
3. W. Richard Stevens, “TCP/IP Illustrated, Volume 1: The Protocols”, Addison-Wesley, ISBN: 0201633469, 1994.
4. Jan Graba, “An Introduction to Network Programming with Java”, Springer, ISBN-13: 978-1-84628-380-2, 2007.
5. Timothy Rooney, “IP Address Management Principles and Practice”, Wiley-IEEE Press, 2011.
6. Richard Burke, “Network Management: Concepts and Practice, A Hands-On Approach”, Pearson Education, ISBN: 9788131718490, 2008.

19IT42E INFORMATION SECURITY L T P C
3 0 0 3

PRE REQUISTE

- Cryptography and Network Security
- Fundamentals of Network

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the various components and their security in an information system. (K2)
CO2: acquire the basic knowledge on vulnerabilities in any computing system. (K2)
CO3: analyze the possible security attacks in complex real time systems. (K2)

CO4: explain the concepts of audits and controls for information security. (K2)
CO5: explore the knowledge on different techniques for physical security. (K2)

UNIT I INTRODUCTION 9

History - Information Security - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing the Components - Balancing Security and Access – SDLC – Security.

UNIT II SECURITY INVESTIGATION 9

Need for Security - Business Needs - Threats - Attacks - Legal - Ethical and Professional Issues.

UNIT III SECURITY ANALYSIS 9

Risk Management: Overview- Identification – Assessment – Control Strategies – Benchmarking and Best practices.

UNIT IV AUDITS, CONTROLS AND CONSOLIDATION 9

Introduction – Establishing a control environment – security audits – preparing and planning for a security audit – executing a security audit – security policies: information security policies – building and implementing security policies.

UNIT V PHYSICAL DESIGN 9

Security Technology – IDS - Scanning and Analysis Tools – Cryptography - Access Control Devices - Physical Security - Security and Personnel.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Cengage Learning, Fourth Edition, 2012.

REFERENCES

1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw-Hill, 2003.
3. Amjad Umar, “Information Security and Auditing in the Digital Age A Practical Managerial Perspective”, NGE solutions, Inc. 2004.
4. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.

19IT43E CYBER FORENSICS AND ETHICAL HACKING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the basics of computer forensic. (K2)
CO2: identify different computer forensic tools to a given scenario. (K2)
CO3: analysis and validate the various forensics data techniques. (K3)
CO4: identify the vulnerabilities in a given network infrastructure. (K3)
CO5: Apply the real-world hacking techniques to test system security. (K4)

UNIT I INTRODUCTION TO COMPUTER FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

UNIT IV ETHICAL HACKING 9

Introduction to Ethical Hacking -Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing.

UNIT V ETHICAL HACKING IN WEB 9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2016.
2. CEH official Certfied, “Ethical Hacking Review Guide”, Wiley India Edition, 2015.

REFERENCES

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, Third Edition, Prentice Hall, 2013.
3. AnkitFadia, “Ethical Hacking”, Second Edition, Macmillan India Ltd, 2006.
4. Kenneth C.Brancik, “Insider Computer Fraud”, Auerbach Publications Taylor & Francis Group–2008.

19IT44E INFORMATION THEORY AND CODING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: define the fundamental concepts of Information Theory, Source Coding and Error Control. (K2)
CO2: examine the various coding and error Control Mechanisms available for text and audio data. (K2)
CO3: demonstrate various source compression codes for image and video data. (K2)
CO4: explain various methods of generating and detecting different types of error correcting block codes. (K2)
CO5: formulate the basic equations of Convolutional codes. (K2)

UNIT I INFORMATION THEORY 9

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

UNITII SOURCE CODING: TEXT, AUDIO AND SPEECH 9

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding.

UNIT III SOURCE CODING: IMAGE AND VIDEO 9

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261,H.264 and MPEG standards.

UNIT IV ERROR CONTROL CODING: BLOCK CODES 9

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, binary cyclic codes, BCH codes, Reed-Soleman codes, Golay codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.

UNIT V ERROR CONTROL CODING: CONVOLUTIONAL CODES 9

Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential and Maximum-Likelihood decoding - Viterbi algorithm – Principle of Turbo coding.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. R Bose, “Information Theory, Coding and Cryptography”, Tata McGraw Hill, 2008
2. Fred Halsall, “Multimedia Communications: Applications, Networks, Protocols and Standards”, Pearson Education Asia, 2007.
3. Paul May, “Mobile Commerce: Opportunities, Applications and Technologies of Wireless Business”, Cambridge University Press, 2001.

REFERENCES

1. K.Sayood, “Introduction to Data Compression”, Elsevier, Third Edition, 2012.
2. S Gravano, “Introduction to Error Control Codes”, Oxford University Press, 2007
3. Amitabha Bhattacharya, “Digital Communication”, Tata McGraw Hill, 2006.

19IT45E	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: explain how data are collected, managed and stored using data science (K2)
- CO2: describe various statistical and probability techniques used in the data science. (K2)
- CO3: explain the key concepts in data visualization approaches in the real-world applications (K2)
- CO4: analyze various data analytics techniques for the dataset. (K3).
- CO5: apply R tool used for solving problems in data science. (K3).

UNIT I INTRODUCTION 9

Benefits and uses of data science and big data – Facets of data – The data science process: Overview-Defining goals-Retrieving data – Cleaning, integrating and transforming data – Exploratory data analysis- Build the model – The big data ecosystem and data science – An introductory working example of Hadoop.

UNIT II STATISTICAL TECHNIQUES 9

Different Sectors using Data science-Linear algebra- vectors, matrices, product of matrix & vector, rank, null space – Statistics- Describing a single set of data-correlation- Simpson's paradox- Probability: Conditional probability - Bayes theorem-Random variables- Continuous and normal distribution- Hypothesis Testing.

UNIT III DATA VISUALIZATION 9

Basic principles, ideas and tools for data visualization, Plots and inferential statistics techniques matplotlib – barcharts - line charts - Scatter plots - Hypothesis and inferences: Statistical hypothesis testing- p-values – Confidence intervals – p-Hacking – Bayesian inference.

UNIT IV DATA ANALYTICS 9

Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA-Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions, Mathematical computing with Python (NumPy)- Scientific Computing with Python (SciPy). Data Manipulation with Pandas.

UNIT V APPLICATION TOOL 9

R Programming, Working with Data in R, data analysis problems using R tool, Data visualization in R, Recent trends in various data collection, application development methods in data science with Jupiter Stack.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Joel Grus, "Data Science from Scratch: First principles with python", Second edition, O'Reilly, 2019.
2. Davy cielen arno d. B. Meysman mohamed ali, "Introducing data science, big data, machine learning, and more, using python tools", Manning Publications, 2016.

REFERENCES

1. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media Inc, 2017.
2. Vijay Kotu, Bala Deshpande, Data Science: Concepts and Practice, Second Edition, Morgan Kaufmann Publishers,2018
3. Lillian Pierson, Data Science For Dummies, John Wiley & Sons, 2017.

19IT46E MACHINE LEARNING TECHNIQUES L T P C
2 0 2 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: explain the supervised and unsupervised techniques in machine learning. (K2)
CO2: understand various classification techniques used in machine learning. (K2)
CO3: analyze various types of clustering techniques for analyzing data. (K3)

CO4: apply optimization techniques for the effective implementation of algorithms. (K3)
CO5: apply the reinforcement learning concepts and its real time applications. (K3)

UNIT I INTRODUCTION 12

Introduction to machine learning – Machine learning applications – Supervised - Semi supervised - Unsupervised learning – Learning a class from example – Probably Approximately Correct learning – Noise – Learning multiple classes – Regression – Model selection and generalization.

UNIT II CLASSIFICATION TECHNIQUES 12

Introduction – Univariate trees: classification trees - Regression trees – Pruning – Rule extraction from trees – Learning rules from data – Multivariate trees- Linear discrimination – Generalizing linear model – Geometry of the linear discriminant – Pair wise separation – Parametric discrimination – Gradient Descent-Logistic discrimination

UNIT III CLUSTERING TECHNIQUES 12

Introduction – mixture densities – K-means Clustering – Expectation maximization algorithms – mixture of latent variable models – Supervised learning after clustering- Spectral clustering – Hierarchal clustering – Choosing the number of clusters.

UNIT IV KERNEL MACHINES 12

Support Vector Machine: Optimal separating hyper plane – *v*-SVM – Kernel trick – Vectorial kernels – Multiple kernel learning – multiclass kernel machines – Kernal machines for regression – kernel machines for ranking – One class kernel machine – Large margin nearest neighbor classifier – kernel dimensionality reduction.

UNIT V REINFORCEMENT LEARNING 12

Introduction – Single state case: K-Armed Bandit – Elements of reinforcement learning – Model based learning: Value iteration – Policy iteration – Temporal Difference learning: Exploration stratergies- Deterministic and Non deterministic Rewards and Actions – Eligibility traces – Generalization – Partially observable states.

L: 30; P: 30; TOTAL: 60 PERIODS

TEXT BOOKS

1. Ethem Alpaydin, “Introduction to machine learning”, Third edition, PHI Learning Pvt.Ltd, 2017.

REFERENCES

1. Joel Grus, “Data Science from Scratch: First principles with python”, Second edition, O’Reilly, 2019.
2. Andreas C.Muller and Sarah Guido, —Introduction to Machine Learning with Python, O‘Reilly Media, 2017.
3. https://www.coursera.org/learn/machine-learning.

19IT47E	DATA ENGINEERING CONCEPTS AND TOOLS	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1: discuss big data architecture and its computing techniques. (K2)
CO 2: Analyze the Hbase architecture functionalities. (K3)
CO 3: apply the data storage and processing techniques. (K3)

CO 4: describe the data stream architecture and its processing techniques (K3).
CO 5: explore the data analysis techniques using Power BI. (K3)

UNIT I INTRODUCTION 12

Evolution of Big data – Structure in big data – characteristics of big data – Big data Analytics – Architecture of big data systems - Big Data Use Cases – Data analytics life cycle: Life cycle for data- centric projects – Big data life cycle- Distributed and parallel computing for big data- cloud services and providers in big data market.

UNIT II HADOOP ECOSYSTEM 12

Introduction - HDFS architecture – Using HDFS files – HDFS commands – HBASE architecture – Storing Big data with HBase – Combing HDFS and HBase- Selecting the suitable Hadoop data organization for applications.

UNIT III DATA STORAGE AND PROCESSING 12

Overview of YARN – YARN Architecture – Scheduler – YARN configuration & commands – Log management – exploring Hive: Variables, Properties and Queries – Data types – Built-in functions – Hive DDL-Data manipulation in Hive – Data retrieval queries - Using JOINS in Hive- Impala – Kudu.

UNIT IV MINING DATA STREAMS 12

Introduction to Streams Concepts – Processing data streams – Data streaming architecture using Kafka and Spark- Spark streaming in R- Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions

UNIT V DATA ANALYSIS WITH POWER BI 12

Introduction – Preparing data for analysis – Power BI architecture - Key metrics – Comparison analysis – Trend analysis – Ranking – Contribution analysis – Variance – Correlation – Frequency analysis- Power BI Visualizations- Interacting with Power BI.

L: 30; P: 30; TOTAL: 60 PERIODS

TEXT BOOKS

1. “Big data Black book”, comprehensive problem solver, DreamTech press, 2015 Edition.
2. Brain Larson, “Data Analysis with Microsoft Power BI”, first Edition, McGrawHill publication, 2019.

REFERENCES

1. Seema Acharya & Subhashini Chellappan, “Big Data and Analytics”, Wiley publications, Second Edition, 2019.
2. Sudha Sadasivam, R.Thirumahal, “Big data Analytics”, Oxford Higher education, 2020.
3. Bart Baesens, —Analytics in a Big Data World: The Essential Guide to Data Science and its Applications‖, Wiley Publishers, 2015.
4. Kim H. Pries and Robert Dunnigan, —Big Data Analytics: A Practical Guide for Managers‖, CRC Press, 2015.

19IT48E **WEB DATA MINING** **L T P C**
2 0 2 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: explain the association rule mining technique for the web data. (K2)
CO2: analyze various information retrieval methods used in webpage processing. (K3)
CO3: explain the social network analysis and web searching techniques.(K2)
CO4: describe the use of various web crawlers for updating web content.. (K2)
CO5: analyze the data modeling techniques for web usage mining. (K3)

UNIT I INTRODUCTION 12

Introduction to internet and WWW, Data Mining Foundations, Association Rules and Sequential Patterns, Basic Concepts of Association Rules, Apriori Algorithm, Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining.

UNIT II INFORMATION RETRIEVAL 12

Basic concepts - Information Retrieval models – Relevance Feedback - Text and Web Page Pre-Processing: Stopword Removal, Stemming, Web Page Preprocessing, Duplicate Detection - Inverted Index and its compression- Latent Semantic Indexing- Web Search- Meta-Search: Combining Multiple Rankings- Web Spamming.

UNIT III SOCIAL NETWORK ANALYSIS 12

Introduction- Co-Citation and Bibliographic Coupling- Page Rank Algorithm - Strengths and Weaknesses of PageRank- Timed PageRank and Recency Search- HITS Algorithm: Finding Other Eigenvectors- Community Discovery: Bipartite Core Communities- Maximum Flow Communities- Email Communities Based on Betweenness - Overlapping Communities of Named Entities.

UNIT IV WEB CRAWLING 12

A Basic Crawler Algorithm – Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stopword Removal and stemming, Link Extraction and Canonicalization, Spider Traps, Page Repository, Concurrency- Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.

UNIT V WEB USAGE MINING 12

Data Collection and Preprocessing, Sources and Types of Data, Key Elements of Web Usage Data Preprocessing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Session and Visitor Analysis, Cluster Analysis and Visitor Segmentation, Association and Correlation Analysis, Analysis of Sequential and Navigation Patterns- Classification and Prediction based on Web User Transactions- Query log mining.

L: 30; P: 30; TOTAL: 60 PERIODS

TEXT BOOKS

1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data”, 2nd Edition, Springer Publications, 2011.

REFERENCES

1. Avinash Kaushik, “Web Analytics 2.0, The art of online accountability and science of customer centricity”, Wiley publication, 2016.
2. Anthony Scime, Web Mining: Applications and Techniques, (State University of New York at Brockport, USA), 2005.
3. Mining the Web: Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Morgan Kaufmann Publishers. 2002.

19IT49E BUSINESS INTELLIGENCE AND ANALYTICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: describe the importance of business process and reporting. (K2)
CO2: explain various business analytics process in an organization. (K2)
CO3: explain the descriptive data analytics process and issues. (K2)
CO4: analyze the performance of various predictive analytics techniques for business data. (K3)
CO5: analyze the prescriptive analytics models for solving problems in the organization. (K3)

UNIT I INTRODUCTION 9

Introduction- Business Process Management lifecycle – Context of process Identification – Process Architecture - BI architecture and components - building blocks of business reports- types of business reports, and the components and structure of business reporting systems- Online Analytical processing (OLAP).

UNIT II BUSINESS ANALYTICS 9

Introduction- Scope - Business Analytics Process - Relationship of Business Analytics Process and organization- competitive advantages of Business Analytics. Statistical Tools: Statistical Notation- Descriptive Statistical methods- Statistical Testing.

UNIT III DESCRIPTIVE ANALYTICS 9

Introduction, Visualizing and Exploring business data, Descriptive Statistics, Sampling and Estimation: Sampling Methods, Sampling Estimation, Introduction to Probability Distributions, Marketing/Planning Case Study on Descriptive Analytics model.

UNIT IV PREDICTIVE ANALYTICS 9

Introduction, Predictive Modeling: Logic-Driven Models, Data-Driven Models, Data mining for Types of Variation in Time Series Data, Regression Model, Smoothing, Fitting models to Data, Marketing/Planning.

UNIT V PRESCRIPTIVE ANALYTICS 9

Introduction, Decision Theory Model Elements for business process, Types of Decision Environments, Decision Theory Formulation, Decision-Making Under Certainty, Decision-Making Under Risk, Decision-Making under Uncertainty, Expected Value of Perfect Information, Sequential Decisions and Decision Trees, The Value of Imperfect Information: Bayes‟s Theorem, Decision Theory Practice Problems.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications, Pearson FT Press, 1st Edition, 2014.

REFERENCES

1. Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, “Fundamentals of Business Process Management”, 2nd Edition, Kindle Edition, 2018.
2. James R Evans, “Business Analytics”, Pearson Education, 2nd Edition, 2017.
3. “Business intelligence concepts, tools, and applications”, Coursera course materials.

19IT50E PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

L T P C
0 0 6 3

COURSE OBJECTIVES

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Upskill in emerging technologies and apply to real industry-level use cases
CO2: Understand agile development process
CO3: Develop career readiness competencies, Team Skills / Leadership qualities
CO4: Develop Time management, Project management skills and Communication Skills
CO5: Use Critical Thinking for Innovative Problem Solving
CO6: Develop entrepreneurship skills to independently work on products

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration	3

	video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

TECHNICAL SKILLS		**SOFT SKILLS**	
Criteria	***Weightage***	***Criteria***	***Weightage***
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
Total	**70**	**Total**	**30**
Total Weightage		**100**	
Passing Requirement		**50**	
Continuous Assessment Only			

P: 90; TOTAL: 90 PERIODS

B.Tech. – INFORMATION TECHNOLOGY

ONE CREDIT ELECTIVE COURSES

19IT01L AGILE DEVELOPMENT PROCESS

	L	T	P	C
	1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: describe the fundamental principles and practices associated agile development methods. (K2)

LIST OF CONTENTS

1. Agile Methodology
2. Agile Models in Software Development & Testing
3. SCRUM Process Framework
4. KANBAN Process Framework
5. Software Development using SCRUM
6. Software Testing using KANBAN

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Robert C.Martin, “Agile Software Development, Principles, Patterns, and Practices”, Pearson New International publication, First Edition, 2013.
2. Ken Schwaber, Mike Beedle,”Agile Software Development with Scrum”, First Edition, Van Haren Publishing, 2001.

19IT02L COMPUTER HARDWARE ANDTROUBLESHOOTING

	L	T	P	C
	0	0	2	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: explain the working principles of components required for system assembly, data transfer and networking. (K2)

CO 2: perform software installation, data recovery and troubleshooting techniques. (K3)

LIST OF EXPERIMENTS

1. PC HARDWAREOVERVIEW

Basic Parts of PC, System board, Microprocessor, Interrupts, DMA, SMPS, BIOS, POST sequence, System configuration, Memory, Mass storage, I/O interface standards.

2. BUS STANDARDS AND NETWORKING

ISA, PCI, SCSI, IDE, USB, Network Interface Cards, Cables and connectors, MODEM.

3. INSTALLATION AND PREVENTIVE MAINTENANCE

System Configuration, Installation Practice, PC Assembling and Integration, Virus, data Recovery.

4. TROUBLESHOOTING & TOOLS

Troubleshooting problems of system boards, add on cards and peripherals.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Michael Meyers, “Introduction to PC Hardware and Troubleshooting”, Mc Graw Hill Publisher, First Edition, 2003.
2. Kyle McRae, Gary Marshall,” Computer Troubleshooting: The Complete step-by-step Guide to Diagnosing and Fixing Common PC Problems”, Second Edition, 2008
3. Govindarajalu.B, “IBM PC AND CLONES: Hardware, Troubleshooting and Maintenance”, Tata McGraw-Hill, 2011.

19IT03L PHP PROGRAMMING L T P C

0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: develop PHP programs to build interactive, data-driven sites with Database connectivity.(K3)

LIST OF EXPERIMENTS

1. History
2. Web Brower
3. Web - Server, Xampp
4. Installation and Configuration files
5. Variable Types, Constants
6. Function, recursion, Pure Functions and Referential Transparency, Higher Order Functions, Lambda Functions, Partial Functions and Currying
7. Arrays
8. Date & Time, Image Uploading
9. PHP OOP concepts: Class Inheritance, Auto loading Classes, constructors and destructors, Member and method visibility, Abstract Classes, Object Interfaces, Overloading, Class Members
10. WEB FEATURES: Sessions, Forms, GET and POST data, Cookies, HTTP Headers
11. Database Programming
12. AJAX
13. Error handling in PHP
14. File handling in PHP

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. W.J.Gilmore “A Programmer‟s Introduction to PHP4.0”, Apress, 2001.
2. W.Jason Gilmore, “Beginning PHP and MySQL”, Fifth Edition, Apress, 2014.

19IT04L THEORYOFCOMPUTATION L T P C

1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: explain the basics of finite automata and construct the equivalence of Languages described by Context-free grammars and push down automata. (K3)

CO 2: describe the working principles of Turing machine. (K2)

LIST OF CONTENTS

1. REGULAR LANGUAGES

Regular Expression (RE) - Regular operations - Closure properties- Finite Automata: Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata (NFA) – Nonregular languages

2. CONTEXT FREE LANGUAGES

Context-free grammars - Parse Trees- Pushdown automata - Non-context-free languages - Equivalence of Pushdown automata and CFG

3. TURING MACHINES AND DECIDABILITY

Turing Machines - Programming Techniques for TM - Decidable languages - The halting problem

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. J.E. Hopcroft, R. Motwani and J.D.Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2007.
2. Anil Maheshwari, Michiel Smid, "Introduction to Theory of Computation", E-book, 2016.

19IT05L BASICS OF COMPILER DESIGN

	L	T	P	C
	1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: describe the functions of lexical analyzer and design various types of parser for language specification. (K3)

CO 2: apply various types of intermediate code generation for various constructs. (K3).

LIST OF CONTENTS

1. INTRODUCTION TO COMPILER

Compiler and its phases - The role of language translation in the programming process - Comparison of interpreters and compilers.

2. LEXICAL AND SYNTAX ANALYSIS

Lexical analyzer - Specification of tokens –Recognition of tokens– Role of parser – CFG - Top Down and Bottom up Parsing - Case study: Parsing with Lex and Yacc.

3. INTERMEDIATE CODE GENERATION

Different Intermediate Forms - Implementation of Three Address Code - Intermediate code for all constructs of programming languages - Directed Acyclic Graph. Case Study: C Complier

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. K.Muneeswaran, “Compiler Design”, Oxford University Press, 2013.
2. Alfred Aho, Monica S.Lam, Ravi Sethi and Jeffrey D.Ullman, “Compiler Principles, Techniques and Tools”, Third Edition, Addison Wesley, 2006.

19IT06L VIRTUALIZATION L T P C

1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: describe the fundamental concepts of server and client virtualization. (K2)

CO 2: develop an application by utilizing cloud platforms such as Google app Engine and Amazon Web Services. (K3)

LIST OF CONTENTS

1. INTRODUCTION TO CLOUD COMPUTING

Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Cloud, Features of a cloud, Infrastructure-as-a-Service, Software-as-a-Service, Platform- as-a-Service, Google App Engine, Microsoft Azure;, Amazon EC2; Challenges and Risks.

2. CLOUD TECHNOLOGIES HYPERVISOR

Introduction, Types of Hypervisor. Virtualization Technology: Virtual machine Technology, virtualization applications in enterprises.

3. NETWORK STORAGE

Network Attached Storage (NAS), Storage Area Network (SAN), Network Virtualization, Server Virtualization, Pitfalls of virtualization.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, “Cloud Computing: Principles and Paradigms”, John Wiley & Sons, First Edition, 2011.
2. Mitch Tulloch with Nigel Cain, Alvin Morales, Michel Luescher, Damian Flynn, “Microsoft System Center: Building a Virtualized Network Solution”, Microsoft Press, First edition, 2014.

19IT07L SOCIAL MEDIA APPLICATION DEVELOPMENT L T P C

1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: explain various concepts in developing Social Media Applications. (K2)

LIST OF CONTENTS

1. Overview of Graph theory
2. Strong and Weak Ties
3. Positive and Negative Relationships

4. Evolutionary Game Theory
5. Modeling Network Traffic using Game Theory
6. Auctions
7. Markets and Strategic Interaction in Networks
8. Bargaining and Power in Networks
9. Information Cascades
10. Power Laws
11. Cascading Behavior in Networks
12. Design own social media application

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.
2. Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.

19IT08L IoS DEVELOPMENT

L T P C
1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: describe key programming terms relevant to Swift and IoS programming. (K2)
CO 2: develop mobile apps using networking and tvOS. (K3)

LIST OF EXPERIMENTS

1. **SWIFT**
   Introduction- Control- Function and closure-Class and structure.

2. **IoS**
   User Interactivity - Multiple View Controllers & Navigation –webservice.

3. **PERSISTENCE AND NETWORKING**
   Introduction to Developing for tvOS –Location- Locomotion and Motion.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Vandad Nahavandipoor, "IoS 8 Swift Programming Cookbook Solutions & Examples for IoS Apps", O'Reilly Media, 2014.
2. Boisy G. Pitre, "Swift for Beginners: Design and Development", PEACHPIT PRESS, 2013.
3. Christian Keur and Aaron Hillegass, "IOS Programming: The Big Nerd Ranch, 2015.
4. Guide -Big Nerd Ranch Guides", Fourth Edition, 2011.

19IT09L E-COMMERCE SECURITY

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: explain wide range of security issues in online forums and services. (K2)

CO 2: illustrate various E-commerce security techniques. (K2)

LIST OF CONTENTS

1. Online Security Issues - Overview
2. Security for Client Computers
3. Communication Channel Security
4. Security for Server Computers
5. Organizations that provide Computer Security
6. Payment Systems for Electronic Commerce
7. Online Payment Basics
8. Digital Wallets
9. Internet Technologies and the Banking Industry
10. Criminal Activity and payment systems: Phishing and Identity Theft

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Gray P. Schneider, “Electronic Commerce”, Course Technology, Cengage Learning, USA, 10th Edition, 2012.
2. Anup K. Ghosh, “E-Commerce Security and Privacy (Advances in Information Security)”, Springer, 2001.

19IT10L HADOOP ARCHITECTURE AND INSTALLATION

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: install and build a Hadoop cluster capable of processing large data. (K3)

CO 2: implement Map/Reduce concepts for parallel programming using Java. (K3)

LIST OF EXPERIMENTS

1. Hadoop Architecture
2. Installing Ubuntu with Java 1.8 on VM Workstation 11
3. Hadoop Versioning and Configuration
4. Single Node Hadoop 1.2.1 installation on Ubuntu 14.4.1
5. Multi Node Hadoop 1.2.1 installation on Ubuntu 14.4.1
6. Linux commands and Hadoop commands1.8. Cluster architecture and block placement
7. Pseudo Distributed Mode
8. Fully Distributed Mode
9. Master Daemons(Name Node, Secondary Name Node, Job Tracker)

10. Slave Daemons(Job tracker, Task tracker)
11. Task Instance
12. Hadoop HDFS Commands
13. Accessing HDFS
14. CLI Approach
15. Implementation of Map/Reduce using Java

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. https://www.tutorialspoint.com/hadoop/hadoop_tutorial.pdf.
2. Tom White, “Hadoop: The Definitive Guide, Storage and Analysis at Internet Scale”, O'Reilly Media / Yahoo Press, Third Edition, 2012.

19IT11L MICROCONTROLLER AND RASPBERRY PI

	L	T	P	C
	1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: describe the architecture and applications of microcontroller. (K2)

CO2: describe the functionality of raspberry Pi and its interfacing. (K2)

LIST OF CONTENTS

1. Introduction to microcontroller- Architecture of 8051 Microcontroller.
2. Instruction sets and Addressing modes.
3. Signals and I/O ports, Timers and interrupt.
4. Interfacing -keyboard, LCD, ADC & DA. Applications- Stepper motor- Power plant control, Traffic light controller
5. Raspberry Pi
6. HDMI output
7. Connection with VGA, VIM text editor
8. Switch relay ,Servo Control ,GUI interface
9. Simple Arduino application

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Kenneth J.Ayala, “The 8051 microcontroller Architecture, Programming and applications”, Third Edition, Minneapolis West Pub, 2005.
2. Eben Upton, Gareth Halfacree, “Raspberry Pi User Guide”, Third Edition, Wiley, 2014.

19IT12L PROGRAMMING IN IOT

	L	T	P	C
	0	0	2	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: describe the fundamentals of IOT and networking. (K2).

CO 2: apply programming in IOT devices. (K3).

LIST OF EXPERIMENTS

1. Introduction to IOT: Sensing, Actuation
2. Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino.
3. Basics of IOT Networking: Communication Protocols, Sensor Networks, Machine- to-Machine Communications.
4. Interoperability in IOT: Introduction to Arduino Programming, Integration of Sensors and Actuators
5. Introduction to Raspberry Pi

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

19IT13L R PROGRAMMING L T P C

0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: develop simple applications using R programming. (K3)

LIST OF EXPERIMENTS

- Getting Data In and Out of R
- Control Structures
- Functions
- Data Manipulation
- String Operations
- Data Visualization
- Basic statistics
- Regression modeling

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Torsten Hothorn, Brian S. Everitt, "A Handbook of Statistical Analyses using R", Third Edition, CRC Press, 2014.
2. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley, 2015.
3. https://www.analytixlabs.co.in/data-analytics-using-r.

19IT14L JAVA GENERICS AND COLLECTIONS FRAMEWORK L T P C

0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: apply the concepts of generic classes and collections for computing problems. (K3)

LIST OF EXPERIMENTS

1. Add String values to the ArrayList class from collection Framework and sort those Strings and print it separately.
2. Take different values in HashMap class and print the Keys and values separately.
3. Write a program to add the items in cart lik amazon applications by using any of these collection Framework classes (ArrayList, LinkedList, Vector).
   Say for example, if you select Mobile, TV, and Pant. The cart should collect all the items and need to print it as **[Mobile,TV,Pant]**
   You should consider each item as a separate class.
   You must override the **toString** method from **Object** class to to return correspnding classes name.
4. Write a program to add the items in cart lik amazon applications by using any of these collection Framework classes (HashMap, LinkedHashMap, TreeMAp).
   Say for example, if you select Mobile, TV, and Pant. The cart should collect all the items with its cost and need to print it as **[5600 = Mobile,12000 = TV,780=Pant]**
   You should consider each item (Mobile, TV and Pant) as a separate class.
   You must override the **toString** method from **Object** class to to return correspnding class's name.
   Note: Please take the cost as key, also enter manually.
5. Write a program to receive Three Employee's details Employee name, Employee ID, Employee Salary.
   Encapsulate all these Employees Informations for Each employee, build the ArrayList object to holds the Object of Each Employee.
   Print the all Employee's informations Separately.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Herbert Schildt, “Java™ The Complete Reference”, Ninth Edition, McGraw-Hill, 2014.
2. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, Ninth Edition, Sun Microsystems Press, 2012.

19IT15L DEEP LEARNING ALGORITHMS

	L	T	P	C
	0	0	2	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: Apply supervised CNN & RNN models for various datasets.(K3)
CO2: Build a classifier with pre-trained models and validate.(K3)

LIST OF EXERCISES

1. Build a classifier using k-Nearest Neighbour (kNN) algorithm for iris dataset to classify its class.
2. Create a Neural Network model to train and test the birds dataset to classify the bird species.
3. Construct a CNN model by considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set, then build an LENET algorithm and test the same.
4. Implement RNNmodel for smile detection. Print both correct and wrong predictions.

5. Design a LSTM network for sentiment analysis on a corpus of movie reviews. Label each phrase on a scale of zero to four. The sentiment corresponding to each of the labels are:
    - 0: negative
    - 1: somewhat negative
    - 2: neutral
    - 3: somewhat positive
    - 4: positive

6. Bulid and train the stacked Autoencoder for image classification. Use handwritten digits dataset.

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Anaconda / Jupyter, Keras, Tensorflow, Google colab

REFERENCES:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MITPress book in preparation,2016.
2. Dr.Adrian Rosebrock, —Deep Learning for Computer Vision with Python: Starter Bundle, PyImage Search, 1st edition, 2017.

19IT16L DATABASE DESIGN AND PROGRAMMING WITH SQL

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: demonstrate a database solution for a business or organization. (K3)

LIST OF EXPERIMENTS

Database Design

- Introduction
- Entities and Attributes
- Relationship Basics
- Super/Sub Types and Business Rules
- Relationship Fundamentals
- UIDs and Normalization
- Arcs, Hierarchies, and Recursive Modeling
- Changes and Historical Modeling
- Mapping
- Creating Database Projects
- Presenting Database Projects

Database Programming with SQL

- Introduction
- Select with WHERE, ORDER BY, and Intro to Functions

- Types of Functions
- JOINs
- Group Functions
- Sub queries
- DML, DDL Statements
- Constraints
- Database Objectives
- Privileges and Regular Expressions
- TCL

P: 30 TOTAL: 30 PERIODS

REFERENCE

1. http://ilearning.oracle.com

19IT17L INTRODUCTION TO NETWORKS

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: build simple LANs, perform basic configurations for routers and switches. (K2)

CO2: implement IP addressing schemes. (K3)

Introduction and explore the network - Configure a network operating system - Network Protocol and Communications - Network Access – Ethernet - Network Layer - IP addressing - Subnetting IP Network - Transport layer - Application Layer - Build a small network

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. https://www.freeccnastudyguide.com/study-guides/ccna/ch1/intro-to-networks/
2. https://www.netacad.com/group/resources/ccna-rs-itn/6.0

19IT18L ROUTING AND SWITCHING ESSENTIALS

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: recognize architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. (K2)

CO2: build simple LANs, perform basic configurations for routers and switches, and implement IP. (K2)

Routing Concepts - Routing Initial configuration - Routing Operation - Static Routing - Configuration & Troubleshooting - Dynamic Routing - Protocols and Routing Tables - Switched Networks - Switch Configuration - Device Configuration – LAN Design and Switched Environment – VLANs - Segmentation - Implementation - VLAN Routing - Access Control

Lists - ACL Operation - Standard IPv4 ACL – DHCP - DHCP v4 – DHCP v6 - NAT for IPv4 - Operation - Configuration - Device Discovery - Management and Maintenance.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. CCNA Routing and Switching Complete Study Guide‟, Todd Lammle, Second Edition, John Wiley & Sons, 2016.
2. https://www.netacad.com/group/resources/ccna-rs-rse/6.0

19IT19L	**SCALING NETWORKS**	**L T P C**
		1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: configure and troubleshoot routers and switches for advanced functionality. (K3)

CO2: resolve common issues with protocols in both IPv4 and IPv6 networks. (K2)

LAN Design: Campus Wired LAN Designs - Campus Network Device Selection. Scaling VLANs: VTP, Extended VLANs, and DTP - Troubleshoot Multi-VLAN Issues. Spanning Tree Protocol (STP): Spanning Tree Concepts - Varieties of Spanning Tree Protocols. Ether Channel and HSRP: Link Aggregation Concepts - Link Aggregation Configuration - First Hop Redundancy Protocols.

Dynamic Routing: Dynamic Routing Protocols - Distance Vector Dynamic Routing - Link-State Dynamic Routing. EIGRP: features and characteristics - Implement EIGRP for IPv4 - EIGRP Tuning and Troubleshooting. OSPF: Single-Area OSPF Operation - Varieties of Spanning Tree Protocols - Multiarea OSPF - OSPF Tuning and Troubleshooting.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Scaling Networks Companion Guide‟, CISCO Press, 2014.
2. https://www.netacad.com/group/resources/ccna-rs-scaling/6.0

19IT20L	**CONNECTING NETWORKS**	**L T P C**
		1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: configure and troubleshoot network devices. (K3)

CO2: implement Virtual Private Networks. (K3)

WAN Concepts - WAN Technologies Overview - Selecting a WAN Technology - Point-to-Point Connections - Serial Point-to-Point Overview - PPP Operation - Troubleshoot WAN Connectivity - Branch Connections - Remote Access Connections – VPNs.

Access Control Lists - Standard ACL Operation and Configuration Review - Extended IPv4 ACLs - LAN Security – SNMP - QoS Overview - QoS Mechanisms - Network Evolution - Network Troubleshooting - Troubleshooting Methodology - Troubleshooting ScenarIoS

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Connecting Networks Companion Guide‟, CISCO Press, 2014.
2. https://www.netacad.com/group/resources/ccna-rs-connect/6.0

19IT21L ROBOTIC PROCESS AUTOMATION

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: understand basic programming concepts and the underlying logic/ structure. (K2)
CO 2: manage and use different variables, arguments and Control flow statements. (K3)

INTRODUCTION

Introduction to Robotic Process Automation – Life Cycle of RPA – RPA tools – Advantages of RPA

LIST OF EXPERIMENTS

1. Practice on RPA tool - Managing variables - arguments panel
2. Practice on Control flow statements –Data Manipulation
3. Extracting data from PDF
4. Data Manipulation in Excel
5. Email Automation
6. Transferring Data from one system to another

SOFTWARE REQUIREMENTS

- UiPath or Blue Prism

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Alok Mani Tripathi ,‖Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots with the leading RPA tool – UiPath‖, Packt Publishing, 2018.
2. Kelly Wibbenmeyer, ―The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization ‖, Universe, 2018.

19IT22L MATLAB PROGRAMMING

L T P C
0 0 2 1

COURSE OUTCOME

Upon Completion of this course, the students will be able to

CO1: develop simple matlab programs. (K2)

LIST OF CONTENTS

1. The MATLAB environment
2. Creating and initializing MATLAB variables
3. Built-in MATLAB functions

4. Introduction to plotting
5. The Logical Data type
6. Branches

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Irfan Turk, “MATLAB Programming for beginners and professionals”, CreateSpace Independent Publishing Platform, December 7, 2018.
2. Stephen J. Chapman, “MATLAB Programming for Engineers”, Sixth Edition, CL Engineering, Sixth edition, January 15, 2019.

19IT23L ETHICS IN CYBERSECURITY

L T P C
1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: explain ethics and cybersecurity ethics and the role of computer engineers making engineering decisions which have ethical consequences. (K2)

Introduction to Cyberethics: Concepts, Perspectives, and Methodological Frameworks – Basic Concepts and Models of Cybersecurity- Ethics - Three ethical frameworks -The ethical hacker - Ethical and Unethical Hacking - A Framework for Ethical Cyber-Defence for Companies - Privacy-Preserving Technologies - Cybersecurity and Cyber Warfare: The Ethical Paradoxof ‘Universal Diffidence.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Mary Manjikian, Cybersecurity Ethics - An Introduction, Routledge - Taylor & Francis Group, 2018.
2. Markus Christen, Bert Gordijn, Michele Loi, “The Ethics of Cybersecurity”, Springer, 2020.
3. Herman T. Tavani, “Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing, John Wiley and Sons, Fourth Edition, 2012.
4. Corey Schou, Steven Hernandez, “Information Assurance Handbook: Effective Computer Security and Risk Management Strategies”, McGraw-Hill Education; First Edition, 2014.

19IT24L ARDUINO PROGRAMMING

L T P C
1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: describe the fundamental Arduino programming language and IDE. (K2)

CO 2: Connect the Arduino microcontroller to a serial terminal to understand communication and stand-alone use. (K3)

LIST OF CONTENTS

1. Introduction to Microcontroller
2. Embedded C and Arduino platform
3. Arduino data types
4. Variables and constants
5. Control Statements
6. Arduino I/O Functions
7. Arduino Secondary Integrations
8. Arduino Communications
9. Arduino Display

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Simon Monk "Programming Arduino Next Steps: Going Further with Sketches", 2nd Edition, McGraw-Hill, 2018
2. Jack Purdum "Beginning C for Arduino: Learn C Programming for the Arduino", 2nd Edition, TIA, 2019

19IT25L MATHEMATICS FOR MACHINE LEARNING

	L	T	P	C
	1	0	0	1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: Understand the mathematical concepts for Machine Learning (K2)
CO2: Understand how the concepts extend for real world ML problems (K2)

UNIT I LINEAR ALGEBRA 5

Scalars, Vectors, Matrices and Tensors - Vector and Matrix Norms – Eigen values and Eigen vectors – Norms and Eigen decomposition.

UNIT II MULTIVARIATE CALCULUS 5

Introduction to Derivatives – Basics of Integration – Gradients and Gradient Visualization – Optimization.

UNIT III PROBABILITY THEORY 5

Introduction – Probability Distributions – Expectation, Variance and Covariance.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Marc Peter Deisenroth, A.Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2020.'
2. "Mathematical Foundation For Machine Learning and AI", Udemy Course

19IT26L **REAL TIME SYSTEMS** **L T P C**
1 0 0 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: explain various components and methodologies in Real Time Operating Systems. (K2)

LIST OF CONTENTS

1. Real-Time Multi-Tasking OS
2. Classification of Real-time Systems
3. Concepts of Computer Control
4. Memory Management
5. Overview of Real-Time Languages
6. Task Management
7. Mutual Exclusion
8. Yourdon Methodology
9. Ward and Mellor Method
10. Hately and Pirbhai Method

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Stuart Bennet, "Real–Time Computer Control", 2nd Edition, Pearson Education, 2008
2. Rajib Mall, "Real–Time Systems: Theory and Practice", 1st Edition, Pearson Education, 2012

19IT27L **NETWORK SIMULATION WITH NS3** **L T P C**
0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: understand the software architecture, conventions, and basic usage of NS3 and NS4 (K2)

LIST OF CONTENTS

- Installation of NS3
- Introduction
- NS3 Features
- Models
- WAF
- Study of network components (Node and Packets)
- Simple Network Creation with NS3 scripts
- Logging Module
- Attributes and Tracing
- Building a Topology
- Building a wireless network topology
- Routing Protocols

- generating flow table entries from user configuration using NS4

REFERENCES

1. Na Vikraman, "How to Write a Perfect Network Simulator - 3 Program (NS - 3): NS - 3 Workshop Manual for All", Volume 2019 of 01 Series, 2019
2. https://www.nsnam.org/tutorials/simutools08/

19IT28L PYTHON FOR DATA SCIENCE

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: identify and make use of python programming elements to solve problems in Data Science.

LIST OF EXERCISES

1. Mathematical Computations with NumPy & ndArray
2. Working with Data in Python: Reading, Writing and Loading data with Pandas
3. Implementation of Data Preparation and Preprocessing Techniques
4. Implementation of Data visualization using matplotlib and seaborn libraries
5. Working on basics of Python Spyder (Tool)
6. Implementation of Clustering Algorithms
7. Implementation of Classification Algorithms
8. Implementation of Regression Algorithms
9. CASE STUDY: Regression:Predicting price of pre-owned cars, Classification: Classifying personal income

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Jake VanderPlas, Python Data Science Handbook: Essential Tools for working with Data.
2. Dr.Mohd. Abdul Hameed, "Python for Data Science", Wiley.
3. Samir Madhavan, "Mastering Python for Data Science" Packt Publishers, 1st Edition, 2015.
4. https://onlinecourses.nptel.ac.in/noc22_cs74/preview

19IT29L NODE JS

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: Develop Interactive data driven based web application using Node JS with database Connection. (K3)

LIST OF EXPERIMENTS

1. Installation/Set up of Node.js

2. Implementation of Functions and local Modules
3. Implementation of User defined packages in NPM
4. Handling HTTP requests in web server
5. Asynchronous File Management
6. Implementation of user defined events by EventEmitter Class
7. Creating web application using Express framework
8. Mysql Connection with Node.Js
9. Mongo DB connection with Node.js
10. Debugging Nodejs using Core Node
11. Mean stack Application development includes Angular JS

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Basarat Ali Syed, — Beginning Node.js, APress, 2014
2. Shelley Powers, - Learning Node – Moving to the Server Side, Second Edition, O'Reilly (2016).
3. Simon Holmes, - Getting MEAN with Mongo, Express, Angular, and Node, Second Edition, Manning (2016).
4. https://www.coursera.org/learn/server-side-javascript-with-nodejs

19IT30L INTRODUCTION TO NoSQL WITH MONGODB L T P C

0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1:Understand the basic structure of NoSQL Components through the CRUD operations (K2)

CO2: Implement database navigation operations using ODBC /JDBC (K3)

LIST OF EXERCISES

1. Study of Open Source NOSQL Database: Mongo DB (Installation, Basic CRUD operations, Execution).
2. Design and Develop Mongo DB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators).
3. Implement aggregation and indexing with suitable example using Mongo DB.
4. Implement Map reduces operation with suitable example using Mongo DB.
5. Create simple objects and array objects using JSON.
6. Case Study discussion (Social Media and IoT based applications).
7. Implement a simple Database navigation operations using ODBC/JDBC by connecting PHP/PYTHON/JAVA

SOFTWARE REQUIREMENTS

Operating System: Windows / Linux
Software: Mongo DB 5.0

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Peter Membrey, “MongoDB Basics”, Apress; First Edition, 2014.
2. https://docs.mongodb.com/manual/tutorial/
3. https://www.tutorialspoint.com/mongodb/index.htm

B.Tech. – INFORMATION TECHNOLOGY

OPEN ELECTIVE COURSES

19IT01N FUNDAMENTALS OF JAVA PROGRAMMING L T P C 3 0 0 3

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: describe the fundamentals of java programming. (K1)
CO2: identify the variables, arguments and return statements of java. (K1)
CO3: explain the various OOPs concepts in java. (K2)
CO4: create constructors and packages in java programming. (K2)
CO5: analyze the exception handling in java. (K2)

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming – Classes and Objects – Methods - Inheritance – Polymorphism - Abstract – Interface - Encapsulation – Constructor – Access specifiers – Static members– Data types – Variables.

UNIT II PACKAGES AND STRING IN JAVA 9

Packages in JAVA – Math class – String in java: String, StringBuffer, StringBuilder, Mutable and immutable, Conversion of string to StringBuffer and vice versa – Synchronized keyword.

UNIT III EXCEPTION AND FILE HANDLING 9

Exceptions – Try, Catch and Finally blocks - Exception hierarchy - Build-in exceptions – Checked and unchecked exception - Creating own exceptions - File – FileWriter – FileReader

UNIT IV MULTITHREADING IN JAVA 9

Thread class – Run method overriding thread lifecycle - Creating a thread – Setting priority to threads – Runnable interfaces.

UNIT V COLLECTION AND GENERIC PROGRAMMING 9

Wrapper classes – Collection framework – Collections class – Set: ArrayList, LinkedList, Vector- List: HashSet, LinkedHashSet, TreeSet – Map: HashMap, HashTable, TreeMap - Generic Programming – Generic concept – Restrictions and Limitations.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Herbert Schildt, “Java The complete reference”, Eighth Edition, McGraw Hill Education, 2011.

REFERENCES

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, Third Edition, Pearson, 2015.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume – I Fundamentals”, Nineth Edition, Prentice Hall, 2013.

19IT02N PYTHON PROGRAMMING - BASICS L T P C 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: classify and make use of python programming elements to solve problems. (K3)
CO 2: experiment with the various control statements in python.(K3)
CO 3: develop python programs using functions and strings.(K3)
CO 4: analyse a problem and use appropriate data structures to solve it.(K4)

CO5: develop python programs to implement various file operations and exception handling. (K3)

UNIT I INTRODUCTION 9

Introduction-Python Interpreter-Interactive and script mode -Values and types- operators-expressions- statements-precedence of operators-Multiple assignments- comments.

UNIT II CONTROL STATEMENTS AND FUNCTIONS 9

Conditional (if)-alternative (if-else)- chained conditional (if-elif-else)-Iteration-while- for- break-continue-pass – Functions – Introduction- inbuilt functions-user defined functions- passing parameter- return values- recursion- Lambda functions**.**

UNIT III DATA STRUCTURES 9

Strings-String slices- immutability-string methods and operations -Lists-creating list- list operations-list methods-mutability- aliasing-cloning lists-list and strings- list and functions-list processing-list comprehension, searching and sorting, Sets-creating sets, set operations-Tuples-Tuple assignment- Operations on Tuples- lists and tuples- Tuple as return value-Dictionaries-operations and methods- Nested Dictionaries.

UNIT IV FILES, MODULES, PACKAGES 9

Files and Exception-Text files- reading and writing files- format Operator-Modules-Python Modules-Creating own python modules-packages, Introduction to exception handling.

UNIT V OBJECT-ORIENTED PROGRAMMING 9

Object-Oriented Programming- Classes and Objects-Creating Classes in Python-Creating Objects in Python- The Constructor Method-Classes with Multiple Objects-Class Attributes versus Data Attributes-Encapsulation-Inheritance-The Polymorphism.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, “Programming and Problem Solving with Python” , Mc-Graw Hill Education,2018.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Updated for Python 3, Shroff / O’Reilly Publishers, 2016.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd,” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.

REFERENCES

1. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
2. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem Solving Focus”, Wiley India Edition, 2013.

WEB REFERENCES

1. http://greenteapress.com/wp/think-python/
2. http://www.mhhe.com/kamthane/python
3. https://www.sanfoundry.com/python-problems-solutions/

19IT03N INTRODUCTION TO VIRTUAL AND AUGMENTED REALITY L T P C 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: define the concepts of virtual reality, its components and input/output interfaces. (K2)
- CO2: describe fundamentals of Computer Graphics and Advanced Techniques in CG. (K2)
- CO3: explain Environment Modeling in Virtual Reality and Interactive Techniques in Virtual Reality. (K2)
- CO4: apply development tools and Frameworks in Virtual Reality. (K2)
- CO5: design and develop various real time VR applications. (K2)

UNIT I INTRODUCTION OF VIRTUAL REALITY 9

Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Multiple Modals of Input and Output Interface in Virtual Reality: Input -Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual / Auditory / Haptic Devices.

UNIT II VISUAL COMPUTATION IN VIRTUAL REALITY 9

Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

UNIT III ENVIRONMENT MODELING IN VIRTUAL REALITY 9

Geometric Modeling, Behavior Simulation, Physically Based Simulation, Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

UNIT IV INTRODUCTION OF AUGMENTED REALITY (AR) 9

System Structure of Augmented Reality. Key Technology in AR. Development Tools, and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools.

UNIT V APPLICATION OF VR IN DIGITAL ENTERTAINMENT 9

VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR, VR Development Tools Frameworks of Software Development Tools in VR, Modeling Tools for VR, X3D Standard; Vega, MultiGen, Virtools.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
2. Alan B. Craig, “Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann, 2013.
3. Burdea, G. C. and P. Coffet. “Virtual Reality Technology”, Second Edition, Wiley-IEEE Press, 2006.

REFERENCES

1. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, Springer 2005.
2. Sherman, William R. and Alan B. Craig, “Understanding Virtual Reality – Interface, Application, and Design”, First Edition, 2002.

3. Fei GAO, “Design and Development of Virtual Reality Application System”, Tsinghua Press, March 2012.
4. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
5. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Meging Real and Virtual Worlds”, 2005.
6. Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.

19IT04N INTERNET OF THINGS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: discover key IoT concepts including identification, sensors, localization, wireless protocols, data storage and security. (K2)
CO2: explore IoT technologies with M2M Communications and Web of Things. (K2)
CO3: realize the cloud computing technologies by collecting, communicating, coordinating and leveraging the data from connected devices. (K2)
CO4: examine technological developments that will likely shape the industrial landscape in the future. (K2)
CO5: develop and implement IoT technologies, solutions, and applications (K2)

UNIT I INTRODUCTION 9

Introduction – Characterizes – Sensing - Actuation and fundamentals of network - Enabling technologies of IoT - Different Communication Protocols in Internet of Things - Internet of Things Network Protocol Stack - 6LoWPAN – CoAP – MQTT - Bluetooth Low Energy – Zigbee - Case study on RFID.

UNIT II M2M COMMUNICATIONS AND WEB OF THINGS 9

Introduction – Applications - Key features - Architecture and components - Requirements for M2M, Issues /concerns in M2M - Standardization Efforts for M2M – Web of Things.

UNIT III UBIQUITOUS CLOUDS AND THE INTERNET OF THINGS 9

Cloud Trends in Supporting Ubiquitous Computing - Performance of Distributed Systems and the Cloud - Enabling Technologies for the Internet of Things - Innovative Applications of the Internet of Things - Online Social and Professional Networking.

UNIT IV TECHNOLOGIES 9

Wireless protocols - Data storage and analysis – Localization - Security in Internet of Things - HCI and Internet of Things World - Robotics and Autonomous Vehicles.

UNIT V APPLICATIONS 9

Smart Buildings - Wireless Technologies for Indoor Localization - Smart Homes - Smart Health - Smart Cities.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, Taylor & Francis Group, 2017.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press, 2014.

3. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Morgan Kaufmann, 2012.

REFERENCES

1. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Morgan Kaufmann, 2016.
2. Fei Hu, Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, CRC Press, Taylor & Francis Group, 2016.
3. Olivier Hersent and David Boswarthick, Internet of Things: Key Applications and Protocols, John Wiley, 2015.
4. Marco Schwartz, Internet of Things with the Arduino Yun, Packt Publishing, 2014.
5. Herve Chabanne, Pascal Urien, Jean-Ferdinand Susini, RFID and the Internet of Things, Wiley, 2011.
6. Dieter Uckelmann, Mark Harrison, Florian Michahelles, Architecting the Internet of Thingsm Springer, 2011.
7. Hakima Chaouchi, The Internet of Things Connecting Objects to the Web, Wiley, 2010.

19IT05N	**BASIC OF NETWORKING**	**L T P C** **3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the fundamental various types of computer networks. (K2)
CO2: compare the TCP/IP and OSI models with merits and demerits. (K2)
CO3: explore the various layers of OSI Model. (K2)
CO4: describe the UDP and TCP Models. (K1)
CO5: enumerate the concept of different routing techniques for data communications.(K2)

UNIT I INTRODUCTION TO NETWORKS 9

Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.

UNIT II PHYSICAL LAYER 9

Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

UNIT III DATA LINK LAYER 9

Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet.

UNIT IV NETWORK LAYER AND CONNECTING DEVICES 9

Tunneling, Address Mapping, ICMP, IGMP, Forwarding. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

UNIT V ROUTING PROTOCOLS 9

Routing-Flooding, Bellman& Ford, Disjkstra’s routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking”, Fourth Edition, Mc Graw Hill Education, 2006.
2. Andrew S Tanenbaum, “Computer Networks”, Fifth Edition, Pearson Education, 2012.
3. James F. Kurose, K. W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Third Edition, Pearson Education, 2007.

REFERENCES

1. Bhusan Trivedi, “Data communication and Networks”, Oxford university press 2016.
2. S.Keshav, “An Engineering Approach to Computer Networks”, Second Edition, Pearson Education, 2008.
3. William A. Shay, “Understanding Data Communications and Networks”, Third Edition, 2003.

19IT06N ADVANCED NETWORKING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the network protocols and standards. (K2)
CO2: enumerate the concept of multiplexing and LAN. (K2)
CO3: elicit the optical networking concepts. (K2)
CO4: describe the integrated service digital networking needs. (K2)
CO5: importance of ATM and WAN protocols. (K2)

UNIT I INTRODUCTION TO PROTOCOLS AND STANDARDS 9

Overview of reference models: The OSI model, The OSI Reference Model, TCP/IP protocol Suite, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models, Addressing, IP versions.

UNIT II MULTIPLEXING AND LOCAL AREA NETWORKS 9

Multiplexing, Types of Multiplexing- FDM, TDM, SM; - Ethernet, token ring, FDDI; switching - circuit switching, packet switching, multicasting.

UNIT III OPTICAL NETWORKING 9

SONET/SDH standards, Dense Wavelength division multiplexing (DWDM), Performance and design Considerations.

UNIT IV INTEGRATED SERVICE DIGITAL NETWORK 9

History of Analog and Digital Network - Access to ISDN - ISDN Layers - Broadband ISDN - X.25 Layers - Packet Layer Protocol.

UNIT V ATM: THE WAN PROTOCO 9

Faces of ATM, ATM Protocol operations (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell, Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model.

L: 45; TOTAL: 45 PERIODS

TEXTBOOK

1. Comer, Douglas E., “Computer Networks and Internets”, Sixth Edition, Prentice Hall, 2016.

REFERENCES

1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, Fourth Edition, McGraw Hill, ISBN 978-0-07-337604-2, 2010.
2. Tanenbaum, A. S., “Computer Networks”, Fourth Edition, Prentice Hall, Upper Saddle River, New Jersey, 2002.
3. William Stallings, “Data and Computer Communications”, Seventh edition, by, Prentice Hall, 2003.

19IT07N INDUSTRIAL NETWORKING

	L	T	P	C
	3	0	0	3

PREREQUISITE

- Basic Networking

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify various internetworking devices involved in industrial networks. (K2)
CO2: understand the various serial communication used in process industries. (K2)
CO3: outline the working of HART and Field bus used in process digital communication. (K2)
CO4: summarize the operation of MODBUS, PROFIBUS protocol & its applications. (K2)
CO5: illustrate the industrial Ethernet and wireless communication. (K2)

UNIT I DATA NETWORK FUNDAMENTALS 9

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Token passing - CSMA/CD, TCP/IP.

UNIT II INTERNET WORKING and RS 232 9

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, Devicenet.

UNIT III HART AND FIELDBUS 9

Introduction - Evolution of signal standard - HART communication protocol - HART networks – HART applications – Field bus - Introduction - General Field bus architecture – Basic requirements of Field bus standard – Field bus topology.

UNIT IV MODBUS AND PROFIBUS 9

MODBUS protocol structure– Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - review of foundation field bus - Data Highway.

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION 9

Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, “Practical Industrial Data Networks Design, Installation and Troubleshooting” Newnes Publication, Elsevier First Edition, 2004.
2. William Buchanan, “Computer Buses”, CRC Press, 2000.

3. Behrouz Forouzan, “Data Communications & Networking”, Third edition, Tata McGraw hill, 2006.

REFERENCES

1. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, Prentice Hall of India Pvt. Ltd., Fifth Edition, 2011.
2. Theodore S Rappaport, “Wireless Communication: Principles and Practice”, Prentice Hall of India, Second Edition, 2001.
3. William Stallings, “Wireless Communication & Networks”, Prentice Hall of India, Second Edition, 2005.

19IT08N DATA ANALYTICS L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1: discuss big data tools and its analysis techniques (K2)
CO 2: describe Graph analytics and NoSQL databases (K2)
CO 3: Analyze data by utilizing clustering and classification algorithms (K4)
CO 4: apply different mining algorithms and recommendation systems for large volumes of data. (K3)
CO 5: Perform analytics on data streams. (K3)

UNIT I INTRODUCTION TO BIG DATA 9

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – A General Overview of High-Performance Architecture – HDFS – Map Reduce and YARN – Map Reduce Programming Model

UNIT I NO SQL DATABASES 9

Using Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Dedicated Appliances for Graph -. No SQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Hbase.

UNIT III SUPERVISED AND UNSUPERVISED LEARNING 9

Supervised Learning - Unsupervised Learning-Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes‘ Theorem

UNIT IV ASSOCIATION AND RECOMMENDATION SYSTEM 9

Advanced Analytical Theory and Methods: Association Rules – Overview – Apriori Algorithm –Recommendation System: Collaborative Recommendation- Content Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

UNIT V STREAM MEMORY 9

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams –Real time Analytics Platform(RTAP) applications - Case Studies -Stock Market Predictions

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Second Eidition ,Cambridge University Press, 2014.
2. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph” First Edition, Morgan Kaufmann/El sevier Publishers, 2013.

REFERENCES

1. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.
2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, “Recommender Systems: An Introduction”, Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers ” CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, “Data-Intensive Text Processing with MapReduce”, Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

19IT09N E-WASTE MANAGEMENT L T P C
3 0 0 3

PREREQUISITE

- Environmental Science and Engineering

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: explain cause and effect of environmental pollution. (K2)
CO2: describe the characteristics of different substances of e-waste. (K2)
CO3: discuss the human impacts of e-waste upon the environment. (K2)
CO4: summarize the storage, transport, processing and disposal of e-waste. (K2)
CO5: discuss the different policies of recycling e-waste. (K2)

UNIT I ENVIRONMENTAL POLLUTION 9

Causes, effects and control measures of Water, Soil, Marine, Thermal pollution - Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution.

UNIT II OVERVIEW OF E-WASTE 9

E-waste growth- hazards of E-waste - Hazardous substances- Waste Electrical and Electronic Equipment - characteristics of pollutants, batteries, electrical and electronic components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.

UNIT III IMPACTS OF E-WASTE 9

Toxicity due to hazardous substances - domestic e-waste disposal - occupational and environmental health perspectives of recycling e-waste in India.

UNIT IV E-WASTE MANAGEMENT 9

Regulatory aspects of E-Waste management - Waste characteristics- Generation– Collection - Material Composition-Transport– Treatment and disposal.

UNIT V RECYCLING OF E-WASTE 9

Optimal planning for Computer waste - Technologies for recovery of resources from electronic waste - resource recovery potential of e-waste – Recycling e-scarp in a global environment – opportunities and challenges - Environmentally responsible business: Policies, Practices and Metrics.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. R.E. Hester, Roy M Harrison, “Electronic waste management”, Cambridge, UK, RSC Publication, 2009.
2. Rakesh Johri, “E-waste: Implications, Regulations and Management in India and Current Global Best Practices”, The Energy and Resources Institute, New Delhi, 2008.

REFERENCES

1. Bharucha Erach, “Text Book of Environmental Studies for undergraduate Courses”, University Press, Second Edition, 2013.
2. Vishakha Munshi, “E-Waste Managing the Digital Dump Yard”, ICFAI University Press, 2007.

NATIONAL ENGINEERING COLLEGE

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REGULATIONS – 2019

CURRICULUM & SYLLABUS

B. E. – ELECTRICAL AND ELECTRONICS ENGINEERING

Accredited by NBA

B. E. – ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM AND SYLLABUS

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

Promoting active learning, critical thinking coupled with ethical values to meet the global challenges.

MISSION

- To instill state-of-the-art technical knowledge and research capability that will prepare our graduates for professionalism and life-long learning.
- To update knowledge to meet industrial and real world challenges.
- To inculcate social and ethical values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Excel in industrial or graduate work in Electrical Engineering and allied fields.
2. Practice their profession conforming to ethical values and active participation in the affairs of the profession.
3. Adapt to evolving technologies and stay current with their profession.

PROGRAMME OUTCOMES (POs)

Pos *describe the expectation of students to know by the time of graduation from the programme*. At the time of graduation, our EEE graduates are expected to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Apply the basic knowledge of mathematics, science and engineering to identify, formulate, design and investigate complex engineering problems of power electronics and drives, power and energy systems, high voltage engineering, control and instrumentation and applied electronics.

PSO2: Apply the modern engineering hardware and software tools in electrical and electronics engineering to adopt in multi disciplinary environments and innovative practices.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **EEE programme** is designed with total number of credits ***167 (127*** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table-1.

TABLE – 1 CATEGORY OF COURSES

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	10
2.	Basic Science courses	29
3.	Engineering Science courses	22
4.	Programme Core courses	64
5.	Programme Elective courses relevant to chosen specialization / branch	15
6.	Open Elective courses from other technical and /or emerging subject areas	12
7.	Skill Development Courses	15
8.	Mandatory courses	(non – credit)
	TOTAL	**167**

i. **Humanities and Social Sciences (HSMC)** include English, Communication Skill laboratory and Management courses

ii. **Basic Science Courses (BSC)** include Chemistry, Physics, Biology and Mathematics

iii. **Engineering Science Courses (ESC)** include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering

iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.

vii. **Skill Development Courses (SDC)** include the courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.

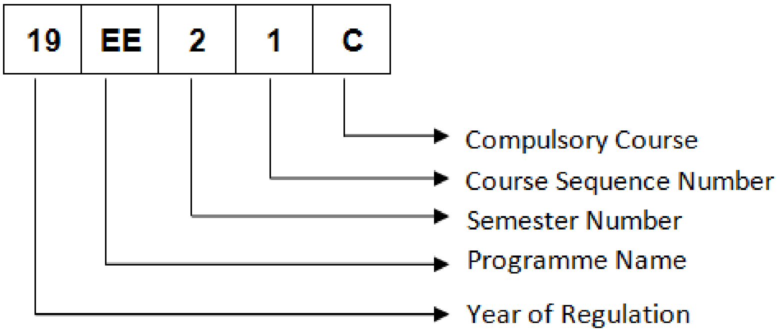
viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

TABLE – 2 QP – QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE


19
EE
2
1
C
Compulsory Course
Course Sequence Number
Semester Number
Programme Name
Year of Regulation

REGULATIONS – 2019 CURRICULUM AND SYLLABUS

SEMESTER – I

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
PRACTICAL COURSES								
6.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	
7.	ESC	19SH17C	Engineering Practice Laboratory* Part A – Mechanical Laboratory Part B – Electrical and Electronics Laboratory	0	0	4	2	
			TOTAL	**11**	**1**	**11**	**17.5**	

SEMESTER – II

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1	HSMC	19EE21C	Professional English	2	0	0	2	B
2	BSC	19EE22C	Calculus, Probability and Statistics	2	1	0	3	A
3	BSC	19EE23C	Waves, Optics and Semiconductor Physics	2	0	0	2	B
4	BSC	19EE24C	Chemistry for Electrical Engineering	2	0	0	2	B
5	ESC	19EE25C	Problem Solving Techniques	3	0	0	3	A
6	ESC	19EE26C	Basic Civil and Mechanical Engineering	4	0	0	4	A
PRACTICAL COURSES								
7.	BSC	19EE27C	Optics and Semiconductor Physics and Chemistry Laboratory Part A – Optics and Semiconductor Physics Laboratory Part B – Chemistry Laboratory	0	0	3	1.5	-
8.	ESC	19EE28C	Problem Solving Techniques Laboratory	0	0	4	2	-
9.	HSMC	19EE29C	Communication Skills Laboratory	0	0	2	1	-
10.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
			TOTAL	**16**	**1**	**11**	**22.5**	

SEMESTER – III

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19EE31C	Fourier Series and Transforms	2	1	0	3	A
2.	PCC	19EE32C	Electrical Circuit Analysis	3	1	0	4	A
3.	PCC	19EE33C	Analog Electronics	3	1	0	4	A
4.	PCC	19EE34C	Electrical Machines-I	3	0	0	3	A
5.	PCC	19EE35C	Electromagnetic Fields	3	1	0	4	A
6.	ESC	19EE36C	Engineering Mechanics	3	0	0	3	A
7.	MAC	19MC01C	Environmental Science and Engineering	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19EE37C	Analog Electronics Laboratory	0	0	3	1.5	-
9.	PCC	19EE38C	Electrical Machines-I Laboratory	0	0	3	1.5	-
			TOTAL	**20**	**4**	**6**	**24**	

SEMESTER – IV

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19EE41C	Complex Analysis, Numerical Methods and Mathematical Logic	2	1	0	3	A
2.	PCC	19EE42C	Digital Electronics	3	0	0	3	A
3.	PCC	19EE43C	Electrical machines-II	3	0	0	3	A
4.	PCC	19EE44C	Measurements and Instrumentation	3	0	0	3	A
5.	PCC	19EE45C	Signals and systems	2	1	0	3	A
6.	BSC	19EE46C	Biology for Engineers	2	0	0	2	B
7.	MAC	19MC02C	Constitution of India	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19EE47C	Digital Electronics laboratory	0	0	3	1.5	-
9.	PCC	19EE48C	Measurements and Instrumentation Laboratory	0	0	3	1.5	-
10.	PCC	19EE49C	Electrical machines-II laboratory	0	0	3	1.5	-
			TOTAL	**18**	**2**	**9**	**21.5**	

SEMESTER – V

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19EE51C	Power System-I	3	0	0	3	A
2.	PCC	19EE52C	Control Systems	3	0	0	3	A
3.	PCC	19EE53C	Microprocessor and Microcontroller	3	0	0	3	A
4.	PCC	19EE54C	High Voltage Engineering	3	0	0	3	A
5.	PEC	-	Program Elective-1	3	0	0	3	
6.	ESC	19EE55C	Object Oriented Programming	3	0	2	4	A
PRACTICAL COURSES								
7.	PCC	19EE56C	Control Systems Laboratory	0	0	3	1.5	**-**
8.	PCC	19EE57C	Microprocessor and Microcontroller Laboratory	0	0	3	1.5	**-**
			TOTAL	**18**	**0**	**8**	**22**	

SEMESTER – VI

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19EE61C	Power System-II	3	0	0	3	A
2.	PCC	19EE62C	Power Electronics	3	0	0	3	A
3.	PCC	19EE63C	Switchgear and Protection	3	0	0	3	A
4.	PEC	-	Program Elective-2	3	0	0	3	-
5.	OEC	-	OE-1	3	0	0	3	-
PRACTICAL COURSES								
6.	PCC	19EE64C	Power System simulation and High voltage Laboratory	0	0	2	1	**-**
7.	PCC	19EE65C	Power Electronics laboratory	0	0	3	1.5	**-**
8.	PCC	19EE66C	Electronics Design Laboratory	1	0	4	3	**-**
9.	SDC	19EE67C	Product Development Laboratory	1	0	2	2	**-**
			TOTAL	**17**	**0**	**11**	**22.5**	

SEMESTER – VII

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PEC	-	Program Elective-3	3	0	0	3	-
2.	PEC	-	Program Elective-4	3	0	0	3	-
3.	OEC	-	OE-2	3	0	0	3	-
4.	OEC		OE-3	3	0	0	3	-
5.	OEC	-	OE-4	3	0	0	3	-
6.	HSMC	19EE71C	Project Management and Finance	3	0	0	3	-
PRACTICAL COURSES								
7.	SDC	19EE72C	Project Work – I	0	0	6	3	-
8.	SDC	19EE73C	Research Paper and Patent Review – Seminar	0	0	2	1	-
9.	PCC	19EE74C	Comprehension	0	0	2	1	-
			TOTAL	**18**	**-**	**10**	**23**	

SEMESTER – VIII

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PEC	-	Program Elective-5	3	0	0	3	-
2.	HSMC	-	Elective Slot For HS (Social sciences-self study)	0	0	0	3	-
PRACTICAL COURSES								
3.	SDC	19EE81C	Internship / In-plant Training	0	0	4	2	-
4.	SDC	19EE82C	Project Work – II	0	0	12	6	-
			TOTAL	**3**	**-**	**16**	**14**	

OVER ALL CREDITS: 167

PROGRAMME ELECTIVE COURSES

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
1.	PEC	19EE01E	Electrical Machine Design	3	0	0	3	A
2.	PEC	19EE02E	Electrical Drives	3	0	0	3	A
3.	PEC	19EE03E	Industrial Electrical Systems	3	0	0	3	A
4.	PEC	19EE07E	Switched Mode Power Conversions	3	0	0	3	A
5.	PEC	19EE08E	Special Electrical Machines	3	0	0	3	A
6.	PEC	19EE10E	Power Electronics for Renewable Energy Systems	3	0	0	3	A
7.	PEC	19EE14E	Power System Transients	3	0	0	3	A
8.	PEC	19EE15E	Wind and Solar Energy Systems	3	0	0	3	A
9.	PEC	19EE16E	Power Quality	3	0	0	3	A
10.	PEC	19EE18E	Power System Dynamics and Control	3	0	0	3	A
11.	PEC	19EE19E	Electrical Energy Conservation and Auditing	3	0	0	3	A
12.	PEC	19EE22E	Solar Photovoltaic Systems	3	0	0	3	A
13.	PEC	19EE24E	Smart Grid	3	0	0	3	A
14.	PEC	19EE25E	Power Generation Systems	3	0	0	3	A
15.	PEC	19EE26E	Electrical Safety	3	0	0	3	A
16.	PEC	19EE28E	CAD of Electrical Apparatus	3	0	0	3	A
17.	PEC	19EE30E	Insulation Technology	3	0	0	3	A
18.	PEC	19EE31E	EHV Power Transmission	3	0	0	3	A
19.	PEC	19EE32E	HVDC Transmission Systems	3	0	0	3	A
20.	PEC	19EE34E	Digital Control Systems	3	0	0	3	A
21.	PEC	19EE35E	Control Systems Design	3	0	0	3	A
22.	PEC	19EE37E	Logic and Distributed Control System	3	0	0	3	A
23.	PEC	19EE38E	Biomedical Instrumentation	3	0	0	3	A
24.	PEC	19EE39E	Advanced Control Theory	3	0	0	3	A
25.	PEC	19EE40E	Soft Computing for Electrical Engineering	3	0	0	3	A
26.	PEC	19EE41E	Digital Signal Processing	3	0	0	3	A
27.	PEC	19EE42E	Robotics and Automation	3	0	0	3	A
28.	PEC	19EE44E	Embedded Systems	3	0	0	3	A
29.	PEC	19EE45E	MEMS and NEMS	3	0	0	3	A
30.	PEC	19EE46E	VLSI Design	3	0	0	3	A
31.	PEC	19EE47E	DSP based System Design	3	0	0	3	A
32.	PEC	19EE48E	Microcontroller based System Design	3	0	0	3	A
33.	PEC	19EE50E	Advanced Microprocessor and Microcontroller	3	0	0	3	A
34.	PEC	19EE52E	Real Time Operating Systems	3	0	0	3	A
35.	PEC	19EE53E	Automotive Electrical and Electronics	3	0	0	3	A
36.	PEC	19EE54E	Mobile Robots and Control	3	0	0	3	A
37.	PEC	19EE55E	Electric Vehicle Machines and Drives	3	0	0	3	A
38.	PEC	19EE56E	Battery Management systems and Modeling	3	0	0	3	A
39.	PEC	19EE57E	Control of Hybrid Electric Vehicles	3	0	0	3	A

40.	PEC	19EE58E	Autonomous Intelligent Vehicles	3	0	0	3	A
41.	PEC	19EE59E	Electronics Design and Technology	3	0	0	3	A

ONE CREDIT ELECTIVE COURSES

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
1.	OEC	19EE01L	Design of Power Converters Laboratory	0	0	2	1	-
2.	OEC	19EE02L	Energy storage system	1	0	0	1	C
3.	OEC	19EE03L	LVDC wiring	1	0	0	1	C
4.	OEC	19EE04L	Digital substation	1	0	0	1	C
5.	OEC	19EE05L	Electrical system for smart building	1	0	0	1	C
6.	OEC	19EE06L	Power System Protection and Substation Automation	1	0	0	1	C
7.	OEC	19EE07L	Energy Laboratory	0	0	2	1	-
8.	OEC	19EE08L	HVDC circuit breakers	1	0	0	1	C
9.	OEC	19EE09L	Earthing design	1	0	0	1	C
10.	OEC	19EE10L	Alternate insulating medium	1	0	0	1	C
11.	OEC	19EE11L	Communication technologies for smart grids	1	0	0	1	C
12.	OEC	19EE12L	Non-Conventional instrument Transformer	1	0	0	1	C
13.	OEC	19EE13L	Industrial Controllers Laboratory	0	0	2	1	-
14.	OEC	19EE14L	Soft Computing for Electrical Engineering Laboratory	0	0	2	1	-
15.	OEC	19EE15L	Electronics for safety critical system	1	0	0	1	C
16.	OEC	19EE16L	PCB design and fabrication	0	0	2	1	-
17.	OEC	19EE17L	Embedded System Laboratory	0	0	2	1	-
18.	OEC	19EE18L	Techno commercial project proposal	1	0	0	1	C
19.	OEC	19EE19L	Virtual Instrumentation	1	0	0	1	C
20.	OEC	19EE20L	Electrical Power Capacitors	1	0	0	1	C
21.	OEC	19EE21L	Internet of Things and Embedded Systems	1	0	0	1	C
22.	OEC	19EE22L	High Voltage Testing Techniques	0	0	2	1	-
23.	OEC	19EE23L	Quality practices for safety critical instrumentation system	1	0	0	1	C
24.	OEC	19EE24L	Switchgear and Protection Laboratory	0	0	2	1	**-**
25.	OEC	19EE25L	Electric vehicles simulation Laboratory	0	0	2	1	**-**
26.	OEC	19EE26L	EV Battery Design and Modeling Laboratory	0	0	2	1	**-**
27.	OEC	19EE27L	Python Programming in Raspberry Pi and Hardware Interfacing	0	0	2	1	**-**
28.	OEC	19EE28L	Arduino Programming	0	0	2	1	**-**
29.	OEC	19EE29L	Hydrogen Energy and Fuel Cells	1	0	0	1	C

TRANS-DISCIPLINARY ELECTIVE COURSES – SELF STUDY

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
1.	OEC	19TD05E	Indian Economy	0	0	0	3	D
2.	OEC	19TD09E	Indian History	0	0	0	3	D
3.	OEC	19TD10E	Sustainable Development and Practices	0	0	0	3	D
4.	OEC	19TD11E	Women in Indian Society	0	0	0	3	D
5.	OEC	19TD13E	Leadership and Personality Development	0	0	0	3	D

19SH11C **TECHNICAL ENGLISH** **L T P C**
(Common to all B.E. / B.Tech. Degree Programmes) **2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply the basic language skills to understand various aspects of communication skills (K3)
CO2: express their thoughts with correct usage of language in formal writings (K3)
CO3: understand various language components and develop the pronunciation skill. (K2)
CO4: make effective technical writings and interpret any pictorial representation. (K3)
CO5: frame sentences and write effective reports. (K3)

UNIT I **6**

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, Letter to Friend / Parent / Siblings - Greetings and Self Introduction – Situational Phrases - Tense (Present)

UNIT II **6**

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) – Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

UNIT III **6**

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

UNIT IV **6**

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

UNIT V **6**

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

Suggested Activity: Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Anderson, Paul V. “Technical Communication: A Reader - Centered Approach”, 9th Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. “A Comprehensive Grammar of the English Language”, Longman Inc., Newyork, 2014.

REFERENCES

1. Murphy Raymond, “Basic Grammar Practice on Tense”, Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., “Engineering English”, Orient Blackswan: Hyderabad, 2015.

19SH12C MATHEMATICAL FOUNDATIONS FOR ENGINEERS L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make use of orthogonal transformation. (K3)
CO2: find the evolutes of various curves.(K2)
CO3: maxima and minima of real valued functions.(K3)
CO4: solve ordinary differential equations.(K2)
CO5: solve partial differential equations.(K2)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivative – Total derivative – Euler’s theorem on homogeneous functions – Taylor’s Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange’s multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order ordinary differential equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9th Edition, Dorling Kindersley Private Limited, 2010.

19SH13C ENGINEERING PHYSICS L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)
CO2: understand the principle and propagation of different types of waves (K2)
CO3: choose the appropriate Laser technique for industrial and medical applications (K2)
CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)
CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

UNIT I CRYSTALLOGRAPHY 6

Lattice, Unit cell, Bravais lattice, Lattice planes - Crystal system - Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

UNIT II WAVES 6

Simple harmonic oscillators - Damped harmonic oscillator - Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

UNIT III LASER 6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

UNIT IV FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

UNIT V QUANTUM PHYSICS 6

Black Body Radiation - Matter Waves - Heisenberg's uncertainty principle - Schrodinger's wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 11th Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", 7th Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D. J. Griffiths, "Quantum mechanics", 2nd Edition, Cambridge University Press, 2014.

REFERENCES

1. Renk, Karl.F "Basics of laser physics", 2nd Edition, Springer international publishing, 2017.
2. H. J. Pain,Patricia Rankin "Introduction to vibration and waves", 1st Edition, Wiley, 2015
3. K.S.Mathur, "Fundamentals of Fiber Optics", 1st Edition, Zorba books, 2018.

19SH14C ENGINEERING CHEMISTRY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)
CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)
CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)
CO4: familiar with the various novel organic material used in electronics industry. (K2)
CO5: understand the principle, components and working of various analytical instruments. (K2)

UNIT I WATER TREATMENT 6

Hardness - Estimation of hardness of water – Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

UNIT II SURFACE CHEMISTRY AND CATALYSIS 6

Adsorption – Types - Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – Kinetics of surface reactions - Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications - Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

UNIT III ELECTROCHEMISTRY AND CORROSION 6

Electrode potential-Nernst Equation-reference electrode - glass electrode - measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)
Corrosion: Types of corrosion - Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

UNIT IV ELECTRONIC MATERIALS 6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidene fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, biosensor - chemical sensors

UNIT V ANALYTICAL TECHNIQUES 6

Spectroscopy:Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., “Engineering Chemistry”, Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20th Edition, 2018.

REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6th Edition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, “Organic Electronics: Materials, manufacturing and applications”, Wiley - VCH, 2016

19SH15C	**ENGINEERING GRAPHICS**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2 0 4 4**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
CO2: construct the orthographic projections of points, straight lines and lamina (K2)

CO3: draw the projections of simple solids in different positions. (K3)
CO4: visualize the sectional views and surface areas of various solids. (K3)
CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P: 60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, “Engineering Drawing”, 53rd Edition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, “Engineering Drawing”, Pearson Education, 2nd Edition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2nd Edition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, “Engineering Drawing”, Subhas Publications, 32nd Edition, 2017.

19SH16C	ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY	L T P C
		0 0 3 1.5

(Common to all B.E. / B.Tech. Degree Programmes)

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K2)
CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium. (K2)
CO3: illustrate the electrical properties of materials. (K2)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster’s bridge.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. David Loyal, “ Physics laboratory” 4th Edition, Cengage learning, 2013
2. Sesha Sai Kumar Vemula, “Engineering Physics lab manual” 1st Edition, LAP LAMBERT Academic Publishing, 2017

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: determine various water quality parameters. (K2)
CO 2: quantify different ions by different analytical techniques. (K2)
CO3: determine the rate of corrosion of mild steel plate. (K2)
CO4: verify the freundlich adsorption isotherm. (K2)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron (Fe^{2+}) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.

6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron (Fe^{2+}) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris “Quantitative Chemical Analysis: International Edition”, W.H.Freeman, 9th Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford , P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19SH17C	**ENGINEERING PRACTICE LABORATORY**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**0 0 4 2**

PART A - MECHANICAL LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: prepare different carpentry joints. (K3)
CO2: prepare pipe connections with different joints for domestic applications. (K3)
CO3: make simple components using sheet metal (K3)
CO4: make components using machining operations (K3)
CO5: explain the types of welding processes (K2)
CO6: discuss the applications of 3D printing and injection moulding processes (K2)

LIST OF EXPERIMENTS

I. CARPENTRY PRACTICES **5**

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands on exercise with application

II. PLUMBING PRACTICES **5**

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands on exercise with application

III. SHEET METAL PRACTICES **5**

1. Forming and Bending
2. Model making: Tray, Conical Funnel etc.

IV. MACHINING PRACTICES 5

1. Simple Turning
2. Drilling Practice
3. Model making: Shaft, stiffener plate, square flange, etc.
4. Demonstration of machining process in Vertical Machining Centre (VMC)

V. METAL JOINING PROCESS 5

1. Demonstration of Gas, Arc and TIG Welding

VI. ADDITIVE MANUFACTURING AND INJECTION MOULDING PROCESSES 5

1. Demonstration of 3D Scanning and Printing
2. Demonstration of Injection Moulding process

P: 30; TOTAL: 30 PERIODS

TEXT BOOK

1. Bawa H.S, “Workshop Practice”, Tata McGraw Hill Publishing Company Limited, 2007

REFERENCES

1. Ramesh Babu V, “Engineering Practices Laboratory Manual”, Revised Edition, VRB Publishers Private Limited, Chennai, 2014.
2. Jeyachandran K, Natarajan S. and Balasubramanian S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
3. Jeyapoovan T, Saravanapandian M. and Pranitha S, “Engineering Practices Lab Manual”, Vikas Publishing House Private Limited, 2006.
4. Rajendra Prasad A and Sarma PMMS, “Workshop Practice”, Sree Sai Publication, 2002
5. Kannaiah P and Narayana KL, “Manual on Workshop Practice”, Scitech Publications, 1999.

PART B – ELECTRICAL AND ELECTRONICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: perform residential house wiring (K2)
CO2: identify faults in any electrical appliances (K2)
CO3: measure energy and resistance to earth of electrical equipment (K2)
CO4: measure AC signal parameters using CRO (K2)
CO5: apply soldering for electronic circuit formation in PCB (K2)

LIST OF EXPERIMENTS

ELECTRICAL

1. Residential House Wiring using Switches, Fuse, Indicator, Lamp and Energy Meter.
2. Stair Case Wiring Connections
3. Measurement of Energy using Energy Meter for Single Phase System.
4. Measurement of Earth Resistance using Electrical Equipment.

5. Study of Emergency Lamp, Choke, Starter, Fan and Iron Box
6. Coil Rewinding for Transformer and Fan using Rewinding Machine.
7. Connection of protective devices

ELECTRONICS

8. Study of Resistor, capacitor and inductor
9. Study and Operation of Digital Multimeter, Function/Signal Generator and Regulated Power Supply.
10. Measurement of AC signal parameter (Peak-Peak, RMS, Period and Frequency) using CRO and DSO.
11. Soldering Practice
12. Study of logic gates AND, OR, NOT, NAND, NOR and EXOR.
13. Half Wave Rectifier and Full Wave Rectifier.

P: 30; TOTAL: 30PERIODS

REFERENCES

1. Jeyachandran K, Natarajan S and Balasubramanian S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapoovan T, Saravanapandian M and Pranitha S, “Engineering Practices Lab Manual”, Vikas Publishing House Pvt. Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A and Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P and Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

19EE21C PROFESSIONAL ENGLISH L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: integrate and apply the acquired skills in real life situation. (K3)
CO 2: write effectively in any professional contexts. (K3)
CO 3: enhance the vital sub-functions of communication in any formal situation. (K3)
CO 4: participate actively in any informal and formal discussion. (K3)
CO 5: recall the acquired skills and apply them in their work place. (K2)

UNIT I 6

Standard Abbreviations - If Conditionals - Presenting articles based on newspaper reading - Listening for specific information - Argumentative essay.

UNIT II 6

One word substitution - Rearranging the jumbled phrases of sentences – Chart Description - Business Letters for Quotations and Clarification.

UNIT III **6**

Idioms and Phrases - Direct & Indirect Speech - Business Letters for Placing orders and Making Complaints - Process Description.

UNIT IV **6**

Synonyms **-** Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples - Demo) - Proposal Writing.

UNIT V **6**

Error Spotting (Based on Concord, Pronouns, Articles & Adverb Placement) - Job Application Letter & Resume Preparation - Circular and Minutes of the meeting - Reading Comprehension.

Suggested Activity: Career Analysis – Herein the students will be required to submit a report about their dream career / company of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Board of editors. “Fluency in English A Course book for Engineering and Technology”, Orient Blackswan, Hyderabad, 2016.
2. Bovee, Courtland, L., John V.Thill. “Business Communication Today”, 13th Edition, Pearson Education, New Delhi, 2018.

REFERENCES

1. Lester Mark and Larry Beason, “Hand book of English Grammar and Usage”, McGraw Hill Education, 1st Edition, 2017.
2. Raman, Meenakshi and Sharma, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press, New Delhi, 2014.

19EE22C **CALCULUS, PROBABILITY AND STATISTICS** **L T P C**
2 1 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: compute double and triple integrals (K2)
CO2: analyze the concepts related to vector calculus (K3)
CO3: use the concepts of multivariate random variables (K2)
CO4: calculate the various measures of dispersion (K2)
CO5: apply all aspects of appropriate testing techniques (K2)

UNIT I **MULTIPLE INTEGRALS** **9**

Double integration – Cartesian and polar coordinates-Change of order of integration - Area as double integral-Volume as triple integral.

UNIT II VECTOR CALCULUS 9

Gradient, Divergence and Curl –Directional derivatives – Irrotational and solenoidal vector fields -Vector integration–Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs)–Simple applications involving cubes and rectangular parallelopipeds.

UNIT III PROBABILITY 9

Random variable - Discrete and continuous random variables–Moments-Moment generating function and their properties - Joint distributions-Marginal and conditional distributions -Covariance-Correlation and regression.

UNIT IV STATISTICS 9

Mean, median, mode and standard deviation–Moments–Skewness –Kurtosis - Correlation – Regression lines.

UNIT V TESTING OF HYPOTHESIS 9

Sampling distributions -Tests for single mean, Proportion, Difference of means (for large samples) – Tests for single variance and equality of variances–t-test, F-test.

L: 30; T: 15; TOTAL: 45 PERIODS

TEXT BOOKS

1. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publications, 44th Edition, New Delhi, 2017.
2. Ronald E.Walpole, Raymond H.Myres, Sharon L.Myres, Keying E. Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Private Limited, 9th Edition, Delhi, 2011.

REFERENCES

1. Gupta S.C, and Kapoor V.K, "Fundamentals of Mathematical Statistics: A modern approach", Sultan Chand & Sons, 10th Edition, Delhi, 2000.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition, 2011.
3. Richard Arnold Johnson, Irwin Miller, John E Freund, "Miller and Freund‟s Probability and Statistics for Engineers", 9th Edition, Pearson Education Private Limited, 2016.
4. Robert V.Hogg, Joseph W.Mckean, Allen Thornton Craig, "Introduction to Mathematical Statistics", 8th Edition, Pearson Education Private Limited, 2018.

19EE23C WAVES, OPTICS AND SEMICONDUCTOR PHYSICS L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: gain knowledge on different types of oscillations and its application in electrical systems (K2)
CO2: understand the laws, phenomenon and applications of light rays in engineering fields (K2)
CO3: infer the principles of quantum physics to understand the properties of semiconductor materials (K2)

UNIT I NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES 6

Wave motion – types of waves – wave equations – differential equations of wave motions - SHO in electrical systems - damped SHM in an electrical circuit- forced oscillations – behaviour of forced oscillator – resonance - impedance matching

UNIT II GEOMETRICAL OPTICS 6

Fermat's principle on laws of reflection and refraction – mirage effect – Brewster's angle – total internal reflection – mirror and lenses – optical instruments – compound microscope – constant deviation spectrometer – matrix methods – refraction and translation matrix.

UNIT III WAVE OPTICS 6

Huygen's theory – principle – superposition of waves – interference of light by wavefront splitting and amplitude splitting – Young's double slit – Newton's rings – Michelson's interferometer – Fraunhofer diffraction – single slit – circular aperture – resolving power of plane transmission grating – Reyleigh's criterion – Limit of resolution of the eye.

UNIT IV INTRODUCTION TO SOLIDS 6

Free electron theory of metals, fermi level, density of states – Types of electronic materials: metals, semiconductors and insulators.

UNIT V SEMICONDUCTORS 6

Intrinsic and extrinsic semiconductors – Dependence of Fermi level on carrier - concentration and temperature - Carrier generation and recombination – Carrier transport: diffusion and drift, p -n junction – LED: device structure, materials, characteristics.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. H.J.Pain, Patricia Rankin "Introduction to vibration and waves", Wiley, 1st Edition, 2015.
2. D. J. Griffiths, "Quantum mechanics", Cambridge University Press, 2nd Edition, 2014.
3. K.S.Mathur, "Fundamentals of Fiber Optics", Zorba books, 1st Edition, 2018.

REFERENCES

1. Arthur Beiser, "Concepts of Modern Physics", McGraw Hill Publications Private Limited, 7th Edition, 2017.
2. Eugene Hecht, "Optics", Pearson Education, 5th Edition, 2016
3. Donald Neamen, Dhrubes Biswas, Mc Graw Hill Education, 4th Edition, 2017

19EE24C CHEMISTRY FOR ELECTRICAL ENGINEERING L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the construction and uses of various energy storage devices. (K2)
CO2: familiar with different polymers used in electrical industry. (K2)
CO3: understand the principle and process of various surface coatings. (K2)
CO4: know about the electrical insulating materials. (K2)

CO5: gain knowledge about the applications of nanomaterials in energy storage devices. (K2)

UNIT I ENERGY STORAGE DEVICES 6

Batteries: Types of batteries – primary battery-dry cell- secondary batteries - lead acid, lithium-ion battery. Fuel cells: H_2-O_2 fuel cell, MOFC and MFC. Super capacitors - construction - Applications.

UNIT II POLYMER IN ELECTRICAL INDUSTRY 6

Dielectric polymers: origin - ferroelectrics, piezoelectric and pyroelectric-application. Characteristics and structural requirements of piezoelectric polymers - Polyvinylidene fluoride - Trifluoroethylene and tetrafluoroethylene copolymers – Nylon -11.

UNIT III SURFACE COATING 6

Introduction - metallic coating - determination of throwing power-electroplating of chromium- Electroless plating- nickel plating. Paints; constituents - multilayer coating on aluminium - zinc pasivation - anodizing.

UNIT IV ELECTRICAL INSULATING MATERIALS 6

Insulating material- requirement - properties – testing - dissolved gas analysis, furan analysis, degree of polymerization. Organic and inorganic insulation material- natural and synthetic.

UNIT V NANOTECHNOLOGY 6

Nanoparticles: synthesis, properties and applications–Lighting/Displays, Batteries, Fuel Cells, Photovoltaic Cells and Electric double-layer capacitors (EDLC) - Toxicity.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. P.C. Jain P.C. and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A text Book of Engineering Chemistry, S.Chand & Company Ltd, 20th Edition, 2018.

REFERENCES

1. R. Huggins, “Energy Storage: Fundamentals, Materials and Applications”, Springer International Publishing, 2nd Edition, 2016.
2. Arthur A. Tracton, “Coating materials and surface coatings” CRC press, Taylor & Francis, 4th Edition, 2016.
3. J.G.Drobny, Polymers for Electricity and Electronics: Materials, Properties, and Applications, Jhon Wiley & Sons, New Jersey, 2012.
4. J.Martinez-Vega, Dielectric Materials for Electrical Engineering, John Wiley & Sons, New Jersey, 2013.

19EE25C PROBLEM SOLVING TECHNIQUES

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: develop algorithmic solutions to simple computational problems. (K3)
CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
CO 3: solve problems using array and functions. (K3)
CO 4: implement various sorting techniques. (K3)
CO 5: implement various searching techniques. (K3)

UNIT I BASICS OF PROBLEM SOLVING 9

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

UNIT II BASIC TECHNIQUES 9

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

UNIT III ARRAYS AND FUNCTIONS 9

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV SORTING TECHNIQUES 9

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

UNIT V SEARCHING TECHNIQUES 9

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Maureen Sprankle and Jim Hubbard, "Problem Solving and Programming Concepts", Prentice Hall, 9th Edition, 2012.
2. Harsha Priya, R. Ranjeet, — Programming and Problem Solving Through C Language, Firewall/Laxmi Publications (P) Ltd., New Delhi, 2015.

REFERENCES

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, 2nd Edition, Oxford University Press, 2013.

2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner‘s Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

19EE26C BASIC CIVIL AND MECHANICAL ENGINEERING

L	T	P	C
4	0	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: discuss the materials and measurement techniques used in civil engineering. K2)
CO2: describe the fundamental elements of civil engineering structures. (K2)
CO3: discuss the components and working principle of power plants.(K2)
CO4: explain various power generation systems in vehicles. (K2)
CO5: discuss the working principle of refrigeration and air conditioning system. (K2)

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 12

Surveying: Objects – classification – principles – measurements of distances – angles – leveling – determination of areas– contours - examples.
Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel - timber - modern materials.

UNIT II BUILDING COMPONENTS AND STRUCTURES 12

Foundations: Types of foundations - Bearing capacity and settlement – Requirement of good foundations.
Civil Engineering Structures: Brick masonry – stonemasonry – beams – columns – lintels – roofing – flooring – plastering – floor area, carpet area and floor space index - Types of Bridges and Dams – water supply - sources and quality of water - Rainwater harvesting - introduction to high way and railway engineering.

UNIT III POWER PLANTS 12

Power Plants – Classification – Construction and working principle - steam, Gas, Diesel, Hydroelectric, Nuclear, Wind Energy and Solar Power plants.

UNIT IV VEHICLE TECHNOLOGIES 12

Internal combustion engines-Classification – Construction - Working principle- Four stroke and two stroke cycles - Comparison of four stroke and two stroke engines.
Electric Vehicle - Hybrid vehicle- Drivetrain configurations - Fuel cell Vehicles.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 12

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system-Layout of typical domestic refrigerator-Window and Split type room Air conditioner.

L:60; TOTAL: 60 PERIODS

TEXT BOOKS

1. Shanmugam G and Palanichamy M.S, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi, 2016.

2. Shanmuga Sundaram S and Mylsamy K, “Basic Civil and Mechanical Engineering”, Cengage Learning, 2011.

REFERENCES

1. Ramamrutham S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd, 2013.
2. Seetharaman S, “Basic Civil Engineering”, Anuradha Agencies, 2005.
3. Amir Khajepour, Saber Fallah M, Avesta ,“Electric and Hybrid Vehicles: Technologies, Modeling and Control – A Mehatronic approach”, Wiley, 2014
4. Shantha Kumar S R J, “Basic Mechanical Engineering”, Hi-tech Publications, 2013.

19EE27C	OPTICS AND SEMICONDUCTOR PHYSICS AND CHEMISTRY LABORATORY	L T P C 0 0 3 1.5

PART A OPTICS AND SEMICONDUCTOR PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: demonstrate the properties of light waves (K2)
CO 2: Illustrate the properties of semiconducting materials (K2)

LIST OF EXPERIMENTS

1. Determination of wavelength of Hg source using diffraction grating
2. Determination of wavelength of laser source and particle size of lycopodium powder
3. Determination of radius of curvature of a plano-convex lens – Newton’s rings
4. Determination of Hall coefficient
5. Bandgap determination of a semiconductor
6. V-I Characteristics of p-n junction diode
7. Characteristics of LED

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. Dr.Samir Kumar Ghosh, “A text book of Practical Physics” New Central Book Agency, 4th Edition, 2017
2. David Loyal, “ Physics laboratory”, Cengage learning, 4th Edition, 2013
3. Sesha Sai Kumar Vemula, “Engineering Physics lab manual”, LAP LAMBERT Academic Publishing, 1st Edition, 2017

PART B CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: quantify different ions by different analytical techniques. (K2)
CO 2: determine the distribution coefficient of analyte. (K2)
CO3: estimate the quality of transformer oil by different analytical techniques. (K2)
CO4: modify the surface of materials to prevent the corrosion. (K3)

LIST OF EXPERIMENTS

1. Estimation of copper (II) by Spectrophotometer.
2. Estimation of Fe^{2+} by Potentiometric titration.
3. To determine the distribution coefficient of iodine between CCl_4 and water at room temperature.
4. Saponification/acid value of vegetable oil.
5. Electroplating of copper on steel.
6. Determination of solubility product of given samples.
7. Condition assessment of transformer oil using spectrophotometer.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. Harris D.C, “Quantitative Chemical Analysis: International Edition”, 9th Edition, W.H.Freeman, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford , P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual , Alpha Science, New Delhi, 2016.

19EE27C PROBLEM SOLVING TECHNIQUES LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO 1: solve simple and Complex problems. (K3)
CO 2: solve sorting and searching problems. (K3)

LIST OF EXERCISES

Programs using simple logics and switch cases

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

Programs using Control Structures

5. Perform the following operations:
    a. Generate Pascal‘s triangle.

  b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.
7. Compute Sine series and Cosine series.
8. Find the 2‘s complement of a binary number.

Programs using Arrays

9. Perform the following operations:
    a. Matrix addition.
    b. Transpose of a matrix.
    c. Matrix multiplication by checking compatibility

Programs to manipulate Strings

10. Perform the following operations on a string:
    a. Insert a sub-string into main string at a given position.
    b. Delete n characters from a given position in a string.
    c. Check whether the given string is palindrome or not.
    d. Replace a character of string either from beginning or ending or at a specified location.

Programs using Functions

11. Perform the following operations: (Use recursive functions)
    a. Find the factorial of a given integer.
    b. Find the GCD (Greatest Common Divisor) of two given integers.
    c. Solve the Towers of Hanoi problem.

Programs using sorting and searching techniques

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

P: 60; TOTAL: 60 PERIODS

Software Requirement: Turbo C / Python

19EE29C	**COMMUNICATION SKILLS LABORATORY**	**L T P C**
	(Common to all B.E. / B.Tech., Degree Programmes)	**0 0 2 1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Listen and respond effectively to interact at different situations fluently (K2)
CO2: Excel appropriately in professional contexts. (K3)
CO3: Acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3)

UNIT I **10**

Lab session: Listening and responding to audio files
Practice session: Mini Presentation related to Business English & Picture description.

UNIT II **10**

Lab session: Role Play – News Reader

Practice session: Resume Preparation

UNIT III **10**

Lab session: Listening to audio files related to soft skills.

Practice session: Practicing Power point presentation, Group discussion.

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Dutt P. Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2013.
2. Comfort, Jeremy, et al. "Speaking Effectively, Developing Speaking Skills for Business English", Cambridge University Press, Cambridge: Reprint 2011.
3. Rizvi.M.Ashraf, "Effective Technical Communication", The MC-Graw Hill Education Private Limited Companies, New Delhi, 2010.

19GN01C INNOVATION THROUGH DESIGN THINKING

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)

CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS **15**

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS **30**

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, "Design Thinking: The Handbook", WS Professional, 2020
2. Pavan Soni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving", Penguin Random House, 2020
3. D.M. Arvind Mallik, "Design Thinking for Educators", Notion Press, 2019
4. Michael Lewrick, "The Design Thinking Playbook", Wiley, 2019
5. Kathryn Christopher, "Design Thinking in Engineering", Kendall Hunt Publishing Company, 2019
6. Robert Curedale, "Design Thinking Process & Methods" 5th Edition, Design Community College Inc, 2019
7. David Lee, "Design Thinking in the Classroom", Ulysses Press, 2018
8. Jimmy Jain, "Design Thinking for Startups", Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, "The Little Booklet on Design Thinking: An Introduction", 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, "Design Thinking: New Product

Development Essentials", Wiley-Blackwell, 2016
11. Thomas Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies - presentation	10 Hours
Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions	20 Hours
Evaluating the students‘ activities through their presentations	

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19EE31C FOURIER SERIES AND TRANSFORMS

L T P C
2 1 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Perform Fourier series analysis of the functions (K2)
CO 2: Compute the Fourier transforms of various functions (K2)
CO 3: Calculate the Fourier series solution of Wave and Heat equations (K3)
CO 4: Apply Laplace Transform techniques to solve ordinary differential equations (K3)
CO 5: Solve difference equations using Z-Transform (K3)

UNIT I FOURIER SERIES 9

Dirichlet's conditions–General Fourier series –Half range series–Complex form of Fourier series– Parseval's identity–Harmonic analysis.

UNIT II FOURIER TRANSFORMS 9

Fourier Integral theorem (without proof)–Fourier transform pair–Fourier Sine and Cosine transforms–Properties–Transforms of simple functions–Convolution theorem –Parseval's identity.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Classification of second order partial differential equations–Fourier series solutions of one dimensional wave equation –One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Insulated edges excluded)

UNIT IV LAPLACE TRANSFORMS 9

Definition of Laplace transform and its inverse –Transforms of elementary functions – Properties(excluding proofs) –Transforms of periodic functions –Initial and Final value theorems–Convolution theorem (excluding proof) – Solutions of linear ordinary differential equations of second order with constant coefficients.

UNIT V Z –TRANSFORMS 9

Z– transform –Elementary properties – Inverse Z–transform – Convolution theorem- Initial and final value theorem – Formation of difference equations –Solutions of difference equations using Z–transform.

L: 30; T: 15; TOTAL: 45 PERIODS

TEXT BOOKS

1. Grewal.B.S “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, Delhi, 2017.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India, 2011.

REFERENCES

1. Bali.N.P. and Manish Goyal, “A Textbook of Engineering Mathematics”, 9th Edition, Laxmi Publications Private Limited., 2014.
2. Ramana B.V, “Higher Engineering Mathematics”, Tata Mc-Graw Hill Publishing Company, New Delhi, 2007.
3. Jain.R.K. and Iyengar.S.R.K., “Advanced Engineering Mathematics”, 5th Edition, Narosa Publishing House Private Limited, 2016.

19EE32C ELECTRICAL CIRCUIT ANALYSIS

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO 1: Describe the basic concepts of electric circuits. (K2)
CO 2: Illustrate the network theorems for DC and AC circuits. (K2)
CO 3: Explain the concepts of resonant circuits. (K2)
CO 4: Discuss the dynamic behavior of electric circuits. (K2)
CO 5: Interpret the performance of three phase electric circuits. (K2)

UNIT I BASIC CIRCUITS ANALYSIS 12

Ohm’s Law – Kirchoff’s laws – DC and AC Circuits – Real & Reactive Power, Power factor – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 12

Network reduction: voltage and current division, source transformation – Star-delta conversion – Thevenin's and Norton's Theorem – Superposition Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 12

Series and parallel resonance – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE ANALYSIS 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and AC with sinusoidal input.

UNIT V THREE PHASE CIRCUITS & TWO PORT NETWORKS 12

Three phase balanced / unbalanced voltage sources – Analysis of three phase 3-wire and 4- wire circuits with star and delta connected loads, balanced and unbalanced loads – Phasor diagram of voltages and currents – power and power factor measurements in three phase circuits- Overview of two port networks.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. William H.Hayt Jr, Jack E.Kemmerly and Steven M.Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, New Delhi, 2013.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.

REFERENCES

1. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw- Hill, New Delhi, 2007.
3. John Bird, "Electrical Circuit Theory and Technology", 4th Edition, Newnes Publication, 2010.
4. Charles K. Alexander, Mathew N.O.Sadik, "Fundamentals of Electric Circuits", 2nd Edition, McGraw Hill, 2004.

19EE33C ANALOG ELECTRONICS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO 1: Infer the different BJT Biasing Circuits and amplifiers. (K2)
CO 2: Analyze the different MOSFET Biasing Circuits and amplifiers. (K2)
CO 3: Infer the characteristics of operational amplifier. (K2)
CO 4: Explain the basic applications of operational amplifier. (K2)
CO 5: Interpret the applications of special ICs and power supply circuits. (K2)

UNIT I DIODE AND BJT CIRCUITS 12

P-N junction diode – I-V characteristics of a diode - half-wave and full-wave rectifiers - Zener Diodes and Regulators - clamping and clipping circuits - Structure and I-V characteristics of a BJT- BJT as an amplifier- biasing circuits- common emitter, common base and common collector amplifiers - Small signal equivalent circuits - high-frequency equivalent circuit- power amplifiers - direct coupled multi-stage amplifier.

UNIT II MOSFET CIRCUITS 12

MOSFET structure - IV characteristics - MOSFET as an amplifier-small signal model-biasing circuits - common-source -common-gate-common-drain amplifiers - small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

UNIT III OPERATIONAL AMPLIFIERS AND ITS CHARACTERISTICS 12

Internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product) Idealized analysis of op-amp circuits - Inverting and non-inverting amplifier-differential amplifier, Instrumentation amplifier- integrator, differentiator.

UNIT IV APPLICATIONS OF OP- AMP 12

Active filter- oscillators (Wein bridge and phase shift) - Analog to Digital Conversion-Hysteretic Comparator, Zero Crossing Detector - Comparator - current mirror - Square wave and triangular wave generators - Precision rectifier- Peak detector- P, PI and PID controllers and lead/lag compensator using an op-amp

UNIT V APPLICATION ICS AND POWER SUPPLY 12

555 timers – Monostable and Astable Multivibrators – Schmitt Triggers – IC voltage regulators – LM78XX, 79XX – Variable voltage regulators switching regulators LM317, LM723 -– Switched Mode Power Supply.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.

REFERENCES

1. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
2. Jacob Millman, Christos Halkias, Chetan Parikh Millman's “Integrated Electronics” McGraw Hill Education; 2 Edition (1 July 2017)
3. David A. Bell “Electronic Devices and Circuits” Oxford; Fifth Edition (30 April 2008)
4. Salivahanan, Kumar “Electronic Devices and Circuits” McGraw Hill Education; Fourth Edition (1 July 2017)
5. D.Roy choudhuri, Shail B. Jain, “Linear Integrated Circuits”, New Age International Publications, 2012.

6. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory”, Amazon Asia-Pacific Holdings Private Limited, 2015
7. Thomas L. Floyd, David M. Buchla, “Basic Operational Amplifiers and Linear Integrated Circuits**”** Prentice Hall (January 10, 1999)

19EE34C ELECTRICAL MACHINES – I

L T P C
3 0 0 3

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO 1: understand the basic concepts of Magnetic circuits (K2)
CO 2: analyze single and three phase Transformer circuits (K2)
CO 3: appraise the concept of electro mechanical energy conversion (K2)
CO 4: understand the operations of DC electrical machines (K2)
CO 5: outline the functions of the motors and its applications (K2)

UNIT I MAGNETIC CIRCUITS 9

Magnetic Circuits – Flux Linkage, Inductance and Energy – Torque – Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines - Magnetic Materials, B-H curve of magnetic materials; flux-linkage Vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; Hysteresis and Eddy current Loss.

UNIT II ELECTRO MECHANICAL ENERGY CONVERSION 9

Energy stored in a magnetic circuit – Force as a partial derivative of stored energy with respect to position of a moving element – Torque as a partial derivative of stored energy with respect to angular position of a rotating element: Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency - Flux density distribution – armature MMF wave – Air gap flux density distribution with armature reaction.

UNIT III DC GENERATOR 9

Construction – Principle of Operation – Lap and Wave windings – EMF Equation – Armature Reaction – Method of Excitation – Commutation – Interpoles and Compensating Winding – Characteristics of DC Generator – Parallel Operation – Losses and Efficiency

UNIT IV DC MOTOR 9

Principle Of Operation – Back EMF – Torque Equation – Types of Motors – Starters and Speed Control – Speed Torque Characteristics – Braking – Losses and Efficiency – Retardation test – Swinburne’s Test – Hopkinson’s Test – Permanent Magnet DC Motor.

UNIT V TRANSFORMER 9

Construction and Working Principle – Equivalent circuit Parameters – Phasor Diagram – Losses and efficiency – All day efficiency and Voltage Regulation – Sumpner’s test – Polarity Test – Separation of Losses – Three Phase transformer-vector groups - types of connection and their comparative features – Scott connection – Parallel Operation – Auto transformer – Tap Changing Transformer-IEC/IEEE/IS

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Nagrath I. J and Kothari D. P. "Electric Machines", 5th Edition, Tata Mc-Graw Hill Publishing Company Limited, 2017
2. S.K.Bhattacharya "Electrical Machines", 4th Edition, Tata Mc-Graw Hill Publishing Company Limited, 2014.

REFERENCES

1. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning Private Limited, New Delhi, 2009.
2. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', 6th Edition, Tata Mc-Graw Hill Books Company, 2003.
3. P.S. Bimbhra, "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.
4. S.Sarma & K.Pathak "Electric Machines", Cengage Learning India Private Limited, Delhi, 2011.
5. V.K.Metha and Rohit Metha "Principles of Electrical Machines" S.Chand Publications, 2014.
6. "Transformers", 2nd Edition, BHEL, 2003.
7. IEC60076 -Transformer standards, IEC 60034 rotating machines

19EE35C ELECTROMAGNETIC FIELDS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: understand the basic laws of electromagnetism. (K1)
CO2: obtain the electric and magnetic fields for simple configurations under static conditions. (K2)
CO3: analyze time varying electric and magnetic fields. (K2)
CO4: understand Maxwell's equation in different forms and different media. (K1)
CO5: investigate the propagation of EM waves in different spaces. (K3)

UNIT I REVIEW OF VECTOR CALCULUS 12

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus-differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

UNIT II STATIC ELECTRIC FIELDS 12

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation.

UNIT III STATIC MAGNETIC FIELDS 12

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetization and permeability, Magnetic boundary conditions, Inductances and mutual inductances.

UNIT IV TIME VARYING FIELDS AND MAXWELL'S EQUATIONS 12

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

UNIT V ELECTROMAGNETIC WAVES 12

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem- Applications EMI/EMC (qualitative)

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

REFERENCES

1. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.
2. W.J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1990.
3. E.G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
4. B.D.Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
5. Henry W. Ott, "Electromagnetic Compatibility Engineering", Wiley-Blackwell; Revised Edition (11 September 2009)

19EE36C ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe basic laws of mechanics and apply equilibrium principles to solve the problems on statics of particles. (K2)

CO2: draw free body diagram for two dimensional rigid bodies and construct shear force and bending moment diagrams of beam section. (K3)
CO3: determine the centroid and moment of inertia of plane lamina. (K3)
CO4: understand the kinematics of rigid bodies and general plane motion. (K2)
CO5: explain the basic principles and applications of friction. (K2)

UNIT I STATICS OF PARTICLES – EQUIVALENT SYSTEMS OF FORCES 9

Laws of Mechanics – Single equivalent force – Equilibrium of a particle - Vectorial representation of forces – Forces in space – Equilibrium of a particle in space – Principle of transmissibility – Equivalent forces – Moments and Couples – Moment of a force about a point - Scalar components of a moment.

UNIT II PROPERTIES OF SURFACES 9

First moment of area of simple sections from integration – Second moment of simple plane area –Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia.

UNIT III EQUILIBRIUM OF RIGID BODIES 9

Free body diagram – Types of supports and their reactions – Equilibrium of Rigid bodies in two dimensions – point loads, UDL and UVL on beams, shear force and bending moment in beams, analysis of cantilevers and simply supported beams - shear force and bending moment diagrams.

UNIT IV FRICTION 9

Frictional force -Laws of Coulomb friction -Simple contact friction – Angle of Repose; Angle of friction - Coefficient of friction – Problems involving dry friction – Ladder friction - Rolling resistance – Belt friction.

UNIT V ELEMENTS OF RIGID BODY DYNAMICS 9

Kinematics of rigid bodies: Dentition and motion of a rigid body; Translation and Rotation of Rigid Bodies - Angular velocity of a rigid body, and its rate of change – General Plane motion – Absolute and relative motion method of analysis.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Hibbeller RC, "Engineering Mechanics: Statics & Dynamics", 13th Edition, Pearson India Education Services Private Limited, 2012.
2. Beer FP, Mazurek DF, Sanghi S, Eisenberg ER, Johnston ER and Cornwell PJ, "Vector Mechanics for Engineers: Statics and Dynamics", 10th Edition, Tata Mc-Graw Hill Education Private Limited, 2012.

REFERENCES

1. L. Meriam and L. G. Kraige, "Engineering Mechanics: Statics & Dynamics", Wiley, 2011.
2. Rajasekaran S and Sankarasubramanian G, "Fundamentals of Engineering Mechanics", 3rd Edition, Vikas Publishing House Private Limited, 2010.
3. Irving H Shames, "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education Asia Private Limited, 2003.

4. Ashok Gupta, “Interactive Engineering Mechanics–Statics – A Virtual Tutor (CDROM)”, Pearson Education Asia Private Limited, 2002.
5. Palanichamy MS and Nagan S, “Engineering Mechanics – Statics and Dynamics”, 3rd Edition, Tata McGraw Hill, 2004.

19MC01C ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P C
3 0 0 0

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: explain the structure and function of ecosystem. (K2)
CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)
CO 3: explain the causes and effects of pollution. (K2)
CO 4: describe social issues related to the environment and the environment act. (K2)
CO 5: identify the nutrients in food and impact of metals on human health. (K2)

UNIT I ENVIRONMENT AND ECOSYSTEMS 9

Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

UNIT II BIODIVERSITY AND NATURAL RESOURCES 9

Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over-exploitation – deforestation – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

UNIT III ENVIRONMENTAL POLLUTION 9

Causes, effects and control measures of air pollution, water pollution, noise pollution and nuclear hazards – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9

Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; Environment laws: environmental (protection) act 1986-the wild life (protection) act 1972.

UNIT V FOOD AND HUMAN HEALTH 9

Carbohydrates, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, cadmium, mercury and chromium on human health.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Miller G. and Spoolman S, “Environmental Science”, 14th Edition, Brooks/Cole Publishing Co., 2012.
2. Maczulak A.E., “Environmental Engineering”, Facts on file Inc., 2009
3. Han D, “Concise Environmental Engineering”, PhD & Ventus Publishing ApS, 2012

REFERENCE

1. Weller K. “Environmental Science and Biological Engineering”, 1st Edition, WIT Press, 2015 2. Strange C. “Environmental Science and production” NasonTrest Publisher, 2010

19EE37C ANALOG ELECTRONICS LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: Design the different Transistor Biasing Circuits and amplifiers (K2).
CO2: Demonstrate the basic applications of operational amplifier (K2).
CO3: Design the applications of special ICs and power supply circuits (K3).

LIST OF EXPERIMENTS

1. Frequency response of Common Emitter Amplifier.
2. Design of MOSFET based amplifier
3. Half wave and Full wave Rectifiers with filters
4. Voltage regulators
5. Design and implementation of power amplifiers
6. Characteristics of MOSFET
7. Characteristics of BJT as CB and CE configuration
8. Timer IC application: Astable and Monostable operation.
9. Application of Op–Amp: Inverting and Non–inverting amplifier, Voltage follower, Comparator
10. Application of Op–Amp: P, PI, PID controller and Active filters
11. Analog to Digital Converter and Digital to Analog Converter
12. Design of Zener Voltage regulator and variable power supply.

P: 45; TOTAL: 45 PERIODS

19EE38C ELECTRICAL MACHINES – I LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO 1: understand the concepts of starters and speed control of DC motor (K2)
CO 2: analyze the performance of DC generators (K2)
CO 3: appraise the characteristics of DC motors (K2)
CO 4: experiment the principle of transformers (K2)
CO 5: identify the losses and efficiency of Transformer and DC machines (K2)

LIST OF EXPERIMENTS

1. External and Internal characteristic of DC Generators (Shunt, Series and Compound).
2. Load Characteristics of D.C. Motor. (Shunt and Series)
3. Speed Control of DC shunt motors
4. Swinburne's Test.
5. Hopkinson's Test
6. Load Test on Single Phase Transformer.
7. Separation of No load Losses in Transformer.
8. Sumpner's Test on Single Phase Transformer.
9. Three phase Transformer Connections.(Phase Groups)
10. O.C. / S.C. Test on single Phase Transformer.
11. Study of Starters

P: 45; TOTAL: 45 PERIODS

19EE41C COMPLEX ANALYSIS, NUMERICAL METHODS AND MATHEMATICAL LOGIC

L T P C
2 1 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Grasp the concepts of analytic functions (K2)
CO2: Evaluate complex integration over contour (K3)
CO3: Use numerical techniques to solve algebraic equation and interpolate (K3)
CO4: Solve differential equations using numerical methods (K3)
CO5: Verify the validity of the arguments (K2)

UNIT I ANALYTIC FUNCTIONS 9

Analytic functions–Necessary and Sufficient conditions Harmonic and orthogonal properties of analytic functions –Harmonic conjugate –Construction of analytic functions – Conformal mapping: w= z+c, cz, 1/z and bilinear transformation.

UNIT II COMPLEX INTEGRATION 9

Cauchy's integral theorem and Cauchy's integral formula – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour excluding poles on boundaries.

UNIT III SOLUTION OF ALGEBRAIC EQUATIONS AND INTERPOLATION 9

Solving non-linear algebraic equations–Newton - Raphson method; Iterative methods – Gauss-Jacobi and Gauss-Seidel methods; Interpolation–Lagrange's and Newton's divided difference formulas –Newton's forward and backward difference formulas.

UNIT IV NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS 9

Taylor's series method – Euler's method –Modified Euler's method – Fourth order Runge - Kutta method – Finite difference methods for solving second order equations –Solution of two dimensional Laplace and Poisson equations.

UNIT V MATHEMATICAL LOGIC 9

Propositional Logic –Equivalences and Implications – Rules of inference – Introduction to proofs – Proof methods and strategy.

L: 30; T: 15; TOTAL: 45 PERIODS

TEXT BOOKS

1. Grewal.B.S "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.
2. Grewal, B.S and Grewal,J.S, "Numerical methods in Engineering and Science", 9th Edition, Khanna publishers, New Delhi, 2007.

REFERENCES

1. Trembly J.P and Manohar.R,"Discrete Mathematical Structures with Applications to Computer Science", Tata Mc-Graw Hill Private Limited, New Delhi, 35th Reprint 2008.
2. Ramana B.V,"Higher Engineering Mathematics",6th Edition, Tata Mc-Graw Hill Private Limited, New Delhi, 2008.
3. Jain M.K, Iyengar S.R.K, Jain R.K., "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New age international (P) Ltd., Publishers, Reprint 2012.
4. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw-Hill Private Limited, New Delhi, Special Indian Edition, 2011.

19EE42C DIGITAL ELECTRONICS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Simplify Boolean functions, design and implement combinational logic circuits. (K2)
CO2: Design and implement sequential logic circuits. (K3)
CO3: Understand the process of Analog to Digital conversion and Digital to Analog conversion. (K2)
CO4: Summarize the characteristics and function of logic families, devices and memories. (K2)
CO5: Write VHDL program for logic circuits. (K2)

UNIT I BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS 9

Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems - binary, signed binary, octal, hexadecimal number, binary arithmetic, one's and two's complements arithmetic, simplification of logic functions using K-map and Quine McCluskey method — Design of combinational circuits: Adders, Subtractors, Multiplexer, De-Multiplexer, Encoder, Decoder, serial adder, digital comparator, parity checker/generator, code converters, Parity checker/generator.

UNIT II ANALYSIS AND DESIGN OF SEQUENTIAL CIRCUITS 9

A 1-bit memory, the circuit properties of Bi stable latch, the clocked SR flip flop, JK, T and D type flip flops, Realization of flip flops, Triggering methods, applications of flip flops, shift registers and its types, sequence generator, design of synchronous counter, asynchronous counter, Analysis of synchronous and asynchronous circuits, special counter IC's.

UNIT III A/D AND D/A CONVERTERS 9

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications, sample and hold circuit, analog to digital converters: Specifications, quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion- Recent converters(qualitative).

UNIT IV LOGIC FAMILIES, MEMORIES AND PROGRAMMABLE LOGIC DEIVCES 9

Characteristics of digital ICs –Digital logic families: TTL, ECL, NMOS, CMOS – Memory organization and operation, expanding memory size, classification and characteristics of memories, read only memory (ROM), read and write memory(RAM), PROM, EPROM, EEPROM, Flash-Memory size calculation- content addressable memory (CAM), charge coupled device memory (CCD), ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

UNIT V HARD WARE PROGRAMMING LANGUAGE 9

RTL Design – Behavior, Data flow and Structural modeling – Data Types – Operators – Packages – VHDL programs (using three approaches) for adder, subtractor, multiplexer, de-multiplexer, encoder, decoder, code converter, flip flops, counters.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Morris Mano. M, "Digital Design: with an Introduction to the Verilog HDL", 5th Edition, Pearson Education, 2014.
2. Donald P. Leach, Albert Paul Malvino, Goutam Sha, "Digital Principles and Applications", 7th Edition, Tata Mc-Graw Hill Private Limited, 2011.
3. Jayaram Bhasker, "VHDL Primer", Prentice Hall, 2007

REFERENCES

1. Floyd and Jain, "Digital Fundamentals", 11th Edition, Pearson Education, 2017.
2. Salivahanan. S and Arivazhagan. S, "Digital Circuits and Design", 4th Edition, Vikas Publishing House Private Limited, 2012.
3. Charles H. Roth, "Fundamentals Logic Design", 7th Edition, Jaico Publishing House, 2013.
4. John F. Wakerly, "Digital Design Principles and Practice", 4th Edition, Pearson Education, 2005
5. Ronald J. Tocci, "Digital Systems: Principles and applications", 11th Edition, Pearson Education, 2010.
6. Raj Kamal, "Digital systems –Principles and Design", 2nd Edition, Pearson Education, 2014.

19EE43C ELECTRICAL MACHINES – II

L T P C
3 0 0 3

COURSE OUTCOMES

Upon the successful completion of this course, students will be able to

CO1: Understand the fundamental concepts of AC rotating machines (K2).
CO2: Explain the operation of Induction machines (K2).
CO3: Describe the performance of single phase AC machines and special machines (K2).
CO4: Analyze the performance of ac generators (K2).
CO5: Discuss t he operation of synchronous machines (K2).

UNIT I FUNDAMENTALS OF AC MACHINES 9

Physical arrangement of windings in stator and cylindrical rotor; Slots, Coils, concentrated and distributed winding, 3D visualization of the above winding types- Air-gap MMF distribution with fixed current through windings , winding distribution factor, Constant and pulsating magnetic field, alternating current in windings with spatial displacement, Magnetic field produced by a single winding with fixed current and alternating current, Magnetic fields produced by 90 degrees spatially displaced windings, three windings spatially shifted by 120 degrees (revolving magnetic field).

UNIT II THREE PHASE INDUCTION MACHINES 9

Construction, Types (squirrel cage and slip-ring), Torque-Slip Characteristics, Starting and Maximum Torque. No load and Blocked Rotor tests, Equivalent circuit, Phasor Diagram, Circle Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

UNIT III SINGLE-PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

Constructional features double revolving field theory, equivalent circuit, and determination of Parameters, performance analysis. Split-phase starting methods and applications, Special machines: Universal Motor, Reluctance motor, Repulsion motor, Hysteresis motor, Stepper motor and AC series motor.

UNIT IV SYNCHRONOUS GENERATOR 9

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation – EMF, MMF,ZPF and ASA methods. Operating characteristics of synchronous machines. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators.

UNIT V SYNCHRONOUS MOTOR 9

Principle of operation – Current loci for constant power input, constant excitation and constant power developed- Power and Torque Equations- Starting methods - V Curves and inverted V curves – Operation on infinite bus bars- Hunting- Synchronous Condensers.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. I. J. Nagrath and D. P. Kothari, “Electric Machines”, Mc-Graw Hill Education, 2010.
2. Mehta. V.K and Rohit Mehta, “Principle of Electrical Machines”, S. Chand Publishers, 2009.

REFERENCES

1. E. Fitzgerald and C. Kingsley, "Electric Machinery”, Tata Mc Graw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
4. Theraja. B.L, Theraja. A.K, “A text book on Electrical Technology”, Volume–II, S. Chand Company and Ltd, 2009.
5. P.C.Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.

19EE44C MEASUREMENT AND INSTRUMENTATION

L T P C
3 0 0 3

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: Perform statistical data analysis and infer characteristics of instruments. (K3)
CO2: Describe the operation of various measuring instruments. (K2)
CO3: Design of DC and AC bridges for measuring passive elements. (K2)
CO4: Select transducers for an application and calibrate the instruments to standards. (K2)
CO5: Explain significance of the computer based data acquisition and digital equipments. (K2)

UNIT I STATISTICAL DATA & ERROR ANALYSIS 9

SI units – Static and Dynamic characteristics of instruments - Types of error - Error analysis – Statistical analysis: Mean, Standard deviation – Variance - Probability of errors - Integral error: ISE, IAE analysis- Standard and Calibration.

UNIT II OPERATION OF MEASURING INSTRUMENTS 9

Fundamental elements of an instrument - Types of analog meters – Principle of Moving coil instruments – Moving iron instruments – Extension of meter range – Induction type wattmeter and energy meters – Instrument transformer - Optical CT-CVT-IVT –Rogowski-Hall sensors.

UNIT III AC AND DC BRIDGES 9

Resistance measurement – Wheatstone bridge, Kelvin double bridge – Measurement of earth resistance, insulation resistance – Megger – Measurement of inductance and capacitance – Maxwell’s bridge, Anderson bridge, Desauty’s bridge and Schering bridge.

UNIT IV TRANSDUCER 9

Transducers selection - Types – Resistive transducer: Potentiometer - Strain gauge – Inductive transducer: LVDT – Capacitive transducer - Measurement of pressure – Piezo-electric transducers – Measurement of temperature: RTD, thermistor, thermocouple, optical and radiation pyrometers– Encoders.

UNIT V DIGITAL INSTRUMENTATION 9

Quantization - Digital voltmeters, Types – Ramp and integrating – Digital multimeter – Digital storage Oscilloscope – Digital printers and plotters – Data logger: block diagram – LED and LCD displays – LCR meter - Multifunction meter - Smart meter-introduction to virtual instrumentation.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Helfrick, Albert. D and Copper. W.D, ‘Electronics Instrumentation and Measurement Techniques’, Prentice Hall of India Ltd. & Co, New Delhi, 2010.
2. Doebin. E, ‘Measurement Systems: Application and Design’, 5th Edition, Tata McGraw Hill, 2006.
3. Sawhney. A.K, ‘A Course in Electrical and Electronics – Measurement and Instrumentation’, Dhanpal Rai & Sons, New Delhi, 2001.

REFERENCES

1. Kalsi. H.S, ‘Electronic Instrumentation’, Tata McGraw Hill, 2011.
2. Ernest Frank, Electrical measurement analysis, McGraw Hill, New York
3. Golding and Widdis, Electrical measurements and measuring instruments, Wheeler Publishing House, New Delhi,1993
4. Rangan. C.S, Sharma. G.R and Mani. V.S, ‘Instrumentation Devices and Systems’, 2nd Edition, Tata McGraw Hill, 2010.
5. John Park Steve Mackay, “Practical Data Acquisition for Instrumentation and Control Systems”, 2003.

19EE45C SIGNALS AND SYSTEMS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

- CO1: describe the types and properties of different signals and systems (K2).
- CO2: appraise the behavior of CT and DT LTI systems with different mathematical approaches (K2).
- CO3: analyze signals and systems in complex frequency domain (K2).
- CO4: explain the concept of sampling and applications of signals and systems (K2).

UNIT I INTRODUCTION 9

Signals: Types – Properties: periodicity, absolute integrability, determinism and stochastic character – Basic Signals: unit impulse, unit step, sinusoid, complex exponential and time-limited signals - continuous and discrete time signals.

Systems: continuous and discrete time systems – Properties: additively and homogeneity, shift-invariance, causality, stability, reliability.

UNIT II BEHAVIOR OF CT AND DT LTI SYSTEMS 9

Impulse response and step response – convolution - input-output behavior - cascade interconnections - Characterization of causality and stability of LTI systems - System representation through differential equations and difference equations – the notion of a frequency response and its relation to the impulse response -State-space Representation of systems - State-Space Analysis.

UNIT III ANALYSIS OF CT SIGNAL AND SYSTEM 9

Fourier series representation of periodic signals - Waveform Symmetries - Calculation of Fourier Coefficients. Fourier Transform - convolution/multiplication and their effect in the frequency domain - magnitude and phase response - Fourier domain duality.

Laplace Transform for continuous time signals and systems - system functions - poles and zeros of system functions and signals - Laplace domain analysis -solution to differential equations and system behavior.

UNIT IV ANALYSIS OF DT SIGNAL AND SYSTEM 9

Discrete-Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT) - Parseval's Theorem. Z-transform for discrete time signals and systems - system functions - poles and zeros of systems and sequences - z-domain analysis - solution to difference equations and system behavior.

UNIT V APPLICATIONS OF SIGNALS AND SYSTEMS 9

Analog to Digital Conversion - Sampling Theorem and its implications - Spectra of sampled signals – Digital to Analog Conversion – Reconstruction with ideal interpolator, zero-order hold, first-order hold - Aliasing and its effects - Relation between continuous and discrete time systems - modulation for communication, filtering, feedback control systems.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J.G.Proakis and D.G.Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.

REFERENCES

1. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
2. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
3. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
4. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
5. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

19EE46C BIOLOGY FOR ENGINEERS

L T P C
2 0 0 2

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: describe and comprehend the fundamental concepts of cell biology. (K2)
CO2: understand the various bimolecular interactions in living organisms. (K2)
CO3: familiar with biological database. (K2)
CO4: understand the thermodynamic concepts in living organisms. (K2)
CO5: apply the molecular modeling methods in the drug design. (K2)

UNIT I CELL BIOLOGY 6

Cell as a basic unit of life-Cell organization of prokaryotic and eukaryotic cells-Structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus-Cell cycle-cell division: mitosis and meiosis.

UNIT II BIO MOLECULAR INTERACTIONS 6

DNA and RNA-hydrophobicity and hydrophilicity-Molecular interactions: Hydrogen bonding, Hydrogen Bonding Descriptors, vander vaals interaction- partition coefficient: (Log p) octanol -water system -Lipinski's rule

UNIT III METABOLISM 6

Cell metabolism with respect to Carbohydrates and amino acids-Regulation of blood glucose and homeostasis- Glycogenesis and glycogenolysis and their regulation-measurement of blood glucose level.

UNIT IV BIOMATERIALS AND TESTING 6

Degradable Biomaterials: PGA and PLA); Composite Biomaterials: Properties-classification-Applications:fabrication of biodevices and implants. Testing: Physiochemical Test, Mechanical Test, Invitro and Invivo types.

UNIT V BIOSENSORS 6

Introduction – requirements to be better sensor-application-construction and function of Biosensor-classification-Advantages of biosensor; amperometric enzyme electrodes-characteristics- enzyme activity determinations – biosensors for enzyme immunoassay – Potentiometric enzyme electrodes – electrode characteristics and performance- pH glass and ion-selective electrodes – solid-state pH and redox electrodes –gas electrodes.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. A.Nag and B. Dey , Computer aided drug design and delivery system, McGraw-Hill, ISBN: 978-0-07-170125-9, 2011
2. Philip N. Bartlett, Bioelectro chemistry: Fundamentals, Experimental Techniques and Applications 1st Edition, John Wiley & Sons, 2008
3. Ratner and Hoffmann, Biomaterial Science: An Introduction to Materials in Medicine, 2nd Edition, 2004

4. D.V.Vranken, G.A.Weiss, Introduction to Bioorganic Chemistry and Chemical Biology, CRC, 1st Edition, Taylor & Francis, 2012

REFERENCES

1. Shashi Chawla, A text book of engineering chemistry, 3rd Edition, Dhanpat rai & Co, New Delhi
2. John K Young, Introduction to Cell Biology, World scientific, 2010

19MC02C CONSTITUTION OF INDIA

L T P C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the salient features of the Indian Constitution. (K2)
CO2: discuss the structure and functions of parliament. (K2)
CO3: elaborate the structure and functions of state legislature. (K2)
CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
CO5: discuss the foreign policy of India. (K2)

UNIT I INDIAN CONSTITUTION 9

Salient Features – Preamble - Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM 9

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM 9

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT IV THE JUDICIARY 9

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS 9

Foreign Policy of India – VISA Application Process - International Institutions like UNO, WTO, SAARC and Environmentalism.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, “Introduction to the Constitution of India”, Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, “Our Constitution”, National Book Trust, New Delhi, 2010.
3. Shukla V N, “Constitution of India”, Eastern Book Company Ltd., New Delhi, 2011

19EE47C DIGITAL ELECTRONICS LABORATORY

L T P C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design and demonstrate the working of combinational circuits. (K2)
CO2: Construct sequential circuits like n –bit modulo counters and shift registers.(K3)
CO3: Design and demonstrate the operation of A/D and D/A converters. (K2)

LIST OF EXPERIMENTS

1. Study of Basic Digital IC’s.
2. Implementation of Boolean Functions and Adder/ Subtractor circuits.
3. Code converters (Binary – Gray, Gray – Binary, BCD – Excess 3)
4. Encoders and Decoders.
5. Multiplexer/ De–multiplexer
6. Magnitude comparator
7. Parity generator and parity checker
8. Flip Flops (SR, JK, D and T)
9. Counters: synchronous and Asynchronous.
10. UP/DOWN counter
11. Shift Registers: SISO, SIPO, PISO, PIPO modes.
12. Analog to Digital Converter and Digital to Analog Converter
13. VHDL coding for simple circuits

P: 45; TOTAL: 45 PERIODS

19EE48C MEASUREMENT AND INSTRUMENTATION LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: Practice statistical data analysis for a set of data to infer characteristics and error in measurement. (K2)
CO2: Design DC and AC bridges and validate using digital meters. (K3)
CO3: Calibrate the instruments and analyze the characteristics various transducers (K2)
CO4: Experiment with DSO and infer the dynamic response of RLC their operational region their limitations. (K3)
CO5: Perform the computer based data acquisition, simulation and coding. (K2)

LIST OF EXPERIMENTS

1. Measure and analysis of Error for a set of data from a batch of resistance

2. Inductance measurement using Anderson bridge and hay's bridge and validate with LCR meter
3. Capacitance measurement using schering bridge and de-saulty bridge and validate with LCR meter
4. Resistance measurement using Kelvin double bridge
5. Insulation resistance measurement using Megger
6. Calibration of LVDT, pressure transducers and strain gauge.
7. Design of temperature measuring circuit using thermocouple
8. Calibration of three phase energy meter by two wattmeter method and validate using multifunction meter.
9. Extension range of voltmeter and ammeter.
10. Current measurement using CT and hall effect sensor
11. Practice of signal measurement and transient analysis of RLC circuit using DSO.
12. ELVIS Data acquisition system using LabVIEW platform.
13. C program code development for electrical parameter measurements.
14. Virtual lab exercises.

P: 45; TOTAL: 45 PERIODS

19EE49C ELECTRICAL MACHINES – II LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO 1: compute the regulation of Three Phase Alternator using various methods (K2).
CO 2: evaluate the performance characteristics of Induction motors (K2).
CO 3: explain the various staring methods of AC motors (K2).
CO 4: predict the performance characteristics of induction motors (K2).
CO5: explain the performance of synchronous motors (K2).

LIST OF EXPERIMENTS

1. Study of AC Motor Starters.
2. Regulation of Three Phase Alternator by EMF method.
3. Regulation of Three Phase Alternator by MMF method.
4. Regulation of Three Phase Alternator by ZPF method.
5. Regulation of Three Phase Alternator by ASA method.
6. Regulation of Three Phase Salient Pole Alternator by Slip test
7. Synchronisation of Alternator with bus bars by dark lamp method.
8. V and Inverted V curves of Three Phase Synchronous Motor.
9. Load test on Three Phase slip ring Induction Motor.
10. Predetermination of performance characteristics of three phase squirrel cage induction motor by circle diagram and equivalent circuit.
11. Separation of No–load losses of Three Phase Induction Motor.
12. Load test on Single Phase Induction Motor.
13. Equivalent Circuit of Single Phase Induction Motor.

P: 45; TOTAL: 45 PERIODS

19EE51C POWER SYSTEM - I

L	T	P	C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the basic concepts of power systems. (K2)
CO 2: Compute the electrical parameters of Transmission line. (K2)
CO 3: Analyze the performance of various Transmission lines. (K2)
CO 4: Evaluate the performance of insulators and cables. (K2)
CO 5: Explain the concepts of substation and mechanical design of overhead line. (K2)

UNIT I BASIC CONCEPTS OF POWER SYSTEMS 9

Evolution of Power Systems and Present-Day Scenario - Structure of a power system: Bulk Power Grids and Micro-grids - Generation: Conventional and Renewable Energy Sources - Distributed Energy Resources - Transmission and Distribution Systems: Meshed and radial systems - Synchronous Grids and Asynchronous (DC) interconnections.

UNIT II TRANSMISSION LINE PARAMETERS 9

Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors - Parameters of single and three phase transmission lines with single and double circuits - stranded and bundled conductors – Skin and proximity effects.

UNIT III PERFORMANCE OF TRANSMISSION LINES 9

Classification of lines – Short, medium and long line – Equivalent circuits, attenuation constant – Phase constant – Transmission efficiency and voltage regulation – Surge impedance loading– Ferranti effect and corona loss.

UNIT IV INSULATORS AND CABLES 9

Insulators-Types, voltage distribution in insulator string, improvement of string efficiency, Underground cables-Types of cables, Parameters of cable, Dielectric stress - Grading of cables, Capacitance of 3-core belted cable.

UNIT V MECHANICAL DESIGN OF OVERHEAD LINES AND SUBSTATION 9

Mechanical design of transmission line - sag and tension calculations for different weather conditions – Towerspotting – Types of towers.

Sub-station Layout (AIS and GIS), Types of substations – Bus-bar arrangements - Methods of grounding.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Wadhwa C.L., “Electric Power Systems”, New Age International (P) Ltd., 6th Edition, 2018.
2. Kothari D.P. and Nagrath I.J., “Power System Engineering”, Tata McGraw Hill Private Limited, New Delhi, 3rd Edition, 2019.
3. Mehta V. K. and Rohit Mehta, “Principles of Power System”, S.Chand Company & Ltd, New Delhi, 2018.

REFERENCES

1. Singh S.N., “Electric Power Generation, Transmission and Distribution”, Prentice Hall Private Limited, New Delhi, 2008.
2. J.Grainger and W.D.Stevenson, “Power System Analysis”, McGraw Hill Education, 1st Edition, 2017.
3. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Private Limited, 3rd Edition, 2011.
4. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power systems”, 5th Edition, Wiley, 2013.

19EE52C	**CONTROL SYSTEMS**	**L T P C**
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 Develop the transfer function model of the physical system. (K3)
CO2: Analyze the time domain behavior of the system. (K3)
CO3: Analyze the frequency domain behavior of the system. (K3)
CO4: Describe the behavior of system using state space representation. (K2)
CO5: Design suitable compensator and controller for a system. (K2)

UNIT I MATHEMATICAL MODELING OF PHYSICAL SYSTEMS 9

Systems - Control System - open and closed loop systems. Frequency domain modeling electrical, mechanical and electro mechanical systems - Transfer function models -Electric Circuit Analogy. Reduction of multiple Subsystems**:** Block Diagram Reduction-Signal Flow Graph.

UNIT II TIME RESPONSE ANALYSIS AND STABILITY 9

Standard test signals - Time response of first and second order systems - Steady State Error - Generalized error series - Characteristic equation - Routh-Hurwitz Criteria-Construction of Root-loci- Effect of addition of poles and Zeros.

UNIT III FREQUENCY RESPONSE ANALYSIS AND STABILITY 9

Frequency response and Frequency domain specifications - Bode Plot - Polar Plot. Closed loop frequency response: M and N circles, Nichol’s chart.Stability: Nyquist Stability Criteria – Gain Margin and Phase Margin via bode plots and Nyquist Diagram.

UNIT IV TIME DOMAIN MODELING OF SYSTEMS 9

Concepts of state variables - State Space Representation: State space model from transfer function - Signal Flow Graphs of State equations - Cascade form- Parallel form- Solution of state equations.- Concept of controllability and observability - Stability in state space.

UNIT V COMPENSATOR DESIGN AND CONTROLLER TUNING 9

Controller and its classification - PID Controller - PID tuning using Ziegler-Nichols technique - State Feedback controller using pole placement - Design of Lag compensator, Lead Compensator and Lag-Lead Compensator using Bode plot.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Nagrath I.J and Gopal M., "Control Systems Engineering", New Age International Publishers, 5th Edition (Reprint), 2016.
2. Norman S. Nise, Control Systems Engineering, 6th Edition, John Wiley, 2010. (Indian Edition)

REFERENCES

1. Benjamin C. Kuo, "Automatic Control systems", PHI Learning Private Ltd, Jan 2014.
2. K. Ogata, "Modern Control Engineering", 5th Edition, Prentice Hall Private Limited, New Delhi, 2010.
3. Richard.C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison –Wesley, Oct, 2013.
4. Gopal M., "Control Systems: Principles and Design", 4th Edition, Tata Mc-Graw Hill Private Limited, New Delhi, 2012.

19EE53C MICROPROCESSOR AND MICROCONTROLLER

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: illustrate the architecture of Microprocessors (8085/8086). (K2)
CO2: write programs based on the instruction sets of 8085 Microprocessor. (K2)
CO3: illustrate the architecture of 8051 Microcontroller. (K2)
CO4: write programs based on the instruction sets of 8051 Microcontroller. (K2)
CO5: develop application circuits by programming towards simple project development. (K2)

UNIT I INTRODUCTION TO 8 AND 16 BIT PROCESSORS 9

Introduction – 8085 Microprocessor: Architecture, Pin outs and signals, Instruction set and addressing modes - Timing diagram, Memory interfacing, Interrupt structure – I/O ports and data transfer concepts - 8086 processor (Architecture and modes of operation only).

UNIT II PROGRAMMING AND INTERFACING OF 8085 MICROPROCESSOR 9

Arithmetic programs using 8085 – Loop structure with counting & Indexing - Delay calculation with single and more loops – Lookup table - Interfacing – Peripheral IC's: 8255 Programmable Peripheral interface architecture and modes of operation, Interfacing ADC, DAC and traffic light ,PID Controller, with 8085 through 8255.

UNIT III 8051 MICROCONTROLLER 9

Overview of the 8051 family – Architecture: CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory - Timer -I/O port structure – Interrupt structure - Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems.

UNIT IV 8051 INSTRUCTION SET AND PROGRAMMING 9

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing - 8051 Instruction set: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instructions - Assembly language programs, C language programs, Programming and debugging tools.

UNIT V APPLICATIONS OF 8051 MICROCONTROLLER 9

Interfacing external memory Devices, Analog to Digital Converter, Digital to Analog Converter, LED, LCD, Keyboard, Stepper motor,DC Motor and Sensor. Synchronous and Asynchronous Communication. RS232, SPI, I^2C. Introduction and interfacing to protocol like Blue-tooth.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Senthilkumar N., Saravanan M. and Jeevananthan.S, “Microprocessor and Microcontrollers”, Oxford University Press, Aug 2016.
2. Krishna Kant “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice Hall Private Limited, New Delhi, Jan 2013.

REFERENCES

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, “The 8051Microcontroller and Embedded Systems: Using Assembly and C”, Pearson Education, 2007.
2. K. J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning, 2004.
3. R. Kamal, “Embedded System”, McGraw Hill Education, 2009.
4. R. S. Gaonkar, “, Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 1996
5. D.A. Patterson and J.H. Hennessy, "Computer Organization and Design: The Hardware/Software interface”, Morgan Kaufman Publishers, 2013.
6. D. V. Hall, “Microprocessors & Interfacing”, McGraw Hill Higher Education, 1991. PCC-EE19: Microprocessor Laboratory (0:0:2 – 1 credit) Hands-on experiments related to the course contents of EE18.

19EE54C HIGH VOLTAGE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain the over voltage phenomenon in electrical Power systems. (K2)
CO 2: describe the various breakdown mechanisms of different dielectrics. (K2)
CO 3: recognize the appropriate methods for high voltage and current generation. (K2)
CO 4: extend the measurement principles to figure the values of high voltage and current. (K2)
CO 5: outline of necessity and methods of testing the various apparatus in HV Lab. (K2)

UNIT I LIGHTNING AND SWITCHING OVERVOLTAGES 9

Lightning overvoltage: Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges– Switching overvoltage: Causes of surges and its effects on power system – Protection against overvoltage – Surge diverters – Surge modifiers – Estimation of Overvoltages – Reflection and Refraction of Travelling waves - Insulation Coordination.

UNIT II DIELECTRICS AND BREAKDOWN MECHANISM 9

Properties of Dielectrics - Gaseous breakdown in uniform and non-uniform fields - Townsend's Theory – Streamer Mechanism – Corona discharges – Vacuum breakdown - Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics – Partial Discharges – Applications and Maintenance of Dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of high D. C. and A.C. voltages – Generation of impulse voltages – Generation of impulse currents – Tripping and control of impulse generators.

UNIT IV MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS 9

Peak voltage, impulse voltage and high direct current measurement methods – Cathode ray oscillographs for impulse voltage and current measurement – Measurement of dielectric constant and loss factor - Partial discharge measurements - Digital Measurement Techniques.

UNIT V HIGH VOLTAGE TESTING AND HIGH VOLTAGE LABORATORIES 9

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, bushing, isolators, circuit breakers and transformers– High voltage laboratory layout– Indoor and outdoor laboratories– Testing facility requirements – Safety precautions in H.V. Labs.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", 5th Edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2013.
2. E.Kuffel and W.S. Zaengl, J.Kuffel, "High voltage Engineering Fundamentals", Newness, 2nd Edition, Elsevier, New Delhi, 2005.

REFERENCES

1. Rakosh Das Begamudre, "High Voltage Engineering, Problems and Solutions", New Age International Publishers, New Delhi, 2010
2. Hugh M. Ryan, "High Voltage Engineering and Testing", 2nd Edition, The Institution of Electrical Engineers, London, United Kingdom, 2001.
3. Various IS standard for HV Laboratory Techniques and Testing.
4. L.L.Alston, "High Voltage Technology", Oxford University Press, 1st Indian Edition, 2011.
5. C.L.Wadhwa, "High Voltage Engineering", New Age International Publishers, 3rd Edition, 2010.

6. Mazen Abdel Salam, Hussein Anis, Ahdab A-Morshedy and Roshday Radwan, “High Voltage Engineering –Theory &Practice”, 2nd Edition, Marcel Dekker, Inc., 2010.
7. Subir Ray, “An Introduction to High Voltage Engineering”, 2nd Edition, PHI Learning Private Limited, New Delhi, 2011.
8. M. Khalifa, “High Voltage Engineering-Theory and Practice”, Marcel Dekker, Inc. New York and Basel, 1990.
9. Dieter Kind and Kurt Feser, “High Voltage Test Techniques”, Reed Educational and Professional Publishing Ltd. (Indian Edition), New Delhi, 2001.

19EE55C OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	2	4

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: identify importance of object oriented programming and difference between structured oriented and object oriented programming features. (K3)

CO2: develop programs using functions and define functions using default, constant, arguments, function overloading (K3)

CO3: adopt appropriate constructor and overloading mechanisms to develop the application (K3)

CO4: understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code (K3)

CO5: use advance features like templates and exception to make programs supporting reusability and sophistication (K3)

UNIT I BASIC CONCEPTS 15

Introduction to OOPs - Headers & Name Spaces - Applications of OOP - Structure of C++ - Program - C++ Basics: Keywords – Constants - Data Types - Dynamic Initialization of Variables - Reference Variables - Operators in C++ - C++ Class Overview: Class Definition – Objects - Class Members - Access Control – Class Scope

UNIT II FUNCTIONS AND MEMORY ALLOCATION 15

Parameter passing methods - static class members - this pointer - Arrays of Objects - Objects as Function Arguments - Default Arguments - Constant Arguments -Inline functions - Function Overloading - Friend Functions - Dynamic memory allocation and deallocation (new and delete)

UNIT III CONSTRUCTORS AND INHERITANCE 15

Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors - Introduction to inheritance - Defining Derived Classes - Single Inheritance - Multiple Inheritance - Multi-Level Inheritance - Hierarchical Inheritance - Hybrid Inheritance -Virtual Base Classes - Abstract Classes - Constructors in Derived Classes.

UNIT IV POLYMORPHISM AND FILES 15

Introduction to pointers - Pointers to Objects - Pointers to Derived Classes - compile time polymorphism - Run time polymorphism - Virtual Functions - Pure Virtual Functions - Virtual Destructors - this Pointer - Operator overloading,-Rules for Operator overloading - overloading of binary and unary operators - Files in C++: File I/O - Unformatted and Binary I/O.

UNIT V TEMPLATES AND EXCEPTION HANDLING 15

Introduction - Class Templates - Class Templates with Multiple Parameters - Function Templates, Function Templates with Multiple Parameters -Member Function Templates - Basics of Exception Handling, Types of exceptions - Exception Handing Mechanism - Throwing and Catching Mechanism -Rethrowing an Exception -Specifying Exceptions.

L: 45; P: 30; TOTAL: 75 PERIODS

TEXT BOOKS

1. Herbert Schildt, “C++: The Complete Reference”, 5th Edition, Tata McGraw – Hill Publishers, 2017.
2. Paul Deitel, Harvey Deitel, “C++ How to Program”, 8th Edition, Prentice Hall Publisher, 2012.
3. Trivedi, Bhushan “Programming with ANSI C++”, 2nd Edition, Oxford University Press _ NASW Press, 2012.

REFERENCES

1. Ira Pohl, “Object Oriented Programming using C++”, 2nd Edition, Pearson Education, Reprint 2004.
2. S. B. Lippman, Josee Lajoie, Barbara E. Moo, “C++ Primer”, 4th Edition, Pearson Education, 2017.
3. Bjarne Stroustrup, “The C++ Programming language”, 3rd Edition, Pearson Education, 2013.

19EE56C CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Develop Transfer Function Models for Electro-Mechanical Systems. (K2)

CO 2: Predict the time domain specifications from the time response of the Linear system. (K2)

CO 3: Understand the concept of stability from time and frequency response of the system. (K2)

CO 4: Design suitable compensator and controller for given specifications. (K3)

LIST OF EXPERIMENTS

1. Determination of Transfer function of AC servomotor
2. Mathematical modeling of Field Controlled DC Servomotor
3. Mathematical modeling of Armature Controlled DC Servomotor
4. Time Response Analysis of first order system
5. Time Response Analysis of Second Order System
6. Stability Analysis of linear system using root locus Technique
7. Frequency response analysis by using Bode Plot
8. Design and simulation of PID Controller using Zeigler Nichols Technique
9. Design of compensators using Simulation software package
10. Design of state feedback controller using Pole placement technique
11. Study of Modeling and control of Rotary Inverted Pendulum
12. Study of QBOT 2 – vision based control

P: 45; TOTAL: 45 PERIODS

19EE57C MICRPROCESSOR AND MICROCONTROLLER LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Develop basic arithmetic operations using microprocessor 8085 and 8051. (K3)
CO2: Apply interfacing techniques that provides solutions to real world problems. (K3)
CO3: Choose appropriate peripheral interfacing devices with 8085 and 8051 for specific applications. (K2)

LIST OF EXPERIMENTS

Assembly language programming using 8085 Microprocessor

1. Simple arithmetic operations
2. Programming with control instructions
3. Interface Experiments:
    - A/D Interfacing.
    - D/A Interfacing.
    - Traffic light controller.
    - Simple experiments using 8255
    - Implementation of PID control algorithm

Assembly Language/ C Programming using 8051 Microcontroller

4. Simple arithmetic operations
5. Programming with control instructions
6. Interface Experiments:
    - A/D Interfacing.
    - D/A Interfacing.
    - Stepper motor

7. Study of microcontroller with FLASH memory.
8. PWM Generation

P: 45; TOTAL: 45 PERIODS

19EE61C POWER SYSTEM – II

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Analyze a power system in steady state using numerical methods. (K2)
CO2: Compute the fault current for different types of faults. (K2)
CO3: Explain various methods to control the voltage and frequency. (K2)
CO4: Discuss about monitoring and control of a power system. (K2)
CO5: Describe the concepts of stability in a power system. (K2)

UNIT I POWER FLOW ANALYSIS 9

Review of the structure of a Power System and its components - Analysis of Power Flows: Formation of Bus Admittance Matrix - Real and reactive power balance equations at a node - Load and Generator Specifications - Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton - Raphson methods.

UNIT II FAULT ANALYSIS 9

Per-unit System and per-unit calculations - Representation of generators, lines and transformers in sequence networks - Method of Symmetrical Components (positive, negative and zero sequences) - Balanced and Unbalanced Faults - Computation of Fault Currents.

UNIT III CONTROL OF FREQUENCY AND VOLTAGE 9

System load variation and characteristics –Load curve –Reserve requirements – Fundamentals of speed governing mechanism and modeling –Speed-load characteristics – Load sharing – control area, LFC control of single and two area systems –Static and dynamic analysis of uncontrolled and controlled cases.

Generation and absorption of reactive power – Relation between voltage, power and reactive power –Methods of voltage control –Tap changing transformer and OLTC

UNIT IV MONITORING AND CONTROL OF POWER SYSTEM 9

Overview of Energy Control Centre Functions: SCADA systems - Phasor Measurement Units – Wide Area Monitoring Systems –State-estimation - System Security Assessment - Various states of a Power System - Contingency Analysis - Preventive Control and Emergency Control.

UNIT V STABILITY CONSTRAINTS IN SYNCHRONOUS GRIDS 9

Swing Equations of a synchronous machine connected to an infinite bus - Power angle curve - Loss of synchronism in a single-machine infinite bus system following a three-phase fault - Analysis using numerical integration of swing equations using Forward Euler method - Runge-Kutta 4th order methods and Equal Area Criterion method - Impact of stability constraints on Power System Operation.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1st Edition, 1994.
2. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power systems”, 5th Edition, Wiley, 2013.

REFERENCES

1. O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 2nd Edition, 2017.
2. A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc., 2nd Edition, 2002.
3. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 4th Edition, 2011.

19EE62C POWER ELECTRONICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: Understand the differences between signal level and power level devices. (K2)
CO2: Analyze the operation of phase controlled rectifiers. (K2)
CO3: Explain the various topologies of DC–DC Converters. (K2)
CO4: Analyze the operation of voltage source inverters. (K2)
CO5: Discuss the applications of power electronics converters. (K2)

UNIT I POWER SEMI–CONDUCTOR DEVICES 9

Basic structure and characteristics of Diode, Thyristor, Power MOSFET and IGBT – Firing and commutation circuit of SCR– Gate driver circuits- snubber circuit - Interpretation of power device data sheet.

UNIT II PHASE–CONTROLLED RECTIFIERS 9

Single-phase diode rectifiers - Single-phase full-bridge thyristor rectifier with R, RL and RLE load - Three-phase full-bridge thyristor rectifier with R, RL and RLE load - Effect of source inductance -Input current wave shape and power factor.

UNIT III DC TO DC CONVERTERS 9

Elementary chopper with an active switch and diode - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage of Buck, Boost and Buck-Boost converters - Overview of Isolated Converters.

UNIT IV INVERTERS 9

Power circuit, analysis and waveforms of Single phase and three phase voltage source inverter – PWM techniques –Current source inverter-AC voltage controller

UNIT V APPLICATIONS 9

Uninterrupted power supply topologies-Electric drives-residential and industrial applications - Electric utility applications- High Voltage DC transmission - Renewable energy source - Energy storage

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Rashid M.H., “Power Electronics: Circuits, Devices and Applications”, Pearson Education, Prentice Hall Private Limited, New Delhi, 4th Edition, 2014.
2. Bimbra P.S., “Power Electronics”, Khanna Publishers, 4th Edition, 2012.

REFERENCES

1. Robert W. Erickson and Dragan Maksimovic, “Fundamentals of Power Electronics”, Springer, 2001.
2. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics: Converters, Applications and Design”, 3rd Edition, John Wiley and sons, 2014.
3. L. Umanand, Power Electronics: Essentials and Applications”, Wiley India, 2014.
4. Singh M. D and Khanchandani K. B., “Power Electronics”, 3rd Edition, Tata McGraw Hill Private Limited, New Delhi, 2008.

19EE63C SWITCHGEAR AND PROTECTION

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: Understand the different components of a protection system. (K2)
- CO 2: Describe the principles of different types of protective relays. (K2)
- CO 3: Understand the protection schemes for different power system components. (K2)
- CO 4: Explain the operation and testing methods of Circuit breakers. (K2)
- CO5: Understand system protection schemes, and the use of wide-area measurements. (K2)

UNIT I PROTECTIVE RELAYS 9

Principles of Power System Protection - Need for protective systems – Protection Zones – Essential qualities of protection - Components of a protection system.

Basic relay terminology - Classification of protective relays based on technology and their operating principles - Classification of protective schemes - Relay Testing - Technical standards and Specifications of Various Relays(Case Study).

UNIT II STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Overcurrent protection, transformer differential protection, distant protection of transmission lines.

UNIT III EQUIPMENT AND OVERVOLTAGE PROTECTION SCHEMES 9

Introduction to Overcurrent Protection and overcurrent relay co-ordination - Directional, Distance, Differential protection - Transformer and Generator protection - Bus bar Protection – Generation of Over-voltages - Lightning and Switching Surges- Overvoltage Protection.

UNIT IV CIRCUIT BREAKERS 9

Arc phenomena and arc interruption –DC and AC circuit breaking –Types of circuit breakers –Air, oil, SF6 and vacuum circuit breakers –Comparative merits of different circuit breakers –Testing of circuit breakers –Routine test and type test –Concept of gas insulated substation – Technical Standards and Specifications of Various Circuit Breakers(Case Study).

UNIT V SYSTEM PROTECTION 9

Effect of Power Swings on Distance Relaying - System Protection Schemes - Under-frequency, under-voltage and df/dt relays - Out-of-step protection - Synchro-phasors - Application of Wide-Area Measurement Systems for improving protection systems - Intelligent Electronic Devices (IED) & their application for monitoring & protection – IEC Protocol for Protection equipment - Integration of SCADA.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Badri Ram and D.N. Vishwakarma, “Power System Protection and Switch Gear”, Tata Mc-Graw Hill, 2nd Edition, 2011.

2. Sunil S. Rao, “Protection and Switch Gear”, Khanna Publishers 4th Edition, New Delhi, 1992.

REFERENCES

1. B. Ravindranath and N.Chander, “Power System Protection and Switch Gear”, New Age International Limited, New Delhi, Reprint 2005.
2. J. L. Blackburn, “Protective Relaying: Principles and Applications”, Marcel Dekker, New York, 1987.
3. Y.G Paithankar and S.R Bhide, “Fundamentals of power system protection”, Prentice Hall of India, 2013.
4. A.G.Phadke and J. S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer US, 2010
5. T.S. Madhava Rao, “Digital / Numerical Relays”, Tata McGraw Hill, 1st Edition, 2005.

19EE64C POWER SYSTEM SIMULATION AND HIGH VOLTAGE LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: determine the various parameters of power system. (K2)
CO2: compute the parameters for different type of faults in power system network. (K2)
CO3: determine breakdown strength of gaseous dielectric and liquid dielectric. (K2)
CO4: demonstrate the generation methods of High voltage AC, DC and Impulse. (K2)
CO5: infer the field distribution simulation model of single and multiple dielectrics. (K2)

LIST OF EXPERIMENTS

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3. Load Flow Analysis: Solution of Load Flow and Related Problems Using Gauss–Seidel and Newton–Raphson Methods
4. Symmetrical and unsymmetrical Fault Analysis
5. Transient stability analysis of single machine infinite bus system (SMIB).
6. Load –Frequency Dynamics of Single–Area and Two–Area Power Systems
7. Generation and measurement of AC, DC and Impulse voltage
8. Measurement of AC and DC breakdown strength of air under different electrode configurations
9. Measurement of dielectric strength of liquid dielectric
10. Computation of field distribution of parallel plate capacitor with single and multiple dielectrics using FEM. (Analysis)
11. Generation of Lightning and Switching Impulse voltages using circuit simulation package

P: 30; TOTAL: 30 PERIODS

19EE65C POWER ELECTRONICS LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: Illustrate the characteristics of various power semiconductor devices. (K2)
CO2: Evaluate the performance of AC-DC converters. (K2)
CO3: Analyze the basic topologies of DC–DC converters. (K2)
CO4: Make use of different PWM techniques for inverters. (K2)
CO5: Demonstrate the operation of AC voltage controller and Cycloconverter. (K2)

LIST OF EXPERIMENTS

1. Characteristics of SCR and TRIAC
2. Characteristics of MOSFET and IGBT
3. Gate firing circuits for SCR
4. AC to DC fully controlled converter
5. AC to DC half controlled converter
6. MOSFET based Buck and boost converter
7. IGBT based PWM inverter
8. AC Voltage Controller
9. Simulation of Power converters.

P: 45; TOTAL: 45 PERIODS

19EE66C ELECTRONICS DESIGN LABORATORY

L T P C
1 0 4 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the practical issues related to practical implementation of applications using electronic circuits (K2)
CO2: Choose appropriate components, software and hardware platforms. (K2)
CO3: Design a Printed Circuit Board, get it made and populate/solder it with components. (K3)
CO4: Work as a team with other students to implement an application. (K3)

LIST OF EXPERIMENTS

1 Concept of Measuring Instruments – Testing of Meters, AFO, CRO and Components
2 Measurements of AC/DC – voltage, current, rise time, THD and Noise
3 Sensor module design using signal conditioning with analog / digital output
4 Introduction to electronic instrumentation and PC based data Acquisition
5 Analog system design – Applications based on analog IC [NE555, LM741 etc]
6 Interfacing of analog and digital signals with microcontroller
7 Electronic system design employing microcontrollers
8 VLSI programming for CPLD/ FPGAs
9 PCB design and layout using Software

10 Group project involving electronic hardware (Analog, Digital) leading to an application.

L: 15; P: 60; TOTAL: 75 PERIODS

19EE67C PRODUCT DEVELOPMENT LABORATORY

	L	T	P	C
	1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)

CO2: verify the functionality of the concept through prototyping (K4)

UNIT I NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION 20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

UNIT II PROTOTYPING AND DEMONSTRATION 25

Prototype development and demonstration - cost estimation - product documentation

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Michael G Luchs, Scott Swan, Abbie Griffin, “Design Thinking: New Product Development Essentials from the PDMA”, Willey, 2015
2. Christian Muller-Roterberg, “Design Thinking”, Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata Mc Graw Hill Education, 4th Edition, 2011.
4. George E Dieter, Linda C Schmidt, “Engineering Design”, Mc-Graw Hill International Edition, 5th Edition, 2013.
5. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2013

Mentor Activities

- Forming multidisciplinary/interdisciplinary batches among the students
- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students’ activities through demonstration and presentations

End semester Assessments can be made through

- Product demonstration and presentation

Other points

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four

- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

19EE71C PROJECT MANAGEMENT AND FINANCE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the concept of operational and project management. (K2)
CO2: Apply the scope of the project to develop the project plan. (K3)
CO3: Relate the technical, business and social environment in the projects. (K3)
CO4: Apply the management principles to form project team successfully. (K3)
CO5: Prepare project schedule using appropriate tools and techniques. (K3)

UNITI BASIC CONCEPT 9

Concept and categories of project - Project development cycle - Concept, tools and techniques of project management - Logistics and supply chain management - Forms of project organizations.

UNIT II PROJECT FORMULATION 9

Project identification, formulation and preparation. Market and demand estimation - Market survey techniques - Demand forecasting. Materials management - Analysis of materials input, technology, production, plant capacity, location and site, civil works, charts, layouts and work schedule. Cost of project - Means of financing, estimates of cost - Financial projections.

UNIT III PROCESS OF PROJECT APPRAISAL 9

Technical, Economic, Financial, Legal and Social appraisal of the Industrial Projects. Problems due to rate of discount, wage-rate, exchange rates, treatment of taxes, social cost-benefits - treatment of risk and uncertainty - sensitivity analysis and probability approach - Single as well as multiple projects.

UNIT IV PROJECT TEAM FORMULATION AND MAXIMIZING PARTICIPATION 9

Project Team frame works - Project Team cultures - Barriers and challenges - Selecting Team Members- Key skills of effective project leaders - Giving / receiving feedback from different members of the project.

UNIT V IMPLEMENTATION, MONITORING AND CONTROL OF PROJECTS 9

Project scheduling, network techniques for resource, cost budgeting and scheduling - Monitoring and post implementation, evaluation of the project – Enterprise Resource Planning (ERP) - Project financing.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Prasanna Chandra, “Projects: Planning, Analysis, Selection, Financing, Implementation and Review”, 9th edition, McGraw-Hill, 2019.
2. Maylor “Project Management”, 4th Edition, Pearson, 2018.

REFERENCES

1. Clements, J.P. and Gido, C., “Successful Project Management” 7th edition South-Western Cengage Learning, 2018.
2. Gray and Larson, “Project Management: The Managerial Process”, 5rd Edition, TMH, 2018.
3. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education,5th Edition 2016.

19EE72C PROJECT WORK – I L T P C

0 0 6 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify an innovate or creative idea / concept / solution to a problem (K3)
CO2: perform the detailed literature survey related to concept / idea (K2)
CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modeling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

P: 45; TOTAL: 45 PERIODS

19EE73C RESEARCH PAPER AND PATENT REVIEW – SEMINAR L T P C

0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the emerging technology / research development in the engineering Field (K2)
CO2: acquaint with the concepts published in reputed journals on their area of interest (K2)
CO3: examine patents and procedures available in the data base.(K3)
CO4: effectively communicate the contents to the target audience and handle the questions with confidence (K3)
CO5: Check for patent plagiarism (K2)

The Students will make a technical presentation on current topics related to the specialization. The same will be assessed by a committee appointed by the department.

The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

P: 30 TOTAL: 30 PERIODS

19EE74C COMPREHENSION

L T P C
0 0 2 1

COURSE OUTCOME

Upon successful completion of this course, the students will be able to

CO1: enhance the comprehensive knowledge for attending interviews and competitive exams. (K4)

COURSE CONTENT

The students will review the following subjects to improve their competency level:

GENERAL APTITUDE: Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction. Numerical Ability: Numerical computation, numerical estimation, numerical

ENGINEERING MATHEMATICS

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigenvalues, Eigenvectors. **Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line integral, Surface integral, Volume integral, Stokes's theorem, Gauss's theorem, Green's theorem.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's equation, Euler's equation, Initial and boundary value problems, Partial Differential Equations, Method of separation of variables.

Complex variables: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, Laurent series, Residue theorem, Solution integrals. Probability and **Statistics:** Sampling theorems, Conditional probability, Mean, Median, Mode, Standard Deviation, Random variables, Discrete and Continuous distributions, Poisson distribution, Normal distribution, Binomial distribution, Correlation analysis, Regression analysis.

Numerical Methods: Solutions of nonlinear algebraic equations, Single and Multi-step methods for differential equations. Transform Theory: Fourier Transform, Laplace Transform, z-Transform.

ELECTRICAL ENGINEERING:

Electric Circuits: Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Passive filters, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Two-port networks, Three phase circuits, Power and power factor in ac circuits.

Electromagnetic Fields: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits,Self and Mutual inductance of simple configurations

Signals and Systems: Representation of continuous and discrete-time signals, Shifting and scaling operations, Linear Time Invariant and Causal systems, Fourier series representation of continuous periodic signals, Sampling theorem, Applications of Fourier Transform, Laplace Transform and z-Transform.

Electrical Machines: Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformers: connections, parallel operation; Auto- transformer, Electromechanical energy conversion principles, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control; Operating principle of single phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.

Power Systems: Power generation concepts, ac and dc transmission concepts, Models and performance of transmission lines and cables, Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, GaussSeidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Control Systems: Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Stability analysis, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, State transition matrix.

Electrical and Electronic Measurements: Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multimeters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Analog and Digital Electronics: Characteristics of diodes, BJT, MOSFET; Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: Biasing, Equivalent circuit and Frequency response; Oscillators and Feedback amplifiers; Operational amplifiers: Characteristics and applications; Simple active filters, VCOs and Timers, Combinational and Sequential logic circuits, Multiplexer, Demultiplexer, Schmitt trigger, Sample and hold circuits, A/D and D/A converters, 8085Microprocessor: Architecture, Programming and Interfacing.

Power Electronics: Characteristics of semiconductor power devices: Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.

Programming and Data Structures: Programming in C, C++, Recursion, Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

- The staff-coordinator is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
- The technical seminars and group discussions will be assisted by subject experts in the department.
- Each student must participate in all the activities and their performance assessment must be recorded.

P: 30 TOTAL: 30 PERIODS

19EE81C	**INTERNSHIP / IN-PLANT TRAINING**	**L T P C**
		0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: acquire the knowledge of different industrial / organizational activities (K2)
CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department
2. A report should be submitted after the successful completion of internship / in-plant training.

P: 60; TOTAL: 60 PERIODS

19EE82C **PROJECT WORK – II** **L T P C**
0 0 12 6

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design and develop the working model (K3)
CO2: work independently to complete the project along with team members (K2)
CO3: demonstrate the results and documents the report (K4)

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

P: 180; TOTAL: 180 PERIODS

19EE01E ELECTRICAL MACHINE DESIGN

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Interpret main dimensions of armature and field systems for D.C. machines. (K2)
- CO2: Outline overall Dimensions of single and three phase transformers core, windings and cooling systems for transformers. (K2)
- CO3: Interpret main dimensions of squirrel cage and Slip ring induction machines. (K2)
- CO4: Illustrate enhanced dimensions of stator of AC machines. (K2)
- CO5: Design the basic electrical machines using software tools. (K2)

UNIT I INTRODUCTION 9

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT II DC MACHINES 9

DC Machines - Output Equations – Main Dimensions and design constraints – Choice of specific loadings – Carter's Coefficient – Net length of Iron – Real & Apparent flux densities-Selection of number of poles – Design of Armature – Design of commutator and brushes- Design of field winding.

UNIT III TRANSFORMERS 9

Output Equations - Sizing of a transformer, main dimensions and design constraints, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT IV INDUCTION MOTORS 9

Output Equations - Sizing of an induction motor, main dimensions and design constraints, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly phase machines, magnetizing current, short circuit current, operating characteristics.

UNIT V SYNCHRONOUS MACHINES 9

Output Equations - Sizing of a synchronous machine, main dimensions and design constraints, design of salient pole machines, short circuit ratio, shape of pole face, armature design, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design, Need for Computer aided Design analysis.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Sawhney A.K. and Chakrabarti A, "A Course in Electrical Machine Design", Dhanpat Rai & Sons, 2016.

2. Say .M.G, “The Performance and Design of Alternating current Machines”, CBS Publishers & Distributors, 3rd edition, 2002.
3. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Publishing, 2006.

REFERENCES

1. K. L. Narang, “A Text Book of Electrical Engineering Drawings”, Satya Prakashan, 2016.
2. A. Shanmuga sundaram, G. Gangadharan and R. Palani, “Electrical Machine Design Data Book”, New Age International Pvt. Ltd., 2015.
3. K.M.V.Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.
4. Electrical machines and equipment design exercise examples using Ansoft’s Maxwell 2D machine design package.

19EE02E ELECTRICAL DRIVES

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: discuss the concepts of multi quadrant dynamics of drives. (K2)
CO2: explain the steady state analyze of fully controlled converter fed separately excited dc drives. (K2)
CO3: design of controller for electrical drives. (K2)
CO4: explain the various speed control strategies of induction motor. (K2)
CO5: describe the various control techniques of synchronous motor. (K2)

UNIT I DRIVE CHARACTERISTICS 9

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC DRIVE 9

Steady state analysis of fully controlled converter fed separately excited DC drive – Continuous and discontinuous conduction – Time ratio and current limit control – Four quadrant operation of converter / chopper fed drive.

UNIT III DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor / load and converter – closed loop control with current and speed feedback – armature voltage control and field weakening mode – design of controllers; current controller and speed controller-converter selection and characteristics.

UNIT IV INDUCTION MOTOR DRIVES 9

Stator voltage, frequency, V/f control and Field Weakening - 87 Hz Characteristics - Running in Current Limit – Compensations – Types – Static rotor resistance control– Slip power recovery scheme – Interpretation of VFD datasheet for Fan & Pump Applications.

UNIT V SYNCHRONOUS MOTOR DRIVES 9

V/f control and self control of synchronous motor – Marginal angle control – power factor control – Permanent magnet synchronous motor – Automatic Motor Adaption (AMA) – Motor Heating and Thermal Monitoring – Functional Safety.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Dubey.G.K., "Fundamentals of Electrical drives", Narosa publications, 2010.
2. Bimal K. Bose., "Modern Power Electronics and AC Drives", Prentice Hall / Pearson Education Private Limited, 2017.

REFERENCES

1. De N. K. and Sen P. K., "Electrical Drives", Prentice Hall Private Limited, 2012.
2. Murphy J.M.D. and Turnbull, "Thyristor control of AC Motor", Pergamon Press Oxford, 2014.
3. Krishnan R., "Electric Motor Drives: Modeling, Analysis, and Control", Wiley, 2014.
4. Gopal K. Dubey, "Power Semi conductor controlled drives", Prentice Hall Private Limited, 2014.
5. Vedam Subramanyan, "Thyristor control of Electrical Drives", Tata McGraw Hill Private Limited, 2017.
6. Handbook on Facts Worth Knowing about Frequency Converters, Danfoss Power Electronics, 2014.

19EE03E INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: explain the electrical layout and safety practices (K2)
CO2: discuss the functionalities of various electrical components (K2)
CO3: evaluate the size, rating and cost of electrical installations for residential, and Commercial applications (K3)
CO4: design the illumination systems for residential, commercial, and industrial applications (K3)
CO5: design appropriate electrical system with protective equipments for industrial applications (K3)

UNIT I ELECTRICAL SYSTEM LAYOUT AND SAFETY PRACTICES 9

Electrical system Layout: LT and HT system - Tariff structure - Electric shock and Electrical safety practices – Civilian and Industrial Standards - Indian Energy Exchange Policies – Open Access Power – Sustainable Development Goals (SDG) 7 & 13.

UNIT II ELECTRICAL SYSTEMS COMPONENTS 9

Wiring components - selection of cables - wires, switches, distribution box, net metering system - Protection components - Fuse, Miniature Circuit Breaker (MCB), Molded Case Circuit Breaker (MCCB), Earth Leakage Circuit Breaker (ELCB), Residual Current Circuit Breaker (RCCB) - inverse current characteristics - Single Line Diagram (SLD) of a wiring system, Contactor, Isolator, Relays, Motor Protection Circuit Breaker (MPCB)

UNIT III RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS 9

Types of residential and commercial wiring systems - general rules and guidelines for installation - load calculation and sizing of wire, rating of main switch, distribution board and protection devices - earthing system calculations - requirements of commercial installation, deciding lighting scheme and number of lamps - earthing of commercial installation - selection and sizing of components.

UNIT IV ILLUMINATION SYSTEMS 9

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, neon lamp, fluorescent lamps, CFL, LED – Smart lighting, design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting – decorative lighting – hybrid lighting.

UNIT V INDUSTRIAL SYSTEMS AND COMPONENTS 9

HT connection - industrial substation - Transformer selection - Industrial loads, motors, starting of motors – Diseal Generator - Cable and Switchgear selection - Lightning Protection - Earthing design - Power factor correction – kVAR calculations - type of compensation - Introduction to Power Control Centre(PCC),Motor Control Centre (MCC) panels –Selection and size of UPS and Battery Banks – Panel metering.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 6th edition (Reprint), 2020.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2018.
3. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2016.

REFERENCES

1. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 2018.
2. H.Partab, Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Co., New Delhi, 2004.
3. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Age International Pvt. Ltd. 2003.
4. E. O. Taylor, “Utilization of Electric Energy in SI units”, The Orient Blackswan, 2007
5. https://www.iexindia.com/
6. https://www.un.org/sustainabledevelopment/energy/
7. https://www.un.org/sustainabledevelopment/climate-change/
8. W. Fordham-Cooper, “Electrical Safety Engineering”, Butterworth-Heinemann, 3rd Edition, 2013.

19EE07E SWITCHED MODE POWER CONVERSIONS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design the magnetics for switched mode power converters. (K3)
CO2: design and analysis of isolated DC-DC converters (K3)
CO3: analyze the non-isolated DC-DC converters. (K2)
CO4: discuss the operation of resonant converters. (K2)
CO5: distinguish various types of UPS and filters. (K2)

UNIT I DESIGN OF MAGNETICS 9

Basic magnetic theory revisions – Inductor design – Design of mutual inductance – Design of transformer for isolated topologies – Ferrite core table and selection of area product – wire table –selection of wire gauge.

UNITII ANALYSIS OF NON-ISOLATED DC-DC CONVERTERS 9

Buck, Boost, Buck- Boost, Cuk and SEPIC converters: Principles of operation – Continuous conduction mode- discontinuous conduction mode – Concepts of volt-sec balance and charge balance – Analysis and design based on steady-state relationships - Performance parameters.

UNIT III ANALYSIS OF ISOLATED DC-DC CONVERTERS 9

Introduction – classification- Forward converter –Flyback converter - Push-pull converter – Half-bridge switching converter – Full-bridge switching converter – Performance parameters.

UNIT IV RESONANT CONVERTERS 9

Classification of resonant converters – Basic resonant circuit concepts – Load resonant converters – Resonant switches converters – zero voltage switching- zero current switching.

UNIT V POWER CONDITIONERS, UPS AND FILTERS 9

Power line disturbances – Power conditioners – Design of UPS, Applications –Voltage filters, Series–parallel resonant filters, filters for PWM VSI, current filter.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Simon S. Ang, “Power Switching Converter”, Marcel Dekker Inc., Taylor and Francis, 3rd Edition, 2010.
2. Umanand L., Bhat S.R., “Design of magnetic components for switched Mode Power converters”, Wiley Eastern Ltd., 2001.

REFERENCES

1. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics: Converters, Applications and Design”, 3rd Edition, John Wiley and Sons, 2018.
2. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press, 2004.
3. Rashid M.H., “Power Electronics: Circuits, Devices and Applications”, 3rd Edition, Pearson Education, 2017.
4. Keng C. Wu, “Switch–Mode Power Converters: Design and Analysis”, 1st Edition, Academic Press, 2005.
5. Ramanarayanan V., “Course Material on Switched Mode Power Conversion”, IISc Bangalore, 2007.

19EE08E SPECIAL ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: analyze given magnetic circuit and understand operation, characteristics and control of PMBLDC motor (K2)

CO2: understand the construction, operation performance characteristics of PMSM and its power controllers. (K2)
CO3: understand the construction, operation and control of SRM drive and its power controllers. (K2)
CO4: understand the construction, operation, characteristics and control of stepper motor. (K2)
CO5: understand the operation & characteristics of other special electrical machines. (K2)

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Fundamentals of Permanent Magnets – Types - Principle of operation - Magnetic circuit analysis - EMF and Torque equations - Characteristics and control

UNIT II PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Construction Features - Principle of operation – EMF and torque equations - Phasor diagram - Power controllers – Characteristics of synchronous reluctance motor - Digital controllers

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Principle of operation - Torque prediction – Performance Characteristics - Power converters and controllers – Control of SRM drive - Sensor less operation of SRM – Applications.

UNIT IV STEPPER MOTORS 9

Constructional features – Principle of operation – Types – Torque equation – Linear and Nonlinear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

UNIT V OTHER SPECIAL ELECTRICAL MACHINES 9

PCB Motor- Flux switch machines – Linear induction motor - Synchronous Reluctance Motors - Constructional features – Types – Axial and Radial flux motors - Applications

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. T.J.E. Miller, "Brushless magnet and Reluctance motor drives", Claredon press, London, 1989.
2. R.Krishnan, "Switched Reluctance motor drives", CRC presses, 2017.
3. T.Kenjo, "Stepping motors and their microprocessor controls", Oxford University press, New Delhi, 2017.
4. K.Venkataratnam**, "**Special Electrical Machines", Universities Press, 2021.
5. Wei Hua, Peng Su, Gan Zhang, Guishu Zhao "Flux-Switching Machines" Wiley Encyclopedia of Electrical and Electronics Engineering, 2015.

REFERENCES

1. T.Kenjo and S.Nagamori, "Permanent magnet and Brushless DC motors", Clarendon press, London, 1988.
2. R.Krishnan, "Electric motor drives", Prentice Hall of India, 2015.

3. D.P.Kothari and I.J.Nagrath, “Electric machines”, Tata Mc Graw hill publishing company, New Delhi, Fifth Edition, 2017.
4. Irving L.Kosow, “Electric Machinery and Transformers”, Pearson Education, Second Edition, 2007.
5. Paul Acarnley, "Stepping Motors – A Guide to Motor Theory and Practice", Institution of Engineering and Technology, Fourth Edition, 2002.

19EE10E POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Understand the various Non-Conventional sources of energy (K2)
CO 2: Acquire knowledge on various power converters for Solar energy system. (K2)
CO 3: analyze the Power converter utilized by the wind energy conversion system. (K2)
CO 4: Understand the concepts of grid connection and its issues. (K2)
CO 5: recognize the hybrid operation of wind and PV systems and features of MPPT tracking. (K2)

UNIT I INTRODUCTION TO RENEWABLE ENERGY RESOURCES 9

World and Indian energy scenario - Wind, Solar, Hydro, Geothermal: Availability and Power extraction - Environmental impacts of Renewable energy sources (GHG emission)

UNIT II POWER CONVERTERS FOR SOLAR PV SYSTEM 9

Solar Photovoltaic System – P-V and I-V Characteristics - Power converters for Solar: Line commutated Converter, Buck, boost, buck-boost converters - Interleaved and Multi port converters - Rating of Converter for SPV system– Standalone PV system – Battery Charing- Battery sizing, Array sizing - Charge Controllers

UNIT III POWER CONVERTERS FOR WIND ENERGY SYSTEM 9

Wind Energy Conversion System - Power Converters for Wind: AC voltage Controller - Matrix converter – Bi directional converter- flyback converter - Standalone operation of fixed and variable speed wind energy conversion systems - Static Kramer Drive for DFIG – Static Scherbius using cyclo converter for DFIG – Rotor Resistance Chopper control for WRIG - Rating of Converter for WECS.

UNIT IV GRID CONNECTED SYSTEM 9

Grid interface - Grid connection issues: leakage current, Islanding, harmonics, Active / reactive Power feeding, unbalance Grid Interactive inverter: Line Commuated Inverter – Self Commutated Inverter – Inverter with high frequency Transformer - Selection of inverter – Rating of Inverters for Grid connected System.

UNIT V HYBRID ENERGY SYSTEM 9

Need for hybrid systems- Range and type of Hybrid systems- Case studies of Wind and PV system – PV-Diesel System – Wind-Diesel Hybrid System – Energy Storage Devices for Hybrid Energy System - Maximum Power Point Tracking (MPPT) - MPPT schemes.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Sudipta Chakraborty, Marcelo G. Simes, and William E. Kramer, “Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration”, Springer Science & Business, 2013.
2. Nicola Femia, Giovanni Petrone, Giovanni Spagnuolo, Massimo Vitelli, “Power Electronics and control for maximum Energy Harvesting in Photovoltaic Systems”, CRC Press, 2013.

REFERENCES

1. Rashid .M. H “Power electronics Hand book”, Academic press, 2001.
2. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
3. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 2009.
4. Gray, L. Johnson, “Wind energy system”, Prentice Hall INC, 1995.
5. B.H.Khan, “Non-conventional Energy sources”, Tata McGraw-Hill Publishing Company, New Delhi, 2017.

19EE14E POWER SYSTEM TRANSIENTS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the various sources of electromagnetic transient (K2)
CO2: describe the formation and characteristics of travelling waves in transmission line (K2)
CO3: describe the mechanism of over voltages and its effects K2)
CO4: discuss the protection schemes against over voltage (K2)
CO5: evaluate the transient effects in power networks and components (K2)

UNIT I TRANSIENTS IN A TRANSMISSION LINE 9

Travelling waves in transmission line - wave equations for voltage and current - characteristic impedance of transmission line from wave equations - special cases of transmission line - input impedance - standing wave ratio - reflection co-efficient and input power of transmission line - Transmission line as circuit elements.

UNIT II TRAVELLING WAVES ON TRANSMISSION LINE 9

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion – Multi-conductor system and Velocity wave.

UNIT III LIGHTNING, SWITCHING AND TEMPORARY OVER VOLTAGES 9

Lightning: Physical phenomena of lightning – Interaction between lightning and power system – Safety measures – Factors contributing to line design – Simple and Abnormal Switching Transients – Transients in three phase circuits – Grounding and Earthing requirements - Earthing Resistance - Very Fast Transient Over voltage (VFTO) – IEC standards and wave models.

UNIT IV PROTECTION AGAINST TRANSIENTS 9

Protection of power systems against transient over-voltage due to switching and lightning - Lightning arrestors - Surge diverter -, Surge capacitors and reactors - Overhead ground wires - Insulation coordination - Computer aids to calculate transient (EMTP).

UNIT V MODELLING OF POWER APPARATUS UNDER TRANSIENT CONDITIONS 9

Introduction - Winding Capacitance - Frequency dependent parameters - Circuit Reduction – Modelling of Lightning and over voltage scenario - Modelling of Transformers, Generators, Motors, Transmission lines, Cables.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Pritindra Chowdhari, “Electromagnetic transients in Power System”, John Wiley and Sons Inc., 2009.
2. L. V. D. Sluis, “Transients in Power Systems”, John Wiley, 2001.

REFERENCES

1. Klaus Ragaller, “Surges in High Voltage Networks”, Plenum Press, New York, 2008.
2. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International (P) Ltd., New Delhi, Fourth Edition, 2011.
3. Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2020.
4. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.

19EE15E WIND AND SOLAR ENERGY SYSTEMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain fundamentals and wind turbine concept of wind energy conversion systems. (K2)

CO2: discuss about the fixed and variable speed system and the various generator used in WECS. (K2)

CO3: describe the fundamentals of solar cells. (K2)

CO4: recognize the various solar PV systems and their up gradations along with their benefits. (K2)

CO5: explain the Grid connected Solar and WECS and its controller (K2)

UNIT I INTRODUCTION 9

Components of wind energy conversion system - Wind energy conversion system schemes - Power obtained from wind-simple momentum theory - Power coefficient - Sabinin’s theory-Aerodynamics of Wind turbine - Horizontal axis Wind Turbine (HAWT) – Vertical Axis Wind Turbine (VAWT) - Power developed – Thrust – Efficiency Tip speed ratio.

UNIT II FIXED AND VARIABLE SPEED WEC SYSTEM 9

Generating Systems - Need of variable speed systems - Constant speed constant frequency systems - Choice of Generators - Doubly Fed Induction Generator (DFIG) - Permanent Magnet Induction Generator (PMSG) - Variable speed generators deciding factors - Synchronous Generator - Squirrel Cage Induction Generator.

UNIT III SOLAR ENERGY-BASIC CONCEPTS 9

Introduction - Sun as Source of Energy - Earth, Sun, Earth Radiation Spectrum - Extraterrestrial and Terrestrial Radiations - Spectral Power Distribution of Solar Radiation - Depletion of Solar Radiation.

UNIT IV SOLAR PHOTOVOLTAIC SYSTEMS 9

Introduction - Solar Cell Fundamentals - Solar Cell Characteristics - Solar Cell Classification - Solar Cell Technologies - Solar Cell: Module, and Array Construction - Maximizing the Solar PV Output and Load Matching - Maximum Power Point Tracke - Balance of System Components - Solar PV Systems - Solar PV Applications.

UNIT V GRID CONNECTED SYSTEMS 9

Stand alone and Grid Connected Solar and WECS system-Grid connection Issues - Machine side & Grid side controllers - WECS in various countries - Solar cells to solar array – On–Grid PV system – With and without storage – Off grid stand alone PV system.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Heir S., “Grid Integration of Wind Energy Conversion Systems”, Wiley, 2006.
2. Rai G.D., “Non-conventional Sources of Energy”, Khanna publishers, 2009.
3. Robert Foster, Majid Ghassemi and Alma Cota, “Solar Energy – Renewable Energy and the Environment”, CRC Press, 2009.

REFERENCES

1. Himanshu Tyagi, Prodyut R. Chakraborty, “Solar Energy: Systems, Challenges, and Opportunities (Energy, Environment, and Sustainability)”, Springer, 2020.
2. Freris L.L., “Wind Energy conversion Systems”, Prentice Hall, 1990.
3. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
4. Golding E.W., “Generation of Electricity by wind power”, Redwood burn Ltd., Trowbridge, 1976.
5. Chetan Singh Solanki, “Solar Photovoltaics Fundamentals, Technologies and Applications”, Prentice Hall Ltd., 2015.
6. James P. Dunlop, “Photovoltaic Systems”, American Technical Publishers, 2009.

19EE16E	**POWER QUALITY**	**L T P C**
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: explain about various Power quality problems. (K2)

CO 2: explain the importance Transients, Voltage and Current balance (K2)

CO 3: compute Harmonic distortion in the given Electrical drive (K3)
CO 4: analyze the types of power factor improvement methods. (K3)
CO 5: discuss the importance of Custom power devices (K2)

UNIT I INTRODUCTION 9

Power quality - Impact of PQ on end users - Need for PQ monitoring - Various PQ problems: Voltage dips - over voltages - short supply interruptions - voltage fluctuations and flicker.

UNIT II TRANSIENTS, VOLTAGE AND CURRENT UNBALANCE 9

Transient system model - examples of transient models and their response - power system Transient model - types and causes of transients – Lightning - other switching transients. Symmetrical components of currents and voltages – sources – effects - measurements and mitigation.

UNIT III HARMONICS 9

Definition - odd and even harmonics - harmonic phase sequence - voltage and current Harmonics - individual and total harmonic distortion - harmonic standards – sources - effects on various electrical components - measurements and mitigation - passive and active filters (Case Studies).

UNIT IV POWER FACTOR 9

Active and reactive power flow with nonlinear load - displacement and distortion power factor - power factor penalty - power factor improvement - applications of synchronous condensers and static VAR compensators - automatic power factor controller (Case Studies).

UNIT V SOLVING POWER QUALITY PROBLEMS USING CPD 9

Power quality measuring equipment - Smart power quality analyzers - Introduction to Custom Power Devices (CPD) – STATCOM - Dynamic Voltage Restorer (DVR) - Unified Power Quality Controller (UPQC).

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Sankaran C, “Power Quality”, CRC Press (Special Indian Edition) 2009.

REFERENCES

1. Angelo Baggini, “Handbook of Power Quality” John Wiley & Sons Ltd, 2008.
2. Duggan R.C., “Electrical Power Systems Quality”, McGraw-Hill, 2017.
3. Math H.J.Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, IEEE Press, New York, 2000.
4. Arrillaga.J, Watson.N.R and Chen.S, “Power System Quality Assessment”, John Wiley & Sons Ltd., England, 2000.
5. Bhim Singh, Ambrish Chandra and Kamal Al-Haddad, “Power Quality: Problems and Mitigation Technique”, Wiley Publications, 2015.
6. Arindam Ghosh and Gerald Ledwich, “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002.

19EE18E	POWER SYSTEM DYNAMICS AND CONTROL	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the concepts of power system operation and control. (K2)
CO2: Explain the concept of park's transformation and synchronous machine equation. (K2)
CO3: Model different power system components for the study of stability. (K3)
CO4: Describe the concept of transient, steady state and dynamic stability. (K2)
CO5: Understand the methods to improve stability. (K2)

UNIT I INTRODUCTION TO POWER SYSTEM OPERATIONS 9

Introduction to power system stability – Power system operations and control – stability problems in power system – Impact on power system operations and control.

UNIT II DYNAMIC ANALYSIS AND MODELLING OF SYNCHRONOUS MACHINE 9

Simplest model of the synchronous machine – Equation in physical quantities – Inductance of synchronous machine – Park's transformation to dqo components – assumptions of balanced currents and voltages in the armature – Final machine dynamic equations

UNIT III MODELLING OF POWER SYSTEM COMPONENTS 9

Modelling of transmission lines and loads: Transmission line physical characteristics **–** Transmission line modelling **–** Load models – Induction machine model – HVDC and FACTS controllers.

UNIT IV POWER SYSTEM STABILITY 9

Basic concepts and definitions – classification of stability – Blackouts around the world – blackout events – Stability of interconnected systems – Bad effects of Instability – Importance of stability to system operation and design.

UNIT V ENHANCING SYSTEM STABILITY 9

Method of improving stability limits – Planning measures – Power system stabilizers – Block diagram of PSS with description – operational measures – preventive control – Emergency control.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. K.R. Padiyar, "Power System Dynamics, Stability and Control", B. S. Publications, 2004.
2. P. Kundur, "Power System Stability and Control", McGraw Hill, 2006.
3. P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 2007.

REFERENCES

1. L.P.Singh, "Advanced Power system Analysis and Dynamics", New Age International Publishers, 2012.
2. B.R.Gupta, "Power System Analysis and Design", S.Chand, 2008.

3. Vijay Vittal, James D. McCalley, Paul M. Anderson, A. A. Fouad, “Power System Control and Stability,IEEE Press, Wiley, 2019.

19EE19E ELECTRICAL ENERGY CONSERVATION AND AUDITING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon the successful completion of this course- the students will be able to

CO1: describe the elements of energy conservation and management. (K2)
CO2: Carry out energy conservation approaches in industry/Organization. (K2)
CO3: Select suitable lighting schemes for various environment (K2)
CO4: Infer the energy conservation in power generation, transmission and distribution (K2)
CO5: explain the concept of energy auditing. (K2)

UNIT I ELEMENTS OF ENERGY CONSERVATION AND MANAGEMENT 9

Energy Scenario - Role of Energy Managers in Industries – Energy monitoring, auditing & Targeting – Economics of various Energy Conservation schemes - Total Energy Systems. Scope for energy conservation and its benefits Energy conservation Principle. Energy Management concept, objectives and Energy management programmes.

UNIT II ENERGY CONSERVATION APPROACHES 9

Supply and demand side management, economic operation; reactive power, power factor correction and capacitor sizing; transformer loading and efficiency analysis; feeder loss evaluation. Energy saving opportunities in electric motors. Energy efficient control and load matching, motor selection; Industrial drives and control schemes, variable speed drives and energy conservation schemes

UNIT III ENERGY CONSERVATION IN LIGHTING 9

Energy efficient lighting schemes, Concept of lighting systems – Choice of lighting – Different Lighting technologies – Energy saving Control of lighting – Lighting standards and requirements – Energy Efficiency in Lighting – Domestic Lighting – Case studies.

UNIT IV ENERGY CONSERVATION IN POWER GENERATION, TRANSMISSION AND DISTRIBUTION 9

Types of generation - Performance improvement of existing power plant: Hybrid system, Co-generation, Demand side management, Load response programmes, conservation methods in Electrical Distribution, Transformers and lines, Technical measures to optimize T and D losses

UNIT V ENERGY AUDIT 9

Necessity of energy audit -Energy audit and its benefits, Methodology of preliminary energy audit and detailed energy audit – Phase I, Pre audit, Phase II- Audit and Phase III-Post audit, Energy audit report. Electrical Measuring Instruments - Power Analyzer, IE rules and regulations for energy audit, Electricity act.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. D. Yogi Goswami, Frank Kreith, “Energy Management and Conservation Handbook”, CRC Press, 2rd edition, 2016.
2. Abbi. Y.P and Shashank Jain, “Handbook on Energy Audit and Environment Management”, The Energy and Resources Institute, 2015.

REFERENCES

1. General Aspects of Energy management and Energy audit, Second Edition 2005, Bureau of Energy Efficiency, Ministry of Power, India.
2. Energy Efficiency in Electrical Utilities, Second Edition 2005, Bureau of Energy Efficiency, Ministry of Power, India.
3. Marguerite A. H Ruffner, Yacov Y. Haimes, “Energy Auditing and Conservation: Methods, Measurements, Management, and Case Studies”, Taylor and Francis, 1980.
4. Energy management handbook, John Wiley and Sons – Wayne C. Turner, 2006
5. Instructions to Energy Auditors, Vol - I and Vol - II National Technical InformationServices US Dept of Commerce Springfield, VA 22161
6. LC Witte, PS Schmidt DR Brown, Industrial Energy Management and Utilization, Hemisphere Publication, Washington, 1988,

19EE22E SOLAR PHOTOVOLTAIC SYSTEMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: recognize the fundamentals of solar cells. (K2)
CO2: understand the various solar cell fabrication processes. (K2)
CO3: recognize the various solar PV system and their up gradations along with their benefits (K2)
CO4: design and analyze on–grid PV applications. (K3)
CO5: design off-grid PV systems and perform cost benefit analysis of PV installations. (K3)

UNIT I SOLAR CELL FUNDAMENTALS 9

Fundamentals of Semiconductors, energy band, doping, PN Junction, charge carriers, carrier motion. Photovoltaic effect, Device physics of solar cell-Principle of solar energy conversion, conversion efficiency – losses in solar cells, Solar radiation measurement: Pyranometer - Pyrheliometer.

UNIT II SOLAR CELL FABRICATION 9

Types of solar cell – Production of polycrystalline and mono crystalline silicon: Czochralski (CZ) and Float zone (FZ), wafer dicing, refining. Thin film solar cells – A-Si, CIS/CIGS, Thin film deposition techniques – Physical vapour deposition (PVD), Chemical vapour deposition (CVD) – Plasma enhanced CVD, Emerging technologies – Organic cells, Multi-junction cells, Dye sensitized cells.

UNIT III SOLAR PHOTOVOLTAIC SYSTEM 9

Introduction, Solar cell characteristics – Solar simulator: I-V measurement, solar cell classification, solar cell technologies, solar cell module and array construction, number of cells in a module and PV module specifications – maximizing the solar PV output and load matching

UNIT IV ON-GRID PV SYSTEMS 9

PV string and array – Balance of system – DC-DC converters – Inverters – Maximum power point tracking – On-Grid PV system – Design & analysis – Net Metering – Performance evaluation & monitoring – Field visit – Grid tied PV power plant

UNIT V OFF-GRID PV SYSTEMS 9

Off-Grid stand alone PV system – System sizing – Module & Battery – Charge controller – Storage Batteries for PV systems – Design & analysis - Solar photovoltaic in domestic applications and agriculture – Performance evaluation & monitoring – Economic indicators: Simple payback, Life cycle costing.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Chetan Singh Solanki "Solar Photovoltaics Fundamentals, Technologies and Applications", 3rd Edition, Prentice Hall of India, 2015.

REFERENCES

1. Chetan Singh Solanki "Solar Photovoltaic Technologies and Systems – A manual for Technicians, Trainers and Engineers", Prentice Hall of India, 2014.
2. Robert Foster Majid Ghassemi, Alma Cota "Solar Energy – Renewable Energy and the Environment", CRC Press, 2010
3. James P. Dunlop "Photovoltaic Systems", 2nd Edition, American Technical Publishers, 2009
4. A. Goetzberger ,V.U. Hoffmann "Photovoltaic Solar Energy Generation", Springer-Verlag Berlin, Heidelberg, 2005.
5. Martin Green "Solar Cells: Operating principles, technology and systems application", Prentice Hall, 1997.

19EE24E SMART GRID L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the concepts of Smart Grid and its present developments. (K2)

CO2: understand about the different Smart Grid Technologies. (K2)

CO3: describe about the different smart meters and apply them in advanced metering infrastructure. (K2)

CO4: analyze power quality management in Smart Grid. (K2)

CO5: understand about the LAN- WAN and Cloud Computing for Smart Grid. (K2)

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid – Concept - Definitions and Need for Smart Grid- Smart grid drivers - functions - opportunities - challenges and benefits- Difference between conventional & Smart Grid- National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers - Smart energy resources- Smart substations - Substation Automation - Feeder Automation -Transmission systems: EMS - FACTS and HVDC - Wide area monitoring- Protection and control- Distribution systems: DMS- Volt/VAR control- Fault Detection- Isolation and service restoration- Outage management- High-Efficiency Distribution Transformers- Phase Shifting Transformers- Plug-in Hybrid Electric Vehicles (PHEV) - V2G and G2V.

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters- Advanced Metering infrastructure (AMI) drivers and benefits- AMI protocols- standards and initiatives- AMI needs in the smart grid- Phasor Measurement Unit (PMU)- Intelligent Electronic Devices(IED)&their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid- Power Quality issues of Grid connected Renewable Energy Sources- Power Quality Conditioners for Smart Grid- Web based Power Quality monitoring- Power Quality Audit.

UNIT V CONTROLLERS AND THEIR COORDINATION 9

Introduction and role of SCADA in smart grid - Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broad band over Power line (BPL) - IP based Protocols- Basics of Web Service, CLOUD Computing - and Cyber Security Issues.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Stuart Borlase, “Smart Grid: Infrastructure, Technology and Solutions”, CRC Press, 1st Edition, 2017.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley 2015.

REFERENCES

1. Vehbi C. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, “Smart Grid Technologies: Communication Technologies and Standards”, IEEE Transactions On Industrial Informatics, Vol.7, No.4, November 2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang ‘Smart Grid –The New and Improved Power Grid: A Survey’, IEEE Transaction on Smart Grids, vol.14, 2012.
3. James Momohe ‘Smart Grid: Fundamentals of Design and Analysis’, Wiley, IEEE Press, 2012.

19EE25E POWER GENERATION SYSTEMS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon the completion of this course- the students will be able to

CO1: explain the layout, construction and working of the components inside thermal power plants. (K2)

CO2: understand the layout, construction and working of the components inside nuclear power plants. (K2)

CO3: explain the layout, construction and working of the components inside hydroelectric power plants. (K2)

CO4: describe the layout, construction and working of the components inside Renewable energy power plants. (K2)

CO5: infer the applications of power plants while extend their knowledge to power plant economics and environmental estimate the costs of electrical energy production. (K2)

UNIT I COAL BASED THERMAL POWER PLANTS 9

Rankine cycle – improvisations - Layout of modern coal power plant - Subsystems of thermal power plants – Fuel and ash handling- Draught system- Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering- Layout and subsystems of Nuclear Power Plants- Working of Nuclear Reactors: Boiling Water Reactor (BWR)- Pressurized Water Reactor (PWR) - CANada Deuterium- Uranium reactor (CANDU)- Breeder- Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT III HYDRO ELECTRIC POWER PLANTS 9

Selection of site- Elements of power plant- Classification- Water turbines Governor action- Hydro-electric generator- Plant layout- Pumped storage plants.

UNIT IV ALTERNATIVE SOURCES OF ENERGY 9

Solar power generation - Photo-voltaic and solar thermal generation- Wind power generation-Geo Thermal- Biomass- Fuel Cell power systems- Hydrogen Fuel Cell - Micro-hydel power plants - Tidal power generation – Onshore and Offshore Power Generation - Sustainable Development Goal (SDG) 7.

UNIT V ENERGY- ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types- Load distribution parameters- load curve- Comparison of site selection criteria- relative merits & demerits- Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants - Sustainable Development Goal (SDG) 13.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Nag. P. K., "Power Plant Engineering", Fourth Edition, Tata McGraw Hill Publishing Company Ltd.,4th edition 2017.
2. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., “A Text Book on Power Systems Engineering”, Dhanpat Rai and Sons, New Delhi, 2nd Revised edition, 2016.
3. J.B.Gupta, “A Course in Power Systems”, S.K.Kataria and Sons, 2013.
4. B.R.Gupta, “Generation of Electrical Energy”, S. Chand Limited, 2017.

REFERENCES

1. M. M. El. Wakil., "Power Plant Technology", Tata McGraw Hill Publishing Company Ltd., 2010.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw Hill, 1998.
4. https://www.un.org/sustainabledevelopment/energy/
5. https://www.un.org/sustainabledevelopment/climate-change/

19EE26E ELECTRICAL SAFETY

L T P C
3 0 0 3

COURSE OUTCOMES

Upon the successful completion of this course- the students will be able to

- CO1: explain the basic concepts of electrical equipments and statutory requirements. (K2)
- CO2: understand about various electrical hazards and its causes. (K2)
- CO3: describe about various protection systems. (K2)
- CO4: explain the role of environment in selection- installation- operation and maintenance of equipments. (K2)
- CO5: interpret about the hazardous zones of electrical industry. (K2)

UNIT I CONCEPTS AND STATUTORY REQUIREMENTS 9

Introduction – electrostatics- electro magnetism- stored energy- energy radiation and electromagnetic interference – Working principles of electrical equipment-Indian electricity act and rules-Statutory requirements from electrical inspectorate - International standards on electrical safety – First aid- Cardio Pulmonary Resuscitation (CPR).

UNIT II ELECTRICAL HAZARDS 9

Primary and secondary hazards - shocks- burns- scalds- falls - Human safety in the use of electricity - Energy leakage - clearances and insulation - Classes of insulation - Voltage classifications excess energy - Current surges - Over current and short circuit current-heating effects of current - Electromagnetic forces - Electrical causes of fire and explosion-ionization- spark and arc-ignition energy - National electrical safety code ANSI. Lightning- hazards- lightning arrestor- installation – Earthing- specifications- earth resistance- earth pit maintenance.

UNIT III PROTECTION SYSTEMS 9

Personal Protective Equipment - Fuse- circuit breakers and overload relays – Protection against over voltage and under voltage – Recent surge protection scheme for generator - Safe limits of amperage – Voltage – Safe distance from lines - Capacity and protection of conductor- joints and connections- overload and short circuit protection - No load protection - Earth fault protection.

UNIT IV SELECTION- INSTALLATION- OPERATION AND MAINTENANCE 9

Role of environment in selection - Safety aspects in application - Protection and interlock self- diagnostic features and fail safe concepts - Lock out and work permit system - Discharge rod and earthing devices - Safety in the use of portable tools - Cabling and cable joints preventive maintenance.

UNIT V HAZARDOUS ZONES 9

Classification of hazardous zones - Intrinsically safe and explosion proof electrical apparatus (IS-API and OSHA standard) - Increase safe equipment and their selection for different zones

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. John Cadick- Mary Capelli-Schellpfeffer- Dennis Neitzel- Al Winfield- “Electrical Safety Handbook”- McGraw-Hill Education- 5th edition, 2019.
2. Fordham Cooper- W.- “Electrical Safety Engineering”- Butterworth and Company- London- 3rd edition, 2013.

REFERENCES

1. Ray A. Jones- Jane G. Jones- “Electrical Safety in the Workplace”- Jones & Bartlett Learning, 2000.
2. Maxwell Adams.J- “Electrical Safety- a guide to the causes and prevention of electric hazards’- The Institution of Electric Engineers- IET, 1994.

19EE28E CAD OF ELECTRICAL APPARATUS

L T P C
2 1 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: compare the conventional and field analysis based design. (K2)
CO2: interpret the basic concept of numerical approach. (K2)
CO3: explain the procedures of CAD packages. (K2)
CO4: apply the knowledge of CAD procedure to high voltage system (K3)
CO5: analyze the design electrical apparatus (K3)

UNIT I INTRODUCTION 9

Outline of Electromagnetic Fields – Electromagnetic field equations – Laplace and Poisson’s Equations – Conventional Design Procedures – Limitations – Need for field analysis based design.

UNIT II NUMERICAL COMPUTATION TECHNIQUES 9

Mathematical models – Differential / Integral equations – Finite Difference method – Finite element method – 2D field problems – Charge simulation method.

UNIT III CAD PACKAGES 9

Elements of a CAD system – Preprocessing – Modeling – Meshing – governing equations – boundary conditions and material characteristics – Setting up solution – Post processing.- Use of open source FEM software for 2D design (Electrode configurations).

UNIT IV NUMERICAL COMPUTATION OF ELECTRIC FIELD IN HIGH-VOLTAGE SYSTEM 9

Insulators and its types - Voltage Stress in Insulators – Capacitance calculation - 2D FEM software based insulator design – Electric Field Distribution around Insulator- Electric Field Distribution in a Condenser Bushing.

UNIT V DESIGN APPLICATIONS 9

Basic concepts of design in electrical machines - Single and three phase transformer – Computation of the No load Inductances – Estimation of Iron Loses and leakage inductances - Flowchart for computer-aided optimal design of Transformer –- Flowchart for computer-aided optimal design of DC machine.

L: 30; T: 15; TOTAL: 45 PERIODS

TEXT BOOKS

1. S.J. Salon, "Finite Element Analysis of Electrical Machines", Springer, Yes DEE publishers, Indian reprint, 2007.
2. K.J.Binns, P.J.Lawrenson and C.W.Trowbridge, "The Analytical and Numerical Solution of Electric and Magnetic Fields", John Wiley and sons, 1993.

REFERENCES

1. Joao Pedro, A.Bastos and Nelson Sadowski, "Electromagnetic Modeling by Methods", Marcell Dekker Inc., 2003.
2. S.R.H.Hoole, "Computer Aided Analysis and Design of Electromagnetic Devices", Elsevier, NewYork, 1989.
3. Matthew N. O. Sadiku, "Principles of Electromagnetics", Oxford University Press, New Delhi, 2015.
4. Nathan Ida, Joao P A Bastos, "Electromagnetics and calculation of fields", Springer Verlag, 2012.
5. S.S.Rao, "The Finite Element Method in Engineering", Elsevier, 2011.
6. Matthew. N.O. Sadiku, S.V. Kulkarni, "Elements of Electromagnetics", Sixth Edition, Oxford University Press, Asian Edition 2015.
7. Nicola Biyanchi, "Electrical Machine analysis using Finite Elements", Taylor and Francis Group, CRC Publishers, 2005.

19EE30E	INSULATION TECHNOLOGY	L T P C
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: summarize the general properties of dielectric materials (K2)
CO 2: dissect the different breakdown mechanism in gaseous dielectrics (K2)
CO 3: perceive the various breakdown mechanisms in solid dielectrics (K2)
CO 4: appraise the conduction and breakdown mechanism in liquid dielectrics (K2)
CO 5: select the different dielectric materials in electrical equipments applications (K2)

UNIT I INTRODUCTION 9

Classification of insulating materials - classification based on temperature – Insulation resistance - Factor affecting insulation resistance -- Polarisation – Polarisation Materials – Polarisability of dielectric material - Dipole-Electric Dipole moment – Permeability - Dependence of permittivity on temperature, pressure, humidity and voltage – Permittivity of mixtures – Bipolar-electric field in mixed dielectrics.

UNIT II BREAKDOWN IN GASES AND VACCUM 9

Basic ionization process – Townsend current growth equations – Townsend criterion for spark breakdown – Streamer mechanisms –– Paschen's law – Breakdown in non-uniform fields – Vacuum: Pre-breakdown conduction – Factors affecting the breakdown voltage-moisture interaction with insulation

UNIT III BREAKDOWN IN SOLIDS 9

Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown – Chemical and electrochemical deterioration – Breakdown due to tracking and treeing – Partial discharges - degradable and non degradable insulation.

UNIT IV ELECTRICAL CONDUCTION AND BREAKDOWN IN LIQUIDS 9

Pure liquids and commercial liquids – Purification – Natural conduction – Induced conduction – Process of conduction – Breakdown phenomena and electric strength of pure liquids – Breakdown of commercial liquids - Alternating liquid dielectric – latest development-cryogenic insulation - effect of moisture and importance of purity - alternate insulation

UNIT V APPLICATION OF DIELECTRIC MATERIALS 9

Classification based on insulating materials and application – Application of insulating materials in transformers, rotating machines, circuit breakers, cables, power capacitors and bushings.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Adrinaus, Dekker J., "Electrical Engineering Materials", Prentice Hall of India Pvt. Ltd., New Delhi, 2015.
2. Alston L.L, "High Voltage Technology", Oxford University Press, London, 1968 (B.S. Publications, First Indian Edition, 2008).

REFERENCES

1. Kuffel E., Zaengl W.S. and Kuffel J., “High Voltage Engineering Fundamentals”, Elsevier India Pvt. Ltd, 2008.
2. Dieter Kind and Hermann Karner, “High Voltage Insulation Technology”, (Translated from German by Narayana Rao Y., Friedr. Vieweg & Sohn, Braunschweig), 1985.
3. Naidu M.S. and Kamaraju V., “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2020.
4. Ushakov V.Y., “Insulation of High Voltage Equipment”, Springer, 2004.

19EE31E EHV POWER TRANSMISSION

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify transmission (HVAC and HVDC) and distribution voltage levels. (K2)
CO2: extract transmission line parameters. (K2)
CO3: locate required HVDC transmission in power system. (K2)
CO4: know the uses of placing FACTS devices. (K2)
CO5: compute electrostatic and magnetic fields of EHV lines. (K2)

UNIT I TRANSMISSION LINE TRENDS 9

Standard transmission voltages, average values of line parameters – Power handling capacity and line losses - number of lines, Advantages and disadvantages of HVAC and HVDC system.

UNIT II LINE AND GROUND PARAMETERS 9

Resistance, Temperature rise and current carrying capacity of conductors. Properties of Bundle conductors – Calculation of L and C parameters – Modes of propagation – Effect of Earth.

UNIT III HVDC SYSTEM 9

HVDC Power transmission–Description, principles of operation and Planning for HVDC transmission–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT IV FACTS 9

Basic concepts – Reactive power control, uncompensated transmission line, series compensation, SVC, thyristor control, series capacitor, static synchronous compensator, unified power flow controller and applications.

UNIT V ELECTROSTATIC AND MAGNETIC FIELDS OF EHV LINES 9

Electric shock – threshold currents – Calculation of electrostatic fields and magnetic fields of AC and DC lines – Effect of fields on living organism – Electrical field measurement – Drone based thermal imaging for electrical stress analysis.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. S Kamakshaiah & V Kamaraju, “HVDC Transmission”, Tata Mcgraw Hilll Publishers, 2011.

2. Rakosh Das Begamudre, “Extra high voltage AC transmission Engineering”, New Age International Publishers, Third Edition, 2013.
3. Narain G Hingorani, “Understanding FACTS” Standard Publishers, 1994.

REFERENCES

1. C.L. Wadhwa “Electrical Power Systems”, New Age International Publishers, Fourth Edition, 2005.
2. K.R. Padiyar, “HVDC Power Transmission System”. New Age International Publishers, First Edition, Reprint 2005.
3. M.L. Soni, P.V. Gupta, U.S. Bhatnagar, A.Chakrabarti, “A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998.
4. Mafen Abdel – Salam, Hussein Anis, Ahdab E-Moshedy, Roshdy Padwan “ High Voltage Engineering – Theory & Practice”, Marcel Dekker Inc., 2000
5. Microtran Power System Analysis Corporation, “Microtran Reference Manual”, Vancouver Canada. (Website: www.microtran.com)
6. R.K. Rajput, “A Text Book of Power System Engineering”, Laxmi Publications, 2015.
7. Xiao–Ping Zhang, “Restructured Electric Power Systems”, Wiley Publications, 2010.
8. Shobhit Gupta, and Deepak Gupta, “EHV AC/DC Transmission”, genius publications, 2014.
9. A. Chakrabarti , D. P. Kothari and A. K. Mukhopadhyay, “Performance, Operation and Control of EHV Power Transmission System”, A H Wheeler Publishing Co Ltd, 1999.
10. https://www.drone-thermal-camera.com/thermodiagnostics-in-the-power-engineering-sector/

19EE32E HVDC TRANSMISSION SYSTEMS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: describe the advantages of DC transmission over AC transmission (K2)
CO 2: analyze HVDC converters (K2)
CO 3: describe the various types, control and protection of MTDC systems (K2)
CO 4: analyze the power flow in AC and DC system (K2)
CO 5: describe the new concepts in HVDC converters (K2)

UNIT I DC POWER TRASNSMISSION TECHNOLOGY 9

Introduction- comparison of HVAC and HVDC transmission – Application of HVDC transmission – Components of HVDC transmission Systems – Planning for HVDC transmission Systems- Modern trends in HVDC transmission systems – Schematic diagram of typical HVDC transmission system

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Pulse Number – choice of converter configurations - simplified analysis of Graetz circuits – converter bridge characteristics – characteristic of twelve pulse converter – detailed analysis of converters

UNIT III MULTI-TERMINAL DC SYSTEMS 9

Introduction – Potential applications of MTDC systems – Types of MTDC systems – Control and protection of MTDC systems – Study of MTDC systems.

UNIT IV POWER FLOW ANALYSIS AND STABILITY ANALYSIS IN AC/DC SYSTEMS 9

Per unit system for DC Quantities – Modeling of DC links – Solution of DC load flow – Solution of AC-DC power flow – Case studies - Basic Concepts: Power System Angular, Voltage and Frequency Stability.

UNIT V NEW CONCEPTS IN HVDC CONVERTERS AND SYSYEMS 9

Introduction – Advanced devices – new concepts for thyristors devices – compact converter stations – GTO based voltage source converters – DC cable developments- Direct connections of generators to HVDC converters – small HVDC tappers.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Padiyar K.R., "HVDC Power Transmission Systems", New Age International (P) Ltd., New Delhi, Reprinted 2017.
2. Arrillaga J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 2007.

REFERENCES

1. Kundur P., "Power System Stability and Control", Tata McGraw-Hill, Reprinted 2009.
2. Erich Uhlmann, "Power Transmission by Direct Current", BS Publications, 2004.
3. Sood V.K., "HVDC and FACTS controllers – Applications of Static Converters in Power System", Kluwer Academic Publishers, April 2004.

19EE34E DIGITAL CONTROL SYSTEMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the components of digital control system. (K2)
CO2: Illustrate the significance of pulse transfer functions and their analysis. (K2)
CO3: discuss the state variable analysis in discrete domain. (K2)
CO4: analyze the stability of the system in discrete domain. (K2)
CO5: design discrete controller using various techniques. (K2)

UNIT I INTRODUCTION TO DIGITAL CONTROL SYSTEM 9

Introduction to digital control – Sampling Process – Effect of quantization - Sample and Hold Circuit – Zero and First Order hold – Z-Transform – Inverse Z- Transform – Region of convergence – Initial and Final Value Theorem

UNIT II PULSE TRANSFER FUNCTION AND TIME RESPONSE 9

Block diagram reduction methods – Reduction Rules- Multi-loop – MIMO Systems – Signal Flow Graph- steady state error – error transfer functions- Error Constants-Time-Domain Analysis of Second Order Systems-Time Response

UNIT III STATE SPACE APPROACH FOR DISCRETE TIME SYSTEMS 9

State space models of discrete systems - State space analysis: Controllability, reachability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability and observability.

UNIT IV FREQUENCY RESPONSE AND STABILITY ANALYSIS 9

Introduction-Jury Stability Test- Schur-Cohn stability Test- Bilinear transformation- Stability by Pole Location –Bode Plot- Nyquist Plot - Lyapunov Stability Theorem – analysis

UNIT V DESIGN OF DISCRETE CONTROLLER 9

Design of Digital Control System - Design of Discrete PID Controller - Design of discrete state feedback controller - Design of set point tracker - Design of Discrete Observer for LTI System.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS:

1. B.C.Kuo, “Digital Control System”, 2^{nd} Edition, Oxford University Press, 2012.
2. M.Sami Fadali, Antonio Visioli, “Digital Control Engineering Analysis and Design”, Academic Press, 2013.

REFERENCES:

1. M.Gopal, “Digital Control and State Variable Methods”, Tata McGraw Hill, 3rd Edition, 2009.
2. V.I.George and C.P.Kurien, “Digital Control System”, Cengage Learning, 2012.
3. Kannan M.Moddgalya, “Digital Control”, Wiley India, 2007.
4. C.L.Philips and J.M.Pan, “Feedback Control System”, Pearson, 2013.

19EE35E	CONTROL SYSTEMS DESIGN	L T P C
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Distinguish the effect of continuous system and discrete system. (K2)
CO2: Design controller for continuous and discrete system by root-locus. (K3)
CO3: Design compensator using frequency response analysis. K3)
CO4: Illustrate state variable and its use in controller design (K2)
CO5: Demonstrate the LQR problem and formulate for various application. (K2)

UNIT I CONTINUOUS AND DISCRETE SYSTEMS 9

Introduction - types of system - Need for discretization – comparison between discrete and analog system. Sample and Hold devices – sampling effect: transfer function and state models– Analysis of discrete model.

UNIT II TIME RESPONSE DESIGN 9

Design specifications- Continuous domain - Limitations- Controller structure- Multiple degrees of freedom- PID controllers - Root locus design-Discretization & Direct discrete design.

UNIT III FREQUENCY RESPONSE DESIGN 9

Digital controller design - Lag-lead compensators – Design using Bode plots- use of Nichol’s chart -Jury’s stability test.

UNIT IV STATE VARIABLE DESIGN 9

Pole Assignment Design- state and output feedback-observers - Estimated state feedback-Design examples (continuous & Discrete) - Full state observer – Reduced order state observer.

UNIT V LQR AND LQG DESIGN 9

Formulation of LQR problem- Pontryagin's minimum principle and Hamiltonian solutions-Ricatti's equation – Optimal estimation- Kalman filter–solution to continuous and discrete systems –QNET Rotary inverted pendulum controller - case study.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. M.Gopal, "Digital Control and State variable methods" Mcgraw hill 4th edition, 2017.
2. Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado "Control system Design",PHI, 2009.

REFERENCES

1. G. F. Franklin, J. D. Powell and M Workman, "Digital Control of Dynamic Systems", PHI, 2002.
2. Richard C. Dorf and Robert H Bishop, "Modern control systems", 12th Edition, Addison Wesley, 2014.
3. Benjamin C. Kuo "Digital control systems", Oxford University Press, 2004
4. M. Gopal, "Modern control system Theory" New Age International, 2005.
5. J.J. D'Azzo, C.H. Houpis and S.N Sheldon, "Linear Control system analysis and design", 5th Edition, CRC Press, 2003

19EE37E LOGIC AND DISTRIBUTED CONTROL SYSTEM

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the hardware components and Programming with PLC. (K2)
CO2: develop the PLC programming routines with the instructions in PLC. (K2)
CO3: recognize the standards and safety precautions in PLC installation. (K2)
CO4: demonstrate the functionality of SCADA for real applications (K2)
CO5: explain the basic concepts of DCS and its Interfacings. (K2)

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9

Advantages of PLC over relay logic – Parts of PLC –Architecture –Principles of operation – scan time and scan cycle –PLC versus Computer –PLC Size and Application – PLC Hardware components –Programming timers and counters - Case study with multiple I/O parameters and logics.

UNIT II INSTRUCTION IN PLC 9

Ladder programming Instructions in PLC – Program control instructions – Data manipulation instructions – math instructions – sequencer and shift register instructions – Programming concept using Instructions. Process of automated drill control - traffic light control system.

UNIT III PRACTICE IN PLC INSTALLATION 9

PLC Installation Practices – Editing and Troubleshooting –Data acquisitions system – System integrity and safety – fail safe wiring and programming – system interlocks – time synchronization – time stamping events - Application of PLC in industry.

UNIT IV SUPERVISORY CONTROL AND DATA ACQUISITION 9

SCADA Functional requirements and Components – General features – Configurations - RTU (Remote Terminal Units) as PLC – Master-slave concept - watchdog controller for error detection – H/W and S/W fault detection–SCADA Communication: Field bus – Profibus – Application in power sector, oil & gas industry.

UNIT V DISTRIBUTED CONTROL SYSTEM AND ITS INTERFACING 9

DCS –Evolution of Architectures –Comparison – selecting DCS - Local control unit – Process interfacing issues –Communication facilities –Low level and high level Operator interfaces – Low level and high level Engineering interfaces - Low and high level control topology - GPS clock synchronizer in DCS

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Petruzella, “Programmable Logic Controller”, Tata McGraw Hill Private Limited, 5th Edition, 2017.
2. David Bailey, Edwin Wright “Practical SCADA for Industry”, Elsevier 2003.
3. Michael P. Lukas, “Distributed Control System”, Van Nostrand Reinhold Co., Canada, 1986.

REFERENCES

1. Lawal.A.B. “PLC programming using RSlogix 500 & real world applications” AB prominents, 2020
2. Krishna Kant, “Computer based Industrial Control”, Prentice Hall Private Limited, New Delhi, 2014.
3. M. Chidambaram, “Computer Control of Processes”, Narosa Book Distributors Private Limited, 2002.
4. John R. Hackworth, Frederick D. Hackworth “Programmable logic controllers: Programming methods and applications”
5. Gordon Clarke, Deon Reynders, Edwin Wright, “Practical Modern SCADA Protocols” Elsevier 2004.
6. Manoj K S, “Industrial automation with SCADA concepts, communications and security”, notion press 2019.
7. https://developpaper.com/application-of-gps-clock-synchronizer-in-dcs-control-system/
8. http://nptel.ac.in/courses/108106022

19EE38E BIOMEDICAL INSTRUMENTATION

L	T	P	C
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COURSE OUTCOMES

Upon completion of this course, students will have the ability to

CO1: Outline the relation of biological system with electrical behavior and sensing. (K2)

CO2: Explain the ways of probing signals from biological system within safety measures. (K2)

CO3: Describe the non-electrical parameter measurements and diagnosis equipment. (K2)

CO4: Recognize the modern biomedical methods of imaging techniques and their analysis. (K2)
CO5: Understand the life assisting techniques, medical robotics, and prosthetics. (K2)

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure – Resting potential - Action Potential and its propagation – Nervous system - cardiovascular systems- Respiratory systems -Kidney – Biomechanics of bone – Biomechanics of soft tissues -Physiological signals and transducers– selection criteria – Piezo electric, ultrasonic transducers –Fiber optic temperature sensors - Basic components of biomedical system.

UNIT II ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes–floating electrodes – pre gelled disposable electrodes – Micro, needle and surface electrodes – Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier – ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms – Electrical safety instruments in medical environment, shock hazards – leakage current.

UNIT III NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSIS 9

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analyzers - pCO2, pO2, finger-tip oximeter – ESR, GSR measurements.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems – Retinal Imaging – Imaging application in Biometric systems.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Dialyzers – Lithotripsy – ICCU patient monitoring system – Nano Robots – Robotic surgery –Orthopedic prostheses fixation.

L: 45; TOTAL: 45PERIODS

TEXT BOOKS

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2nd Edition, 2012.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 3rd Edition, 2014.
3. Joseph J Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and sons, New York, 4th Edition, 2012

REFERENCES

1. John G. Webster, “Medical Instrumentation Application and Design”, Wiley, New York, 4th Edition, 2015.
2. Duane Knudson, “Fundamentals of Biomechanics”, Springer, 2nd Edition, 2012.

3. Valérie Bélanger, Nadia Lahrichi , Ettore Lanzarone, Semih Yalçındağ ., “Health Care Systems Engineering ”, Springer, 2020.
4. Ed. Joseph D. Bronzino, “The Biomedical Engineering Hand Book”, CRC Press Taylor & Francis Group, 4th Edition, 2015.
5. M. Arumugam, ‘Bio-Medical Instrumentation’, Anuradha Agencies, 2003.

19EE39E ADVANCED CONTROL THEORY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the characteristics of nonlinear systems. (K2)
CO2: Describe the stability of the system using Lyapunov theorem. (K2)
CO3: illustrate the parameters to design optimal control problems. K2)
CO4: Demonstrate the significance of robustness of controller design. (K2)
CO5: Develop adaptive control scheme with model reference. (K3)

UNIT I NON-LINEAR SYSTEM 9

Methods of linearization– Phase plane analysis of non-linear system– Derivation of describing functions for common nonlinearities – Describing function analysis of non-linear systems – limit cycles - Singular points – Stability of oscillations.

UNIT II LYAPUNOV STABILITY ANALYSIS 9

Lyapunov stability definition – Lyapunov stability theorem – Lyapunov functions for non-linear system – Krasovskii method – Variable gradient method – Direct method of Lyapunov and linear systems.

UNIT III OPTIMAL CONTROL 9

Parameter optimization: Servo mechanism – Optimal control problems: Transfer function and State variable approaches – State regulator problem – Infinite time regulator problem– Output regulator and Tracking problem – Parameter optimization: regulators.

UNIT IV ROBUST CONTROL 9

Sensitive parameters of system – Analysis of robustness – Systems with uncertain parameters – Design of robust control systems – PID controller – H ∞ Control - Design of robust PID controller – Design of robust internal model control system – Pseudo quantitative feedback system.

UNIT V ADAPTIVE CONTROL 9

Model reference adaptive control – MIT rule – MRAC using Lyapunov theory – First order systems –higher order systems – MRAC for a single link manipulator – Self tuning control.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Gopal M, “Modern Control System Theory”, New Age International, 2021.
2. Richard C. Dorf and Robert H Bishop, “Modern control systems”, 12th Edition, Addison Wesley, 2014

REFERENCES

1. Cheng D, Sun Y, Shen T and Ohmori H, “Advanced Robust and Adaptive Control Theory and Applications”, New Age International, 2010.

2. Astrom KJ & Wittenmark B, “Adaptive Control”, Dover Publications, 2013.
3. Kirk D.E, “Optimal Control Theory: An Introduction”, Dover Publications, 2012.
4. K.Ogatta, “Discrete time control system”, PHI, 2010.
5. B.C.Kuo,” Digital Control Systems”, SRL Publication, 2003.

19EE40E SOFT COMPUTING FOR ELECTRICAL ENGINEERING

L	T	P	C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Interpret the components of fuzzy logic system. (K2)
CO2: Distinguish various structures of ANN. (K2)
CO3: Describe the basic concepts of genetic algorithms. (K2)
CO4: Apply ANN and FLC to various electrical applications. (K3)
CO5: Employ GA to power system optimization and control applications. (K3)

UNIT I FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning – Fuzzification, inferencing and defuzzification methods – Fuzzy knowledge and rule bases – Fuzzy logic modelling

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Basic concepts – Types of activation functions – McCulloch–Pitts neuron model – Adaline and Madaline– Back Propagation Neural Networks – Kohenen Neural Network-Architecture – Feed forward and Feedback – Multilayer Perceptron– Hopfield network – Self organizing network.

UNIT III GENETIC ALGORITHM 9

Basic concepts – Functional evaluation and constraint handling – Representation – Crossover – Mutation – Selection schemes – Stopping criteria.

UNIT IV APPLICATIONS OF FLC AND ANN 9

Implementation of fuzzy logic controller for motor drives – Identification and control of linear and nonlinear dynamic systems using Neural Network – ANN application to short term load forecasting .

UNIT V APPLICATIONS OF GA 9

GA application to power system optimization problem – Economic dispatch, load scheduling and unit commitment problems – System Identification and PID controller tuning.- Multilevel inverter..

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 2006.
2. Kosko, B. "Neural Networks And Fuzzy Systems", Prentice Hall Private Limited, 2004.

REFERENCES

1. S.N. Sivanandam & S.N.Deepa, “Principles of Soft Computing”, Wiley India Private Limited, 2013.
2. S. N. Sivanandam,S. Sumati&S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, Springer, 2007.
3. Klir G.J. and Folger T.A. "Fuzzy sets, uncertainty and Information", Prentice Hall Private Limited, 2010.
4. Zimmerman H.J. "Fuzzy set theory–and its Applications" Kluwer Academic Publishers, 2014.
5. Driankov, and Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers, 2nd Edition, 2011.
6. Samir Roy, “Introduction to Soft Computing: Neuro – Fuzzy and Genetic Algorithms” Pearson Education, 1st Edition, 2013.
7. Fakhreddine O. Karray, “Introduction to Soft Computing: Neuro – Fuzzy and Genetic Algorithms”, Pearson Education, 1st Edition, 2009.
8. Devendra K. Chaturvedi, “Soft Computing: Techniques and its Applications in Electrical Engineering”, Springer, 2008.

19EE41E DIGITAL SIGNAL PROCESSING L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: compute the frequency response using DFT and the FFT algorithms. (K2)
CO2: design and realize IIR digital filters. (K3)
CO3: design and realize FIR digital filters. (K3)
CO4: recognize the effects of finite word length in DSP. (K2)
CO5: explain the architecture and applications of digital signal processors. (K2)

UNIT I DISCRETE FOURIER TRANSFORM 9

Need and benefits of Digital Signal Processing – Signal classification - Fourier Series and Fourier Transform -Discrete Fourier Transform (DFT) - Properties – DIT-FFT and DIF-FFT radix2 algorithms - linear filtering via circular convolution - Inverse FFT

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Characteristics and applications of IIR filters - Design techniques for analog Butterworth and Chebyshev Filters -Frequency transformation - Digital IIR filter design: impulse invariant and bilinear transform methods – Canonical forms of Realization: direct, cascade, and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Symmetric and Antisymmetric FIR filters - Linear phase FIR filters – Characteristics and applications of FIR filters - Windowing Techniques - Design using Rectangular, Hamming, Hanning, Blackmann and Kaiser Windows - Realization of FIR filters

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors A/D quantization noise – Product round off errors - Overflow error – Round off noise power - limit cycle oscillations due to product round off and overflow errors - Finite word length effects in IIR filters and FFT algorithms.

UNIT V APPLICATIONS OF DIGITAL SIGNAL PROCESSING 9

Architecture of TMS320LF2407 – On-chip peripherals – Addressing modes – Instruction set of TMS320LF2407 - PWM generation – DSP based stepper motor control(Qualitative treatment only) - optimal filter- ARMA – LMS -Forward and Backward Linear prediction and FIR Wiener Filter.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing: Principles, algorithms and applications”, Pearson Prentice Hall, 2014.

REFERENCES

1. Li Tan, Jean Jiang, “Digital Signal Processing: Fundamentals and applications” Academic press, 2013.
2. Salivahanan.S, Gnanpriya.C., “Digital Signal processing”, McGraw Hill, 2011.
3. Ifaeachor E.C, Jervis B. W., “Digital Signal processing: Practical approach”, Pearson publication, 2002.
4. Shaila Apte, “Digital Signal Processing”, Wiley India Publication, 2013.
5. Navas.K.A., Jayadevan.R., “Lab Primer through MATLAB”, PHI, 2014.

19EE42E ROBOTICS AND AUTOMATION

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the individual components of Robotics. (K2)
CO2: summarize the kinematics transformation techniques used in Robotics. (K2)
CO3: illuminate the Jacobian matrix used for robotic differential motion and velocities. (K2)
CO4: describe the role of image processing and vision system for an automation of robot. (K2)
CO5: demonstrate the real time robotic system for an application (K2)

UNIT I INTRODUCTION TO ROBOTICS 9

Robot: components – Classification- DOF-Robot joints coordinates- Reference frames-workspace– Actuators: Electric, Hydraulic, Pneumatic - Sensors: Position - velocity - acceleration - Torque sensors-tactile and touch sensors.

UNIT II KINEMATICS 9

manipulator kinematics - link description, link connection, affixing frames to links, Forward kinematics - Matrix representation-homogenous transformation - DH representation – Inverse Kinematics - solution and programming

UNIT III DIFFERENTIAL MOTION AND VELOCITIES 9

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian- Inverse Jacobian- Design-Lagrangian mechanics-dynamic equations-static force analysis–degeneracy and dexterity.

UNIT IV IMAGE PROCESSING AND VISION SYSTEMS 9

2D and 3D images – representation-noise and edges convolution masks-Processing techniques-noise reduction - edge detection - segmentation- Image analysis and object recognition.

UNIT V CASE STUDIES 9

Robots in industry: Robotic Arm – material handling - pick and place - spot welding – spray coating – automation in assembly line and inspection. Robots in medicine: Prosthetics – service robots – clinical robots - Electronic travel aids (ETA) - Navigational Assistance to Visually Impaired (NAVI).

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Saeed B. Niku, “Introduction to Robotics: analysis, Control, applications”, 3rd Edition, Pearson Education, 2020
2. Mikell P.Groover, “Industrial Robotics: Technology Programming and Applications” 2nd Edition, Tata Mcgraw Hill, 2012.

REFERENCES

1. R.K. Mittal and I J Nagrath, “Robotics and Control”, Tata McGraw Hill, 4th Reprint, 2005.
2. Fu, Gonzalez and Lee McGraw hill, “Robotics”, International TATA McGraw Hill, 2008.
3. R.D. Klafter, TA Chmielewski and Michael Negin, “Robotic Engineering, an Integrated Approach”, Prentice Hall of India, 2003.
4. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1999.
5. Ramachandran Nagarajan, “Introduction to industrial robotics” Pearson publication 2016.
6. Mark W. Spong, Seth Hutchinson, M.Vidyasagar “Robot Dynamics and Control “, Wiley publication 2004.

19EE44E EMBEDDED SYSTEMS

L	T	P	C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: expose the fundamentals of Embedded Systems. (K2)
CO 2: describe about Hardware / Software in a embedded system design. (K2)
CO 3: understand the memory interfacing with microprocessor/ controllers. (K2)
CO 4: discuss the programming concepts of embedded systems. (K2)
CO 5: explain the design aspects in interfacing hardware with system. (K2)

UNIT I INTRODUCTION TO EMBEDDED HARDWARE AND SOFTWARE 9

Terminology – Gates – Timing diagram – Memory – Microprocessor buses – Direct memory access – Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency - Embedded system evolution trends – Interrupt routines in an RTOS environment .

UNIT II SYSTEM MODELLING WITH HARDWARE/SOFTWARE PARTITIONING 9

Embedded systems, Hardware/Software Co-Design, Co-Design for System Specification and modeling - Single-processor Architectures & Multi-Processor Architectures, comparison of Co-Design Approaches, Models of Computation, Requirements for Embedded System Specification, Hardware/Software Partitioning Problem, Hardware/Software Cost Estimation, Generation of Partitioning by Graphical modelling, Formulation of the HW/SW scheduling, Optimization.

UNIT III MEMORY AND INTERFACING 9

Memory: Memory write ability and storage performance – Memory types – composing memory – Advance RAM interfacing communication basic – Microprocessor interfacing I/O addressing – Interrupts – Direct memory access – Smart Storage Memory - Arbitration multilevel bus architecture – Serial protocol – Parallel protocols – Wireless protocols – Digital camera example.

UNIT IV PROGRAMMING LANGUAGES AND TOOLS 9

Programming Languages and Tools – Desired language characteristics – Data typing – Control structures – Facilitating Hierarchical Decomposition, Packages, Run time (Exception) Error handling – Overloading and Generics – Multitasking – Low level programming – Task Scheduling – Timing Specifications – Programming Environments – Run – time support.

UNIT V SYSTEM DESIGN – CASE STUDY 9

Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System – Applications in Automobile Industries.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, Reprinted 2013.
2. Rajib Mall, ”Real-time systems: theory and practice”, Pearson Education, 2007
3. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, April 2004
4. Raj Kamal, “Embedded Systems- Architecture, Programming and Design” Tata McGraw Hill, Reprinted 2018.

REFERENCES

1. Steve Heath, “Embedded System Design”, Elsevier, Second Edition, Reprinted 2017.

2. Ralf Niemann, “Hardware/Software Co-Design for Data Flow Dominated Embedded Systems”, Kluwer Academic Pub, 1998.
3. Stuart Bennett, “Real Time Computer Control – An Introduction”, Prentice Hall of India, 1998.
4. S.T. Allworth and R.N.Zobel, “Introduction to real time software design”, Macmillan, 1987.
5. R.J.A Buhur, D.L Bailey, “An Introduction to Real – Time Systems”, Prentice – Hall International, 1999.

19EE45E **MEMS AND NEMS** **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: outline the importance of scaling in MEMS. (K2)
CO2: identify the properties of MEMS fabrication materials (K2)
CO3: describe the fabrication process of MEMS (K2)
CO4: utilize MEMS technology for various applications. (K2)
CO5: investigate the properties and applications of nano systems. (K2)

UNIT I INTRODUCTION TO MEMS AND SCALING 9

MEMS and Microsystems -development of MEMS technology - MEMS future and applications - scaling in geometry, rigid body dynamics, electrostatic, electromagnetic forces, electricity, heat transfer.

UNIT II MATERIAL PROPERTIES OF MEMS 9

Substrates - crystal structure- miller indices- properties silicon compounds -silicon dioxide, silicon carbide, silicon nitride, polycrystalline silicon-gallium arsenide-quartz-piezoelectric crystals –polymers.

UNIT III MICROMACHINING PROCESS 9

Bulk micromachining -Isotropic and anisotropic etching, wet etchants, etch stop, dry etching, surface micromachining -Introduction, process, associated problems-LIGA Process and electroplating -Integration of electronics and MEMS technology-packaging - die attach, Wire bond and Sealing

UNIT IV MEMS SENSORS AND ACTUATORS 9

Micro sensors – Micro actuators - Mechanical: Beam and Cantilever – Capacitive effect – MEMS Gyroscopes – Micromachined thermocouple probe – Heat pumps – MEMS relay – Shape Memory Alloys. RF based communication system – MEMS inductors – Filter – Resonator – Switches – Phase shifter.

UNIT V NEMS 9

Properties of nano materials: structural, thermal, mechanical, magnetic, optical properties– fabrication and process techniques – integration of nano systems and devices – applications – Single Electron Transistor – Carbon Nano tube Devices: Modeling, analysis and simulation-simulation of Actuators - Pressure transducer.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mc-Graw Hill Private Limited, 2007.
2. Nitaigour Premchand Mahalik, "MEMS", Tata McGraw Hill Private Limited, 2012.
3. James JAllen, ―Micro Electro Mechanical System Design CRC Press-Taylor & Francis‖, New York, 2005.

REFERENCES

1. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
2. Mohamed Gad–el–Hak," The MEMS Handbook", CRC press Baco Raton, 2006.
3. Chang Liu, "Foundations of MEMS", Pearson Education India Limited, 2012,
4. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2007
5. W.R.Fahrner, "Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques", Springer, 2007.

19EE46E	**VLSI DESIGN**	**L T P C**
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe the concepts of digital building blocks using MOS transistor. (K2)
CO2: Design combinational MOS circuits and power strategies. (K2)
CO3: Design and construct Sequential Circuits and Timing systems. (K2)
CO 4: Explain the performance of various arithmetic building blocks.(K2)
CO 5: Write verilog HDL code for the digital system components. (K2)

UNIT I INTRODUCTION TO MOS TRANSISTOR 9

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9

Circuit Families: Static CMOS, Ratioed Circuits, Cascade Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits. Timing Issues: Timing Classification of Digital System - Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS 9

Data path circuits: Architecture for ripple carry adder, carry look ahead adder, high speed adder, accumulator, Multiplier, divider, Barrel shifter, speed and area tradeoff.

UNIT V SPECIFICATION USING VERILOG HDL 9

Design Methodologies – Modules – Instances – Test bench – Operators – Number Specification – Identifiers and Keywords – Data Types – Modules and Ports – Gate-Level Modeling - Dataflow Modeling – Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks. Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, Behavioral modeling of “n” bit comparator, D flip-flop, T flip-flop, Structural modeling of Asynchronous counter, shift register, PRBS – Applications of FPGA.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Neil H.E. Weste, David Money Harris, “CMOS VLSI Design: A Circuits and SystemsPerspective”, 4th Edition, Pearson, 2017.
2. Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", 2nd Edition, Pearson Education, 2005.

REFERENCES

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje. Nikolic, “Digital Integrated Circuits: A Design perspective”, 2nd Edition, Pearson, 2016.
2. M.J.S Smith, "Application Specific integrated circuits", Pearson Education, 2008. (5th reprint)
3. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, “Digital Integrated Circuits: A Design Perspective”, PHI, 2nd Edition, 2003.
4. D.A. Pucknell & K.Eshraghian, “Basic VLSI Design”, PHI, 3rd Edition, 2003.
5. Wayne Wolf, “Modern VLSI design”, Pearson Education, 3rd Edition, 2007.
6. Uyemura J.P, “Introduction to VLSI circuits and systems”, Wiley, 2002.

19EE47E DSP BASED SYSTEM DESIGN L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: classify the instruction sets of C2xx DSP Controller. (K2)
CO 2: discuss the various peripheral functions of DSP Controller. (K2)
CO 3: explain the Event Managers used in DSP Controller. (K2)
CO 4: demonstrate DSP Controllers based power electronics applications. (K2)
CO 5: determine the current trends in DSP system design. (K2)

UNIT I INTRODUCTION 9

TMS LC2407 DSP controller– Peripherals – Software tools – C2xx DSP Core and Code Generation – CPU and Instruction Set – Components of C2xx DSP Core – Mapping – Interface System Configuration–Memory – Programming using C2xx DSP Instruction Set.

UNIT II PERIPHERALS 9

General purpose Input/output (GPIO) Functionality – Multiplexing and Control Registers – Interrupt Hierarchy – Initializing and Servicing Interrupts in Software – A/D converter– PWM signal generation.

UNIT III EVENT MANAGERS 9

Event Manager (EV) – Interrupts – General Purpose (GP) Timers – Compare Units – Capture Units and Quadrature Encoded Pulse (QEP) Circuitry – General Event Manager Information

UNIT IV DSP BASED POWER ELECTRONICS APPLICATIONS 9

DC– DC Buck – Boost converters – Continuous and Discontinuous Conduction Mode – Interfacing DSP to Buck – Boost Converter – Interrupt Service Routine – Regulation Code Sequences – Space Vector PWM Technique – Principle of constant V/f control of induction motor – DSP implementation.

UNIT V RECENT TRENDS IN DSP SYSTEM DESIGN 9

FPGA – Features and families – Complementary Programmable Logic Device – DSP versus FPGA – VHDL programming – VHDL based controller design – Applications of FPGA – Signal and Image Processing.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Mitra, Sanjit Kumar, “Digital Signal Processing: a Computer Based Approach”, Tata McGraw Hill Private Limited, 2012.
2. Sen M Kuo, Woon .Seng. Gan, “Digital signal Processors–Architecture, implementation and applications”, Pearson Education, 2005.

REFERENCES

1. Avtar Singh and S. Srinivasan, “Digital Signal Processing”, Thomson Brooks, 2004.
2. Phil Lapsley, Bler, Sholam, E.A.Lee, “DSP Processor fundamentals”, IEEE Press, 1999.
3. Charles.D. Roth, “Digital System Design using VHDL”, 2008.
4. N. Mohan, T.M. Undeland, and W.P. Robbins, “Power Electronics: Circuits, Devices and Applications “, John Wiley & Sons, 2nd Edition, 1995.
5. Wolf Wayne, "FPGA Based System Design", Pearson Education, 2009.

19EE48E MICROCONTROLLER BASED SYSTEM DESIGN

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: To understand the basics and requirement of processor functional blocks. (K2)
CO2: Observe the specialty of RISC processor Architecture. (K2)
CO3: Incorporate I/O hardware interface of a processor-based automation for consumer application with peripherals. (K2)
CO4: Incorporate I/O software interface of a processor with peripherals. (K2)

CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors (K2)

UNIT I PIC MICROCONTROLLER 9

Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.

UNIT II ARM ARCHITECTURE 9

Architecture – memory organization – addressing modes – The ARM Programmer's model -Registers – Pipeline - Interrupts – Coprocessors – Interrupt Structure

UNIT III PERIPHERALS OF PIC AND ARM MICROCONTROLLER 9

PIC: ADC, DAC and Sensor Interfacing –Flash and EEPROM memories. ARM: I/O Memory – EEPROM – I/O Ports – SRAM –Timer –UART - Serial Communication with PC – ADC/DAC Interfacing.

UNIT IV ARM MICROCONTROLLER PROGRAMMING 9

ARM general Instruction set – Thumb instruction set – Introduction to DSP on ARM – Implementation example of Filters

UNIT V DESIGN WITH PIC AND ARM MICROCONTROLLERS 9

PIC implementation - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Home Automation - Stand alone Data Acquisition System – ARM Implementation - Simple ASM/C programs - Loops – Look up table- Block copy- subroutines - Smart Agriculture using IoT.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Steve Furber, "ARM system on chip architecture", Addision Wesley, 2010.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield "ARM System Developer's Guide Designing and Optimizing System Software", Elsevier 2007.

REFERENCES

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey "PIC Microcontroller and Embedded Systems using Assembly and C for PIC18", Pearson Education 2008.
2. John Iovine, "PIC Microcontroller Project Book", McGraw Hill 2000
3. William Hohl, '"ARM Assembly Language", Fundamentals and Techniques, 2009.
4. Rajkamal, "Microcontrollers Architecture, Programming, Interfacing & System Design, Pearson, 2012
5. ARM Architecture Reference Manual, LPC213x User Manual
6. www.Nuvoton.com/websites on Advanced ARM Cortex Processors.

19EE50E ADVANCED MICROPROCESSOR AND MICROCONTROLLER L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the fundamental concepts of microprocessor architecture. (K2)
CO2: develop knowledge about high performance Pentium CISC architectures. (K2)
CO3: discuss about the ARM processors. (K2)
CO4: describe the concept of PIC microcontroller. (K2)
CO5: design and write simple programming using arduino. (K3)

UNIT I INTRODUCTION 9

Generic Architecture – Instruction Set – Addressing modes – Memory hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – Instruction level parallelism – Reduced instruction set – RISC versus CISC.

UNIT II PENTIUM CISC ARCHITECTURE 9

CPU Architecture – Bus Operations – Pipelining – Branch prediction – Floating point unit – Operating Modes – Paging – Multitasking – Exception and Interrupts – Instruction set – Addressing modes.

UNIT III ARM RISC ARCHITECTURE 9

Organization of CPU – Bus architecture – Memory management unit – Instruction set – Thumb Instruction set – Addressing modes – Programming.

UNIT IV PIC MICROCONTROLLER 9

CPU Architecture – Instruction set – interrupts – Timers – I2C Interfacing – UART – A/D Converter – PWM and introduction to C–Compilers

UNIT V INTRODUCTION TO ARDUINO 9

Architecture – Instruction set – Registers and memory access – Digital I/O – timers, Debugging – Pulse width modulation (PWM) – Serial communication – Interrupts – Design of Arduino based temperature monitor and control.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Barry.B.Breg, “The Intel Microprocessors Architecture, Programming and Interfacing”, Merrill, 2014.
2. B. P. Singh, Renu Singh, “Advanced Microprocessor and Microcontroller”, New Age International, 2008
3. John .B.Peatman, “Design with PIC Microcontroller”, Prentice Hall Private Limited, 2007.
4. Steve Furber, "ARM System–On–Chip Architecture”, Addison Wesley, 2001.

REFERENCES

1. Mike McRoberts, “Beginning arduino”, Apress; 2013.
2. Valvano, "Embedded Microcomputer Systems", Thomson Asia Private Limited, First Reprint, 2012

3. Gene .H.Miller, “Micro Computer Engineering”, Pearson Education, 2003.
4. James L.Antonakos, “An Introduction to the Intel family of Microprocessors‟, Pearson Education 1999.
5. James L. Antonakos, “The Pentium Microprocessor‟, Pearson Education, 1997.
6. Daniel Tabak, ‟Advanced Microprocessors”, Tata McGraw Hill Private Limited, 1995.

15EE52E REAL TIME OPERATING SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: recall the processes of general Operating systems. (K1)
CO 2: describe the basics concepts of RTOS. (K2)
CO 3: explain the Real time models and scheduling. (K2)
CO 4: distinguish the various interprocess functions in RTOS. (K2)
CO 5: demonstrate the applications of RTOS in various domains. (K3)

UNIT I REVIEW OF OPERATING SYSTEMS 9

Basic Principles – Structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes –Distributed Operating system – Distributed scheduling.

UNIT II RTOS CONCEPTS 9

Need for RTOS – Advantage and Disadvantage – Multitasking–Non preemptive Kernels – Preemptive Kernels – Round Robin Scheduling–Task Priorities – Mutual Exclusion – deadlock – inter task Communication – Message Mailboxes–Message Queues–Interrupts.

UNIT III µC/OS II BASICS 9

Features–Goal – Kernel Structures: Task– Task States–Task Scheduling– Idle Task – Statistics Task– Interrupts – Clock Tick– Initialization. Task Management: Creating Tasks– Task Stacks–Stack Checking– Suspending Task– System Time.

UNIT IV RTOS INTERPROCESS FUNCTIONS 9

Message Mailbox Management: Creating a Mailbox–Waiting for a Message box–Sending Message to a Mailbox. Message Queue Management: Creating Message Queue–Deleting a Message Queue–Waiting for a Message at a Queue–Sending Message to a Queue–Flushing a Queue– Semaphores in µC/OS II.

UNIT V MEMORY MANAGEMENT AND RTOS APPLICATIONS 9

Memory Management: Memory Control Blocks– Creating Partition– Obtaining a Memory Block function –Returning a Memory Block function – Applications: Image Processing – Voice over IP – Control Systems.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Raj Kamal, "Embedded Systems– Architecture, Programming and Design" Tata McGraw Hill Private Limited, 2015.
2. Herma K., "Real Time Systems – Design for distributed Embedded Applications", Kluwer Academic, 2011.

REFERENCES

1. Charles Crowley, "Operating Systems–A Design Oriented approach" Tata McGraw Hill Private Limited, 1998.
2. C.M. Krishna, Kang, G.Shin, "Real Time Systems", Tata McGraw Hill Private Limited, 1997.
3. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", Prentice Hall Private Limited, 1999.
4. Mukesh Sighal and N G Shi "Advanced Concepts in Operating System", Tata McGraw Hill Private Limited, 2011.
5. Jean J. Labrosse, "Micro C/OS–II: The Real Time Kernal", CMP Books, 2nd Edition, 1998.

19EE53E AUTOMOTIVE ELECTRICAL AND ELECTRONICS

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: distinguish the types of lighting system, batteries and accessories. (K2)
CO 2: describe the basics concepts of starting systems. (K2)
CO 3: explain the aspects of charging systems. (K2)
CO 4: explain the various processes in automotive electronics. (K2)
CO 5: develop the sensors and activators using Arduino. (K3)

UNIT I ELECTRICAL SYSTEMS 9

Principle and Construction of Lead Acid and Lithium-Ion Battery - Characteristics of Battery Rating Capacity and Efficiency of Batteries - Various Tests on Batteries - Maintenance and Charging - Lighting System and Photometry: insulated and Earth Return System- Details of Head Light and Side Light- LED Lighting System- Head Light Dazzling and Preventive Methods Horns- Wiper System.

UNIT II STARTING AND IGNITION SYSTEM 9

Condition at Starting- Behavior of Starter During Starting - Series Motor and Its Characteristics - Principle and Construction of Starter Motor - Over Running Clutch Working of Different Starter Drive Units - Care and Maintenances of Starter Motor - Starter Switches - Spark Plugs - Advance Mechanisms - Different Types of Ignition Systems.

UNIT III CHARGING SYSTEM 9

Generation of Direct Current - Shunt Generator Characteristics - Armature Reaction - Third Brush Regulation – Cutout - Voltage and Current Regulators - Compensated Voltage

Regulator Alternators Principle and Constructional Aspects and Bridge Rectifiers - New Developments.

UNIT IV ELECTRONICS SYSTEMS 9

Current Trends in Automotive Electronic Engine Management System - Types of EMS Electromagnetic interference Suppression - Electromagnetic Compatibility - Electronic Dashboard Instruments - Onboard Diagnostic System - Security - Warning System infotainment and Telematics.

UNIT V SENSORS AND ACTUATORS 9

Types of Sensors: Sensor for Speed - Throttle Position - Exhaust Oxygen Level - Manifold Pressure - Crankshaft Position - Coolant Temperature - Exhaust Temperature - Air Mass Flow for Engine Application – Solenoids - Stepper Motors – Relay - Introduction to Arduino about actuators and sensors.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Tom denton, “Automotive Electrical And Electronics Systems”, Allied Publishers, 2016.
2. A. L. Statini, “Automotive Electrical and Electronics”, Delmar Publications, 2013.

REFERENCES

1. William B.Ribbens “Understanding Automotive Electronics”, Butter worth Heinemann Woburn, 2017.
2. Robert Bosch “Automotive Hand Book”, SAE, 2018.
3. Ganesan.V. “Internal Combustion Engines”, Tata McGraw Hill Private Limited, New Delhi, 2017.
4. Young A.P. & Griffiths. L. “Automotive Electrical Equipment”, ELBS & New Press, 1999.
5. Bechhold “Understanding Automotive Electronics”, SAE, 1998.
6. Crouse, W.H “Automobile Electrical Equipment”, Tata McGraw Hill Private Limited, New York, 1996.
7. Judge A.W “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 2012.
8. Robert N Brady, “Automotive Computers and digital Instrumentation”, Prentice Hall, Eagle Wood Cliffs, New Jersy,1988.
9. Vinal.G.W., “Storage Batteries”, John Wiley & Sons Inc., New York, 1985.
10. Tom Weather Jr and Cland C. Hunter, “Automotive Computers and Control System”, Prentice Hall Private Limited, New Jersey, 1996.
11. Kohli.P, “Automotive Electrical Equipment”, Tata McGraw Hill Private Limited, New Delhi, 2017.

19EE54E MOBILE ROBOTS AND CONTROL

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: study the different types of mobile robots and sensors onboard (K2)
CO2: develop the kinematic and dynamic models of mobile robotics.(K2)
CO3: examine the locomotion and navigation of robot with obstacle avoidance. (K2)
CO4: investigate the environment around robots using camera module. (K2)
CO5: apply kinematic and dynamic control for mobile robot application. (K2)

UNIT I MOBILE ROBOTS AND MANIPULATORS 9

Introduction: mobile robots & mobile manipulators – Locomotion - Types: Autonomous Ground Vehicle (AGV), aerial robots - Sensors: magnetic & optical position sensor, gyroscope, accelerometer, tactile & proximity sensors, rangefinder, laser scanner.

UNIT II MODELLING OF MOBILE ROBOTS 9

Wheeled mobile robot: Kinematics model – Degree of Freedom (DOF) – maneuverability - different wheel configurations -Generalized wheel model - holonomic and non-holonomic robots -Dynamics of mobile robot: Lagrange-Euler and Newton-Euler methods.

UNIT III NAVIGATION AND LOCALIZATION 9

Robot navigation – Localization: Error propagation model, Probabilistic map-based localization, Autonomous map building, Simultaneous localization and mapping (SLAM) - Motion and path planning: collision free path planning and sensor-based obstacle avoidance.

UNIT IV IMAGE PROCESSING FOR MOBILE ROBOT 9

Camera - Image representation–threshold – BLOB analysis - object recognition- noise and edges convolution masks-edge detection - Processing techniques – sematic segmentation

UNIT V CONTROL OF MOBILE ROBOT 9

Motion control of mobile robots - Motion controlling methods, kinematic control, dynamic control and cascaded control – Case study: QBOT 2 robot - wireless connected robot – agent control - Communication protocols.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. R Siegwart, IR Nourbakhsh, D Scaramuzza, Introduction to Autonomous Mobile Robots, MIT Press, USA, 2011.
2. Gregor Klancar, Andrej zdesar, Sasa Blazic, Igor Skrjanc, “Wheeled mobile robotics”, Elsevier, 2017.

REFERENCES

1. Eugene Kagan, Nir Shvalb, Irad Ben-Gal, “Autonomous Mobile Robots and Multi-Robot Systems: Motion-Planning, Communication, and Swarming” Wiley publication 2020.
2. SG Tzafestas, Introduction to Mobile Robot Control, Elsevier, USA, 2014.
3. A Kelly, Mobile Robotics: Mathematics, Models, and Methods, Cambridge University Press, USA, 2013.
4. S Thrun, W Burgard, D Fox, Probabilistic Robotics, MIT Press, USA, 2005.

5. G Dudek, M Jenkin, Computational Principles of Mobile Robotics, Cambridge University Press, USA, 2010.
6. https://onlinecourses.nptel.ac.in/noc21_me44/preview

19EE55E ELECTRIC VEHICLE MACHINES AND DRIVES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Understand the fundamentals on electric and hybrid vehicles. (K2)
- CO2: Analyze the operation of DC and AC motor drives. (K2)
- CO3: Explain the configurations and design of permanent magnet brushless and switched reluctance motor drives. (K2)
- CO4: Explain the configurations and design of stator-permanent magnet, magnetic-geared and vernier permanent magnet motor drives. (K2)
- CO5: Discuss the advanced motor drives in Electric Vehicle. (K2)

UNIT I INTRODUCTION 9

Overview of conventional vehicle drive system and issues – Introduction to Electric Vehicle (EV) Pure Electric Vehicle - Hybrid Electric Vehicle - Gridable Hybrid Electric Vehicle – Fuel Cell Electric Vehicle - Overview of EV Technologies: Motor Drive Technology - Energy Source Technology - Battery Charging Technology -Vehicle-to-Grid Technology.

UNIT II DC AND AC MOTOR DRIVES 9

DC Machines: An Overview - Soft-Switching DC–DC Converter Topologies - Design Criteria of DC series Motor Drives for EVs with application examples - Induction Machines: An Overview - Inverters for Induction Motors: PWM Switching Inverters, Soft-Switching Inverters - Design Criteria of Induction Motor Drives for EVs with application examples.

UNIT III PERMANENT MAGNET BRUSHLESS AND SWITCHED RELUCTANCE MOTOR DRIVES 9

Permanent Magnet Brushless DC Motor (PMBLDC): Overview - Inverters for PMBLDC Motors: Inverter Requirements, Switching Schemes for Brushless AC and DC Operation - Design Criteria of PMBLDC Motor Drives for EVs with application examples. Switched Reluctance Motor (SRM): Overview - Comparison of Converters for SRM drives - Design Criteria of SRM Drives for EVs.

UNIT IV STATOR-PERMANENT MAGNET, MAGNETIC-GEARED AND VERNIER PERMANENT MAGNET MOTOR DRIVES 9

Overview of Stator Permanent Magnet (PM) motor - Doubly-Salient PM Motor Drives - Hybrid-Excited PM Motor Drives - Design Criteria of Stator-PM Motor Drives for EVs - Magnetic-Geared (MG): System Configurations, MG Machines, Inverters for MG Motors, Vernier Permanent Magnet: System Configurations, Vernier PM Machines, Inverters for Vernier PM Motors.

UNIT V ADVANCED MOTOR DRIVES 9

Advanced Magnet less Motor Drives: System Configurations, Flux-Switching DC and Axial-Flux magnet less Motor Drives - Design Criteria of Advanced magnet less Motor Drives for EVs - Integrated-Starter-Generator Systems - System Configurations, Design Criteria and its application on EVs.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Denton, Tom. Electric and hybrid vehicles. Routledge, 2020.
2. Hughes, Austin, and Bill Drury. Electric motors and drives: fundamentals, types and applications. Newnes, 2019.
3. Neapolitan, Richard E., and Kwang Hee Nam. AC motor control and electrical vehicle applications. CRC press, 2018.

REFERENCES

1. Emadi, Ali, ed. Advanced electric drive vehicles. CRC Press, 2014.
2. Electric Vehicle Machines and Drives Design, Analysis and Application, K.T.Chau, John Wiley & Sons Private Limited, Singapore, 2015

19EE56E BATTERY MANAGEMENT SYSTEMS AND MODELING

**L T P C
3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the different types of batteries. (K2)
CO2: Analyze the efficiency and capacity of vehicle batteries. (K2)
CO3: Explain the various factors associated to battery management systems. (K2)
CO4: Compute the state of charge and state of health estimation of EV batteries. (K2)
CO5: Discuss the testing and safety requirements of the battery. (K2)

UNIT I INTRODUCTION TO BATTERIES 9

Battery basics - Fuel Cell Technology - super capacitors – Applications: Electric Vehicle - Choice of a Battery Type for Electric Vehicles –equivalent circuit model.

UNIT II BATTERY EFFICIENCY AND CAPACITY 9

Effects of valve regulated lead–acid (VRLA) Battery - Battery Storage - Lithium-ion Battery - Traction Battery Pack Design - Battery efficiency and Capacity - Temperature Dependence of Battery Capacity - State of Charge of a VRLA, lithium Battery - Li-ion Battery Capacity - Energy Balances for the Electric Vehicle - Electric Vehicle Battery Charging and Discharging - Electric Vehicle Battery Performance.

UNIT III BATTERY MANAGEMENT SYSTEM (BMS) REQUIREMENTS 9

Battery-pack topology - BMS design requirements - Battery-pack sensing: voltage, current, temperature - Isolation sensing - Charger control - State of charge estimation - Power estimation –Modeling of battery cells – Simulation of battery packs.

UNIT IV BATTERY-STATE ESTIMATION AND HEALTH ESTIMATION 9

SOC estimation - approaches to estimate SOC - linear Kalman filter - Implementing an EKF using the ESC cell model - Real-world issues pertaining to sensors, initialization - Need for health estimates - Negative-electrode aging - Positive-electrode aging - Robustness and speed - Code to simulate the methods - Example EV simulations.

UNIT V TESTING AND SAFETY REQUIREMENTS OF BATTERY 9

Cell Balancing - Voltage-Based Power-Limit Estimation - Testing of Batteries: Cell / Module / Pack level testing - Accelerated Reliability Testing of Electric Vehicles - Battery Cycle Life versus Peak Power and Rest Period - Safety Requirements for Electric Vehicle Batteries – EV charging station - Battery disposal and recycling techniques.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. The 2021-2026 World Outlook for Battery Management Systems (BMS), Prof Philip M. Parker – 2020.
2. Shunli Wang, Carlos Fernandez, Yu Chunmei, Fan Yongcun, Cao Wen, Daniel-Ioan Stroe, Zonghai Chen. Battery System Modeling, Elsevier 2021.
3. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.
4. Pop, Valer, Henk Jan Bergveld, Dmitry Danilov, Paul PL Regtien, and Peter HL Notten. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.
5. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, 2015.

REFERENCES

1. Link, Albert, Alan O'Connor, and Troy Scott. Battery Technology for electric vehicles: Public science and private innovation. Routledge, 2015.
2. Dhameja, Sandeep. Electric vehicle battery systems. Elsevier, 2001.

19EE57E CONTROL OF HYBRID ELECTRIC VEHICLES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the layouts of hybrid electric vehicles (HEVs). (K2)
CO2: Explain the basic components of hybrid electric vehicles. (K2)
CO3: Analyze the modeling of hybrid vehicle systems. (K2)
CO4: Analyze the power electronics and electric motor drive control. (K2)
CO5: Derive the energy storage system modeling and control. (K2)

UNIT I INTRODUCTION 9

Classification of Hybrid Electric Vehicles - General Architectures of Hybrid Electric Vehicles - Typical Layouts of Hybrid Electric Systems - Hybrid Electric Vehicle System

Analysis: Power Flow, Fuel Economy Benefits, Typical Drive Cycles, Vehicle Drivability - Controls of Hybrid Electric Vehicles.

UNIT II BASIC COMPONENTS OF HYBRID ELECTRIC VEHICLES 9
Prime Mover - Electric Motor with a DC–DC Converter and a DC–AC Inverter - Energy Storage System: Energy Storage System Requirements for Hybrid Electric Vehicles - Basic Types of Battery for Hybrid Electric Vehicle System Applications - Transmission System in Hybrid Electric Vehicles.

UNIT III HYBRID VEHICLE SYSTEM MODELING 9
Modeling of Internal Combustion Engine - Modeling of Electric Motor: BLDC and AC induction motors - Modeling of Battery System - Modeling of Transmission System: Clutch and Power Split Device, Torque Converter, Gear Box, Transmission Controller - Modeling of Final Drive and Wheel - PID-Based Driver Model.

UNIT IV POWER ELECTRONICS AND ELECTRIC MOTOR DRIVE CONTROL 9
Basic Power Electronic Devices - DC/DC Converter: basic Principle of operation, and closed loop PID controller design - DC–AC Inverter: Operation, closed loop PID controller design - Electric Motor Drives: BLDC motor and control.

UNIT V ENERGY STORAGE SYSTEM MODELING AND CONTROL 9
Introduction - Methods of Determining the State of Charge - Estimation of Battery Power Availability - Battery Life Prediction - Cell Balancing - Estimation of Cell Core Temperature - Plug-In Battery Charger Design - Battery Protection and control - Case study.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Taghavipour, Amir, Mahyar Vajedi, and Nasser L. Azad. Intelligent control of connected plug-in hybrid electric vehicles. Springer International Publishing, 2019.
2. Guo, Zhiqiang, and Deshang Sha. New Topologies and Modulation Schemes for Soft-switching Isolated DC-DC Converters. Springer, 2020.
3. Rahman, Md Ashib, Md Rabiul Islam, Kashem M. Muttaqi, and Danny Sutanto. "Modeling, Design, and Control of Solid-State Transformer for Grid Integration of Renewable Sources." In Emerging Power Converters for Renewable Energy and Electric Vehicles, pp. 1-36. CRC Press, 2021.

REFERENCES

1. Barbi, Ivo, and Fabiana Pottker. Soft Commutation Isolated DC-DC Converters. Vol. 1. Springer International Publishing, 2019.
2. Soylu, Seref, ed. Electric vehicles: modelling and simulations. BoD–Books on Demand, 2011.
3. Liu, Wei. Hybrid electric vehicle system modeling and control. John Wiley & Sons, 2017.

19EE58E AUTONOMOUS INTELLIGENT VEHICLES

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the basic components of autonomous vehicle. (K2)
CO2: Discuss the role of control in autonomous systems. (K2)
CO3: Describe the system architecture and sensors. (K2)
CO4: Explain the maps and path planning for Autonomous electric vehicle. (K2)
CO5: Review the recent research on autonomous systems. (K2)

UNIT I AUTONOMOUS VEHICLE 9

Introduction - Background in Autonomy in Cars - Components of Autonomy - Autonomous Vehicle Operational Models - Automated Driving Levels - Operating Models Comparison - Research and Experiments on Autonomous Vehicles (Case study).

UNIT II THE ROLE OF CONTROL IN AUTONOMOUS SYSTEMS 9

Introduction – feedback: Speed Control Using Point Mass and Force Input, Stopping, Swerving - Car Following and Advanced Cruise Control - Steering Control Using Point Mass Model: Open-Loop Commands - Steering Control Using Point Mass Model: Closed-Loop Commands.

UNIT III SYSTEM ARCHITECTURE AND SENSORS 9

System Architecture - Hybrid System Formulation - State Machines for Different Challenge Events – Sensors: Proximity sensors - Sensor Characteristics - Vehicle Internal State Sensing: Pressure and temperature sensors, Global positioning system, inertial measurements - External World Sensing: Image processing sensors, LIDAR – Estimation - Sensor Fusion - Track Classification - Antilock-Brake Systems - Steering Control and Lane Following – Parking.

UNIT IV MAPS AND PATH PLANNING 9

Map Databases - Path Planning - radar tracking system -Vehicle-to-Vehicle Communication (V2V) - Vehicle-to-Infrastructure Communication (V2I) - The Panoramic Imaging Model.

UNIT V RECENT RESEARCH – A REVIEW 9

Advancement in Autonomous electric vehicle (AUEV) – Global challenges related to AUEV system – comparison of autonomous electric vehicles and electric vehicle: Benefits, cost, performance, life cycle etc.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Yu, Huafeng, Xin Li, Richard M. Murray, S. Ramesh, and Claire J. Tomlin, eds. Safe, Autonomous and Intelligent Vehicles. Springer, 2018.
2. Hanky Sjafrie, Introduction to Self-Driving Vehicle Technology (Chapman & Hall/CRC Artificial Intelligence and Robotics Series), CRC Press 2020.

3. Adouane, Lounis. Autonomous vehicle navigation: from behavioral to hybrid multi-controller architectures. CRC Press, 2016.
4. Bizon, Nicu, Lucian Dascalescu, and Naser Mahdavi Tabatabaei, eds. Autonomous vehicles: intelligent transport systems and smart technologies. Nova Science Publishers, 2014.

REFERENCES

1. Nonami, Kenzo, Muljowidodo Kartidjo, K. Yoon, and Agus Budiyono. "Autonomous control systems and vehicles." Intelligent Systems, Control and Automation: Science and Engineering 65 (2013).
2. Ozguner, Umit, Tankut Acarman, and Keith Alan Redmill. Autonomous ground vehicles. Artech House, 2011.
3. Fazlollahtabar, Hamed, and Mohammad Saidi-Mehrabad. Autonomous guided vehicles. Vol. 20. Springer Science and Business Media LLC: Cham, Switzerland, 2015.
4. Cheng, Hong. Autonomous intelligent vehicles: theory, algorithms, and implementation. Springer Science & Business Media, 2011.

19EE59E ELECTRONICS DESIGN AND TECHNOLOGY L T P C
3 0 0 3

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to,

CO1: use the electrical components in an application circuit (K3)
CO2: implement the application circuit of the semiconductor devices. (K3)
CO3: Describe the op-amp application circuits (K2)
CO4: Explain the digital concepts with its design and application (K2)
CO5: implement the power supply circuits using electronics technology (K3)

UNIT I BASIC CIRCUITS 9

Resistor, Inductor, Capacitor - Types – selection, ratings - power calculation – Reactance - Data sheet approach – Review of Network Reduction (R/L/C) - Energy stored - Star delta conversion- RC, LC circuits – Filters - Voltage and Current Division Resistance Inductance Capacitor Behavior in AC and DC Circuits – Transient Characteristics - Applications of Network Theorems - DC sources – Battery - Serial and Parallel - AH calculations – Ohm meter concepts – Ammeter – Voltmeter– internal resistance - Range modification - shunt calculation – PWM for Variable DC concepts

UNIT II SEMICONDUCTOR DESIGN 9

Review of Diode Circuits – Design of wave shaping circuits – Zener voltage regulator, threshold, Power and Resistor design –Limiter – BJT- gain in various configuration - region of operation, cutoff and saturation – load line - V/I calculation for various region of operation- simple circuits design – Darlington as buffer – datasheet - BJT as switch - Relay interfacing – BJT JFET comparison – JFET circuits Design – variation in channel resistance – MOSFET – Operating Region – different circuits design – Current Mirrors - LED driver design- opto coupler design

UNIT III OP-AMP APPLICATIONS 9

Review of Op-amp characteristics – Open loop, closed loop concepts –positive and Negative feedback - importance of a Buffer- sensor interfacing – Application circuits of amplifier, summer, integrator/differentiator, comparator with AC/DC inputs, and sine to square converter – precision rectifiers – peak detector – S&H circuits - Application circuits of First order LPF, HPF, BPF, BRF – compensation –Slew rate – clock and delay generating circuits - ADC concepts review, Resolution

UNIT IV DIGITAL DESIGN 9

Review of Number system and Conversion - Gates formation using Diode, Transistor and MOSFET, Universal Gates – Difference Conversion - CMOS and TTL concepts - Application circuits of Gates – Application circuits of Flip flop – Counters – design of Mod Counter - Application of Adder subtractor – Mux and Demux Concepts – Serial communication – SPI I2C protocols and its concepts – Clock generation circuits – high precision oscillators – Latch Buffer – Edge level triggering – DAC concepts

UNIT V POWER SUPPLY 9

Design of Rectifier Circuits – Output voltage, power calculations – Selection of devices – Filters design – EMI suppressor – Metal oxide varistor – Need of Regulator - Design of complete LMPS with regulator – Fixed Regulator ICs – Design of Variable power supply – HF ripple reduction techniques – signal and power supply ground – SMPS – Block diagram – importance – difference between LMPS and SMPS – Fast Recovery Devices - Schottky diode – ESR concepts – DC to DC simple circuits.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw- Hill, New Delhi, 2007.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10th Edition, Prentice Hall, 2009.
3. Millman and Halkias. C., “Integrated Electronics”, Tata McGraw-Hill, 2010 (Reprint).
4. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, New Delhi, 2009.

REFERENCES

1. Keith H.Billings, “Switchmode Power Supply Handbook”, McGraw-Hill Professional, 3rd Edition, 2010.
2. S.Salivahanan, N. Suresh Kumar and A.Vallavaraj, “Electronic Devices and Circuits”, 3rd Edition, TMH, 2012.
3. Donald D.Givone, “Digital Principles and Design”, Tata Mc-Graw Hill Publishing company limited, New Delhi, 2003.

R – 2019 B.E - EEE

ONE CREDIT ELECTIVE COURSES

19EE01L DESIGN OF POWER CONVERTERS LABORATORY

L T P C
0 0 2 1

COURSE OUTCOME

Upon the successful completion of this course, the students will be able to,

CO1: design and construct the various types of power converters. (K2)

LIST OF EXPERIMENTS

1. Single phase controlled rectifiers.
2. Three phase controlled rectifiers.
3. Step-down and step-up dc choppers.
4. Buck/boost converters.
5. Single phase voltage source inverter.
6. Three phase voltage source inverter.
7. Ac voltage controllers.
8. Two stage sequence control of ac voltage controller.
9. Step up cycloconverter.
10. Step down Cycloconverter.

P: 30 TOTAL: 30 PERIODS

19EE02L ENERGY STORAGE SYSTEM

L T P C
1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: understand the operational mechanisms of each energy storage system (K2)

CO2: characterize and analyze electrochemical energy storages (K3)

COURSE CONTENT

Energy storage overview - Thermodynamics - Rechargeable Batteries and their Fundamental Electrochemistry - Li-ion Battery Technology and Challenges - Cathode and Anode Materials - Electrolytes - Fuel cell / regenerative fuel cell - Super-capacitor - Reaction kinetics - Electrochemical characterization - Introduction to Super Conducting Magnetic Energy Storage (SMES) operation - Load Leveling - Frequency Regulation - Power Quality - Applications.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Robert A. Huggins, “Energy Storage”, Springer Science and Business Media, 2010.
2. Ryan O‟Hayre, Suk-Won Cha, Whitney Colella and Fritz B. Prinz, “Fuel Cell Fundamentals”, Wiley, 3rd Edition, 2016.
3. A.G.Ter-Gazarian, “Energy Storage for Power Systems”, 2nd Edition, IET Publications, 2011.

19EE03L LVDC WIRING

L T P C
1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to

CO1: describe the fundamental knowledge in electrical engineering (K2)
CO2: prepare the details of estimation for residential and commercial electrical installations (K3)

COURSE CONTENT

Electrical symbols - DC Source (solar panel) - Voltage levels in DC supply - Types of storage device - DC Appliances : CFL, LED bulbs/TV, Vacuum cleaners, Computers, Mobile chargers, DC Ceiling fans(muffin fans), DC Refrigerators - DC wirings(PoE) - Switches and relays (solid state DC circuit breakers) - DC sockets - Safety practices – Advantages.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. S.L. Uppal, “Electrical Estimating and costing”, New Age International Pvt. Ltd., 2014.
2. J.B. Gupta, “Electrical Installation estimating and costing”, S. K. Kataria and Sons, New Delhi, 15th Edition 2016.
3. Relevant IS Code for - Service Line Connection, Lying of Cable, Wiring Installation, National Building Code - Vol. 4.
4. https://www.allaboutcircuits.com/textbook/direct-current/
5. http://hackaday.com/2017/03/06/what-voltage-for-the-all-dc-house/
6. http://www.edn.com/electronics-blogs/dave-s-power-trips/4402704/How-do-we-get-to-a DC-powered-home
7. http://chrisgammell.com/can-dc-power-an-entire-home/
8. http://www.backwoodssolar.com/when-to-use-dc-appliances
9. http://www.treehugger.com/sustainable-product-design/big-steps-in-building-change-our-wiring-to-12-volt-dc.html

19EE04L DIGITAL SUBSTATION

L T P C
1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: describe the architecture of a digital substation (K2)
CO2: explain the importance of intelligent electronic devices (K2)

COURSE CONTENT

Introduction to digital substation - Power system automation - Modern grid and substation automation - System architecture - Components of digital substation - IEC 61850 substation architecture - Intelligent Electronic devices - Station and process bus - GPS time clock - Merging units - Electronic fibre optic CT and VT - Working of a digital substation - Security threats - Advantages of digital substation.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Evelio Padilla, “Substation Automation Systems: Design and Implementation”, Wiley, 2015.
2. Cobus Strauss, “Practical Electrical Network Automation and Communication Systems”, Elsevier, 1st Edition, 2003.
3. http://myelectrical.com/notes/entryid/245/how-a-digital-substation-works
4. store.gedigitalenergy.com/faq/documents/general/iec61850.pdf

19EE05L ELECTRICAL SYSTEM FOR SMART BUILDING L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: understand the basic features of intelligent buildings (K2)

CO2: understand the operating principle and characteristics of various service Systems / technologies (K2)

COURSE CONTENT

Introduction to Intelligent Buildings - Basic Concepts - Intelligent Building Automation - Introduction to Smart Materials - HVAC (Heating, Ventilation And Air-Conditioning) Systems - Electrical Installations - Lighting Systems - Security and safety systems - Intelligent vertical transportation systems - Communication Systems - Structured cabling systems - Electrical Power Quality In Buildings - EMI/EMC Issues - Grounding Problems - Overview of Home/Building Automation - Case studies.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Derek Clements and Croome, “Intelligent Building Design, Management and Operations”, Thomas Telford Publishing, London, 2004.
2. Derek Clements and Croome, “Intelligent Buildings: An Introduction”, Routledge,2014
3. Shengwei Wang**,** “Intelligent Buildings and Building Automation”, Spon Press, London, 2010.
4. P. Manolescue, “Integrating Security into Intelligent Buildings”, Cheltenharn, 2003.
5. Albert Ting – Pat So and Wai Lok Chan, “Intelligent Building Systems”, Kluwer Academic Publisher, U.S.A, 1999.
6. C. Ehrlich, “Intelligent Building Dictionary: Terminology for Smart, Integrated, Green Building Design, Construction, and Management” San Francisco, Calif: Hands-on-Guide, 2007.
7. www.ieindia.org,www.koetterfire.com, www.informit.com

19EE06L POWER SYSTEM PROTECTION AND SUBSTATION AUTOMATION L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: describe the protection schemes of electrical apparatus (K2)

CO2: explain the structure of substation automation system (K2)

COURSE CONTENT

Introduction to power system protection - Protection of generators and motors - Protection of transformers and reactors - Protection of transmission lines - Circuit breaker protection and monitoring - Introduction to substation integration and automation system - Functional architecture - Substation automation: Distributed structure, Centralized structure - Substation integration and automation technical issues.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Badri Ram and D. N.Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw Hill, 2nd Edition, 2011.
2. Cobus Strauss, “Practical Electrical Network Automation and Communication Systems”, Elsevier, 1st Edition, 2003.
3. Evelio Padilla, “Substation Automation Systems: Design and Implementation”,Wiley, 2015.

19EE07L ENERGY LABORATORY

L T P C
0 0 2 1

COURSE OUTCOME

Upon the successful completion of this course, the students will be able to,

CO1: Design the renewable energy system for given application by collecting the field data.(K3)

LIST OF EXPERIMENTS

1. Design and estimation of solar radiation transmission through glazing materials in solar collector.
2. Design the solar photovoltaic systems and predict the array yield, final yield and performance ratio of the systems.
3. Design the battery backup system for domestic application by investigating the charging and discharging characteristics of battery.
4. Design the Anaerobic digester for organic waste generated from community buildings through research of literature.
5. Design the small scale wind energy systems for a location by collecting metrological data.
6. Design and investigate the performance of solar water heating system for the residential building.

P: 30 TOTAL: 30 PERIODS

19EE08L HVDC CIRCUIT BREAKERS

L T P C
1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: understand the modern trends used in HVDC circuit breakers (K2)

CO2: explain the characteristics of HVDC circuit breakers (K2)

COURSE CONTENT

Introduction to HVDC Circuit Breakers - Construction - Principle – Comparison between HVAC and HVDC Circuit Breakers - IGBT Based Switching - Switching Energy - Interruption of DC Current - Type of HVDC Circuit Breakers - Capability and Characteristics of HVDC Circuit Breaker - Requirements of HVDC Circuit Breakers – Applications, Advantages and Disadvantages of HVDC Circuit Breakers.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. K.R. Padiyar, "HVDC Power Transmission Systems", New age international publications, 3rd Edition, 2017
2. P. Kundur, "P.S. Stability and Control", Tata McGraw Hill, 1994
3. C.L. Wadhwa, "Electrical Power Systems", New age International Pvt. Ltd., 6th Edition, 2010

19EE09L EARTHING DESIGN L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: describe the earthing system design (K2)

CO2: explain the various types of earthing in substations (K2)

COURSE CONTENT

Factors Influencing the Choice of Earthed and Unearthed Systems - System Earthing - Substation Earthing/Grounding - Power Frequency Earthing - High Frequency Earthing - Touch and Step Potential - Surge Phenomenon and Suppression Techniques - Earthing In Substations - Earthing Associated With Overhead Power Lines- Calculation of Earth Fault Currents - Measurement of Earth Resistivity, Electrode Resistance, Earth Loop Impedance.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Institute of Electrical and Electronics Engineers, IEEE Guide for Safety in AC Substation Grounding, IEEE standard 80 – 2000.
2. Maneesh Kumar and Gagandeep Singh, "Design of Grounding System for an Electrical Substation: An Overview", International Journal of Scientific & Engineering Research, Vol. 5, No. 11, pp. 246-248 November 2014.

19EE10L ALTERNATE INSULATING MEDIUM L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: identify the various insulating materials. (K2)

CO2: explain the structure of fluoroketone based gas mixture. (K2)

COURSE CONTENT

Introduction to Insulating Medium - Overview of Solid, Liquid, Gas And Vacuum medium -

Performance and Environmental Issues of Existing Dielectric Medium - Global warming potential (GWP) - Need For Alternate Insulating Medium - SF_6 - Advantages And Disadvantages - Identification Of New Gases - A Fluoroketone Based Gas Mixture - Properties - Dielectric Performance - Thermal Performance - Long-Term Behavior - Life-Cycle Assessment (LCA) - Benefits - Future Grid Carbon Footprint - alternate esteroids.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. P.Simka and N.Ranjan, “Dielectric Strength of C_5 Perfluoroketone,” in 19th International Symposium on High Voltage Engineering, Pilsen, Czech Republic, 2015.
2. J. C. Devins, “Replacement gases for SF_6,” IEEE Transactions on Dielectric Electrical Insulation, Vol. 15, pp. 81– 86, 1980.
3. ABB review 2016 in AirPlus^{TM}
4. Maik Hyrenbach, Tobias Hintzen, Pascal Muller and John Owens, “Alternative insulation gas for medium-voltage switchgear”, 23rd International Conference on Electricity Distribution Lyon, June 2015.
5. J.D. Mantilla, N. Gariboldi, S. Grob and M. Claessens, “Investigation of the Insulation Performance of a New Gas Mixture with Extremely Low GWP”, IEEE Electrical Insulation Conference, pp. 469-473, 2014.

19EE11L COMMUNICATION TECHNOLOGIES FOR SMART GRIDS

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: explain the communication channels and protocols for smart grid (K2)

CO2: describe the standards of smart grid communication (K2)

COURSE CONTENT

Introduction - Data communication -Communication channels - Communication/networking architecture - Smart Grid architecture - Internet based architecture - Power Line Communication architecture - Wireless Communication technologies - IEEE 802 series - Other issues in communication/networking - Challenges and research directions.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, and Nick Jenkins, “Smart Grid Technology and Applications”, A John Wiley and Sons Ltd. Publication, 1st Edition, 2012.
2. James Momoh, “Smart Grid: Fundamentals of Design and Analysis”, A John Wiley and Sons Ltd. Publication, 2012.
3. Jingcheng Gao, Wei Liang, Yang Xiao and C. L. Philip Chen, “A survey of communication/ networking in Smart Grids”, Future Generation Computer Systems, Vol. 28, No. 2, pp. 391-404, February 2012.

19EE12L NON-CONVENTIONAL INSTRUMENT TRANSFORMER

L T P C
1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: describe the structure and operation of non conventional instrument transformer (NCIT). (K2)
CO2: explain the measurements in real time applications by non conventional instrument transformer (NCIT). (K2)

COURSE CONTENT

Introduction to NCIT - Need of NCIT - Comparison of conventional Instrumentation transformer and NCIT - NCIT structure - Extended Merging Unit - NCIT operation - Measurements: HV laboratory - real operation states - NCIT in gas insulated switchgear - Advantages of NCIT.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. ABB Product Guide: Difference between Sensors and conventional Instrument Transformers.
2. Non-conventional instrument transformers: Advanced GIS substations with IEC 61850-9-2 LE process bus.
3. IEEE PES ELK-CP 050602_R0-5.ppt : Non-Conventional Instrument Transformers.
4. Holger Heine, Patrice Guenther and Farel Becker, “New Non Conventional Instrument Transformer (NCIT) – A future technology in Gas Insulated Switch Gear”, IEEE Conference on Transmission and Distribution and Exposition (T&D), May 2016.
5. Jure Mocnik, Janez Huma and Andrej Zemva, “A non-conventional instrument transformer”, Measurement, Elsevier, Vol. 46, No. 10, pp. 4114-4120, December 2013.

19EE13L INDUSTRIAL CONTROLLERS LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: articulate the PLC programming for Industrial processes. (K3)
CO2: implement the performance of controller in DDC and DCS. (K2)

LIST OF EXPERIMENTS

1. Design of Electronic On/Off controller with relay concept
2. Implementation of On Off controller using NI DAQ
3. Micro-processor based temperature control system
4. Batch process control by Programmable Logic Controller
5. PLC controlled level process
6. Reaction vessel control using Programmable Logic Controller
7. Traffic light control Using Programmable Logic Controller
8. Bottle filling system controlled by Programmable Logic Controller

9. Computer controlled Closed loop response of Temperature process
10. Computer controlled Closed loop response of pressure process
11. Monitor and Control of Temperature Process using SCADA with PLC
12. Implementation of Controller for Pressure and Temperature process in Distributed Control system
13. Automation of the Cement Plant, Sugar and Beverage Plant using Distributed Control system

P: 30 TOTAL: 30 PERIODS

19EE14L SOFT COMPUTING FOR ELECTRICAL ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: implement various structures of ANN to system identification and control of linear and nonlinear systems. (K3)
CO2: develop program with fuzzy relationship to control electrical drives. (K3)
CO3: employ GA to power system optimization and control problems. (K3)

LIST OF EXPERIMENTS

1. Implement Discrete Hopfield Network and Test for Input Pattern.
2. Implement Adaline with Bipolar Inputs and Outputs
3. Implement Back Propagation Network for a Given Input Pattern.
4. Implement Composition of Fuzzy and Crisp Relations.
5. Perform max-min composition of two matrices obtained from cartesian product.
6. System identification using neural network
7. Controlling linear and nonlinear dynamic systems using neural network
8. Short term load forecasting using neural network
9. Implement the fuzzy logic controller for motor drives
10. Economic dispatch problem using GA
11. Load scheduling problem using GA
12. Unit commitment problem using GA
13. PID controller tuning using GA
14. System identification using GA

P: 30 TOTAL: 30 PERIODS

19EE15L ELECTRONICS FOR SAFETY CRITICAL SYSTEM

L T P C
1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: describe the standards of safety critical system (K2)
CO2: explain the development of electronics and software tools with respect to safety critical system. (K2)

COURSE CONTENT

Introduction to safety critical system - Need for safety critical systems - Integrity level and standard for safety critical system - Specification and Design - Verification - Commercial and Industrial Standards for Electrical Appliances - Grounding Techniques in Electrical / Electronics, ESD Protection, Need of Redundancy in Critical Applications to Avoid Risks - Single point failures- Elimination of Hazard / Risk Analysis - Basics of Reliability Analysis - Fault tree analysis - Failure mode effective analysis.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. An Introduction to Safety Critical Systems, www.qa-systems.com
2. G.R. Nisha, "A model driven approach for design and development of a safety critical system", IEEE 2011 3rd International Conference on Electronics Computer Technology (ICECT) - Kanyakumari, India, 2011.
3. Ashok N. Srivastava and Johann Schumann, "Software Health Management: A Necessity for Safety Critical Systems", Journal of Innovations in Systems and Software Engineering, Vol. 9, No. 4, pp. 219-233, 2013.
4. MIL STD 217 / 217 Plus, MIL STD 1629, for Reliability and FMEA / FMECA.

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19EE16L PCB DESIGN AND FABRICATION

L T P C
0 0 2 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: design and analyze the Printed Circuit Boards fabrication. (K2)
CO2: develop the Printed Circuit Boards and discuss the factors affecting PCB performance. (K3)

COURSE CONTENT

Introduction to PCB design - Basics of hardware and software - Types of PCB, terminologies, PCB Layers - Different tools and software used for PCB designing - Different circuit on PCB design software - Creating a new project Building parts and symbols - Schematic of Different circuits - Creating multi-sheet flat designs - PCB layout and 3D Imaging - Introduction to Proteus and OrCAD Capture - Placement of components and Routing - Assigning reference designators - Design Rules checking - Adding inter sheet signal references - PCB stackup preparation-Characteristics impedance calculation-Signal Integrity analysis - Creating a Bill of Materials and Print layout - Gerber generation - PCB fabrication methods - Soldering Methods.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Charles Hamilton, "A Guide to Printed Circuit Board Design" Elsevier, 2013.
2. Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor" Newnes Publications, 2009.
3. Christopher T. Robertson, "Printed Circuit Board Designer's Reference" Prentice Hall Professional, 2004.
4. Eric Bogatin, "Signal integrity analysis simplified", Prentice Hall Modern

Semiconductor Design Series, 2012.
5. http://www.ece.ucsb.edu/Faculty/Johnson/ECE189/Mentor2007/
6. http://read.pudn.com/downloads120/ebook/509920/High-speed%20Digital%20Design%20-%20Johnson%20&%20Graham.pdf

19EE17L EMBEDDED SYSTEM LABORATORY L T P C

0 0 2 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: interface GPIO, Timer, and ADC with external peripherals along with interrupt concept.(K3)

CO2: utilize serial communication protocols like UART, SPI and I^2C (K2)

LIST OF EXPERIMENTS

1. Program to interface on chip GPIO with external LED‟s and switches
2. Program to control three different DC motors with different timings using delay routines and OnChip timers separately and compare both
3. Program to interface an Analog sensor with processor through OnChip ADC and display the measurement at external LCD.
4. Program to establish serial communication between two I^2C compatible boards
5. Program to establish serial communication between two UART compatible boards
6. Program to establish serial communication between two SPI compatible boards

P: 30 TOTAL: 30 PERIODS

19EE18L TECHNO COMMERCIAL PROJECT PROPOSAL L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: determine the technical feasibility and financial viability of the project (K2)

CO2: assess the risk associated with the project and enumerate imminent actions that are required to be taken (K3)

COURSE CONTENT

Introduction - Gathering Background Information - Components of a Proposal - Executive Summary - Statement of Need - Project Description - Methods - Staffing/Administration - Evaluation - Sustainability - Budget - Support and Revenue Statement - Budget Narrative - Organizational Information and Conclusion - Case studies.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Jane C. Geever, “The Foundation Center's Guide to Proposal Writing”, New York: The Foundation Center, 6th Edition, 2012.
2. Ellen Karsh and Arlen Sue Fox, “The Only Grant-Writing Book You'll Ever Need”, Basic Books, 4th Edition, 2014.
3. http://grantspace.org/

19EE19L VIRTUAL INSTRUMENTATION L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: design of electronic circuits using Virtual Instrumentation. (K2)
CO2: develop the fundamental program for monitoring and control of process variable. (K2)

COURSE CONTENT

Concepts of Analog IO, Digital IO, Power supply, Counters, timers and PWM-Generation of signal using ELVIS **-** Design of RLC resonance circuit-Verification of logic gates- Design and implementation of adder and subtractor circuit **-** VI characteristics of Diode **-** VI characteristics of transistor amplifier-Analysis of Half wave rectifier with and without filter-Study of temperature measurement using ELVIS **-** Monitoring the displacement using LVDT-Vibration measurement using LVDT **-**Time response analysis of first order and second order process **-** Design of PID controller using ELVIS

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Rick Bitter, Taqi Mohiuddin ,Matt Nawrocki "Labview Advanced Programming Techniques" CRC press ,2 nd Edition ,2007
2. Gary Johnson, "LABVIEW Graphical Programming", 2ndEdition, McGraw Hill, 2009.
3. S. Gupta, J.P. Gupta, "PC Interfacing for Data Acquisition and Process Control", ISA, 2ndEdition, 2010.
4. Skolkoff, "Basic concepts of LABVIEW 4", PHI, 1998

19EE20L ELECTRICAL POWER CAPACITORS L T P C

1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: explain the general concepts and building blocks of capacitors. (K2)
CO2: summarize the various applications of capacitors. (K2)

COURSE CONTENT

Introduction: Capacitance – Basics of dielectric Materials – Dielectric Constant – Loss Angle – General Conceptions of Gaseous, Liquid and Solid Dielectrics – IS Standards – Solid Dielectrics, Composite Dielectrics, Electrolytes. Building Blocks of Capacitors: Condenser Tissue Paper – Polypropylene and Polyester Film – Aluminium Foil - Materials for Others Components – Discharge Resistors: Safety Consideration and Design – Housing of Capacitors – Impregnating Liquids – Manufacture of Paper and Plastic Film Capacitor. Application of Capacitors: DC and Energy Storage Capacitors –Series Capacitors for Power Quality Improvement –Harmonic Filters –Surge Protection Capacitors –Capacitors Voltage Transformers – Coupling Capacitors – Future capacitors.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. D.M.Tagore, "Electrical Power Capacitors – Design and Manufacturing", Tata Mc-Graw Hill Publishing Company Ltd., 2002.
2. R.P. Deshpande, "Capacitors – Technology and Trends", Tata Mc-Graw Hill

Publishing Company Ltd., 2012.
3. T.Longland, T.W.Hunt and W.A.Brecknell, "Power Capacitors Handbook", Butterworths Publishers, 1984.
4. Ramasamy Natarajan, "Power System Capacitors", CRC Press, 2005.
5. R.E. Marbury, "Power Capacitors", Tata Mc-Graw Hill Publishing Company Ltd., 1949.

19EE21L INTERNET OF THINGS AND EMBEDDED SYSTEMS L T P C 1 0 0 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: Explain the fundamentals of IoT and its applications.(K1)
CO2: Develop simple applications using ARM processor and IoT.(K3)

COURSE CONTENT

Introduction – History of IoT - Characteristic of IoT – Machine to Machine communication – Web of Things – IoT protocols – IoT Vs M2M – Architecture of IoT - Connecting IoT to cloud – Cloud Storage for IoT – Data Analytics for IoT. ARM Based Embedded System Design: Overview of IoT supported Hardware platform–ARM Cortex Processor – Programming —Various Real time applications of IoT and ARM Processor – Generating different patterns on LED‟s – Sensor interfacing - Smart Traffic system.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jonathan W. Valvano, "Embedded Systems and introduction to ARM cortex – Microcontrollers" 5th Edition, CreateSpace Independent Publishing Platform, 2012.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.
4. Dr.Yifeng Zhu, "Embedded systems with ARM cortex - M microcontrollers in assembly language and C". 2nd Edition, Man Press, 2015.

19EE22L HIGH VOLTAGE TESTING TECHNIQUES L T P C 0 0 2 1

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: perform the high voltage testing in insulating materials. (K2)
CO2: predict the behavior of different insulating material used in high voltage equipment. (K2)

LIST OF EXPERIMENTS

1. Study of high voltage testing objectives, classification, standards and specifications, correction factors.

2. Measurement of AC, DC and impulse breakdown voltage of insulating material
3. Partial discharge measurement with φ-q-n pattern
4. Measurement of flash over voltage for dry and wet 11kV outdoor insulator
5. Measurement of soil resistivity
6. Measurement of 50% critical impulse flashover voltages on the 11 kV insulator for positive / negative voltages.
7. Measurement of dielectric characteristics (Insulation Resistance, Absorption Index and Polarization Index) of insulating material
8. Investigate the effect of pollution severity on critical flashover voltage of 11 kV insulator.
9. Analyse the effect of dry band location of 11 kV insulator on electric field distribution using ANSYS.
10. Study on measurement of Radio interference voltage
11. Statistical Evaluation of Measured Results of breakdown phenomenon

i) Direct determination of probability values on disruptive discharge voltage
ii) Determination of the distribution function of a measured quantity
iii) Determination of the confidence limits of the mean value of the breakdown discharge voltage
iv) Determination of breakdown discharge voltages for given probability ranges 12.Study of multi stress ageing and life time analysis for different insulating medium

P: 30 TOTAL: 30 PERIODS

19EE23L	**QUALITY PRACTICES FOR SAFETY CRITICAL INSTRUMENTATION SYSTEM**	**L T P C** **1 0 0 1**

COURSE OUTCOMES

Upon the successful completion of this course, the students will be able to,

CO1: expose the students to requirement of standards and calibration techniques, safety and reliability mechanisms used in process industries. (K2)
CO2: impart knowledge about EMI and EMC problems in industrial measurements.(K2)
CO3: make the students to draw the specification of the industrial instruments and prepare the instrumentation project documents. (K2)

COURSE CONTENT

Standards and Calibration: Introduction to standards and calibration of measuring instruments - Guidelines of enclosure design.

EMI and EMC: Introduction - interference coupling mechanism - basics of circuit layout and grounding - concepts of interfaces - filtering and shielding - co-axial & twisted pair cable - electronic grounding.

Safety: Introduction - electrical hazards - hazardous areas and classification - nonhazardous areas – enclosures - NEMA types - fuses and circuit breakers. Protection methods: Purging - explosion proofing and intrinsic safety.

Reliability: Bathtub curve - reliability for series parallel systems - Mean Time To Failure (MTTF) - Mean Time To Repair (MTTR) - Mean Time Between Failures (MTBF) –

availability - redundancy and stand by.

Specifications: Specification of instruments - preparation of project documentation - process flow sheet - instrument index sheet - instrument specifications sheet – panel drawing and specifications, instrument specifications - Project procedure - schedules, vendor drawing, tender documentation - selection of measurement method and control panels.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Noltingk B.E., Instrumentation Reference Book, Butterworth Heinemann, 2nd Edition, 1995.
2. Liptak B.G, Process Measurement and Analysis, Chilton Book Company, Radnor, Pennsylvania, 4th Edition, 2003.
3. Andrew W.G, Applied Instrumentation in Process Industries – A survey, Vol I & Vol II, Gulf Publishing Company, Houston, 2001
4. Patranabis D., Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Company Limited, 3rd Edition, 2010.
5. Lawrence D. Goettsche, Maintenance of Instruments and Systems, International society of automation, 2nd Edition, 2005.
6. Henry W.Ott, Electromagnetic Compatibility Engineering, A John Wiley & Sons, INC., Publication, 2009

19EE24L SWITCHGEAR AND PROTECTION LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: demonstrate the characteristics of various numerical protection relays. (K2)
CO 2: analyze power system problems using ETAP and SCADA software studies. (K2)

LIST OF EXPERIMENTS

1. Study and plotting Characteristics of IDMT type Induction over current relay
2. Testing on (i) Under Voltage Relay and (ii) Earth Fault Relay
3. Differential protection of transformer
4. Motor protection using numerical relay
5. Protection of Transmission line using Impedance relay
6. Load flow solution using software package
7. Simulation of various power system faults using software package

P: 30; TOTAL: 30 PERIODS

19EE25L ELECTRIC VEHICLES SIMULATION LABORATORY L T P C 0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Interpret the different models and configurations of EVs and HEVs. (K2)

CO2: Design the equivalent motor and battery model using MATLAB simulink package. (K2)

CO3: Design and simulate the power electronic converters and EVs controller unit using MATLAB simulink. (K2)

LIST OF EXPERIMENTS

1. Performance Study of EVs and HEVs based on datasheet.
2. Recent EV models and its configurations – A report
3. Architectural frame of EV using MATLAB/Simulink platform.
4. Simulation of E-vehicle Battery model design (Lithium Ion / Other) using MATLAB simulink.
5. E-vehicle Motor design and model (BLDC/DC/SR/PMSM/AC) using MATLAB simulink.
6. E-vehicle Motor Controller design using MATLAB simulink package.
7. Simulation and Experimental validation of Power electronic Converters for EV.
8. Design and simulation of Phase shifted full bridge converter for EV battery system.
9. Design of vehicle internal electronic control unit using MATLAB/Simulink.

P: 30 TOTAL: 30 PERIODS

19EE26L EV BATTERY DESIGN AND MODELING LABORATORY L T P C 0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design and develop the equivalent model for various EV batteries with different power ranges using MATLAB simulink. (K2)

CO2: Analyze the different characteristics of EV batteries using simulink. (K2)

CO3: Design and Simulate Battery Management System. (K2)

LIST OF EXPERIMENTS

1. Study of various EV batteries and its characteristics using datasheet.
2. Design and development of equivalent circuit model for lead acid battery using MATLAB simulink.
3. Design and development of equivalent circuit model for Lithium-Ion battery using MATLAB simulink.
4. Design and development of equivalent circuit model for Nickel-Metal Hydride battery using MATLAB simulink.
5. Charging and discharging characteristics for Lead acid, Li-ion, Ni-MH batteries using MATLAB simulink platform.

6. SOC and SOH estimation of various batteries using MATLAB simulink.
7. Simulation of EV Battery Management System using MATLAB.
8. Simulation of Solar battery system with inverter using MATLAB.
9. Simulation of Hybrid Electric Vehicle (HEV) Model for a Passenger Car using MATLAB.
10. Study of Accessories like Battery Tester and BMS (Battery Monitoring System).
11. Study of Electric Vehicle Trainer kit.

P: 30 TOTAL: 30 PERIODS

19EE27L PYTHON PROGRAMMING IN RASPBERRY PI AND HARDWARE INTERFACING

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Write python codes to interface sensors and actuators with raspberry pi.(K3)
CO2: Create IoT projects and communicate with IoT devices and cloud. (K3)

LIST OF EXPERIMENTS

1. Python programming using simple commands
2. Implementation of list, tuple and dictionary in Python
3. Setting up raspberry pi and booting raspberry pi with raspbian OS
4. Compiling Python codes in raspberry pi.
5. Controlling an output device – LED.
6. Data acquisition from an input device – Button.
7. Generating PWM signal – Fading of LED.
8. DC motor interfacing.
9. Interfacing temperature and humidity sensor.
10. Distance measurement using HCSR05 sensor.
11. Interfacing ADC – MCP3008 via serial peripheral interface.
12. Sending room temperature to Firebase Google IoT cloud.

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Gowrishankar S, Veena A, “Introduction to Python Programming” CRC Press, 2018.
2. Jeffrey Elkner, Allen B. Downey, Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python” Samurai Media Limited, 2016.
3. Derek Molloy, “Exploring Raspberry Pi” Wiley, 2016.
4. https://docs.python.org/3/tutorial/
5. https://www.raspberrypi.org/learn/

19EE28L **ARDUINO PROGRAMMING** **L T P C**
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Write C programming to interface sensors and actuators using Arduino (K3)
CO2: Create Arduino projects and communicate with IoT devices and Android App development (K3)

LIST OF EXPERIMENTS

1. Features of Arduino and pinout
2. LED and LCD Interfacing using Arduino
3. Analog and Digital I/O Interface using Arduino
4. DC motor Interfacing [Forward/Reverse]
5. Ultrasonic distance sensor Interfacing
6. Servo/Stepper Motor Interfacing
7. GSM/GPS Interfacing using Arduino
8. Bluetooth interfacing with Arduino
9. Simple mobile application development
10. Obstacle avoidance robot using Arduino
11. Line Following robot using Arduino
12. IR controlled appliances and interface
13. IOT application using NodeMCU ESP8266 Wi-Fi Module

P: 30 TOTAL: 30 PERIODS

19EE29L **HYDROGEN ENERGY AND FUEL CELLS** **L T P C**
1 0 0 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand and demonstrate the hydrogen production technologies, storage methods and strategies for transition to hydrogen economy. (K2)
CO2: Explain the concepts and characteristics of various types of fuel cell (K2)
CO3: Describe the application of fuel cells. (K2)

COURSE CONTENT

Hydrogen Energy - Introduction to hydrogen economy, production, storage and transportation systems, hydrogen from fossil fuels, electrolysis of water, safety and environmental impacts, economics of transition to hydrogen systems. Fuel Cells - Concept, key components, physical and chemical phenomena in fuel cells, advantages and disadvantages, different types of fuel cells, characteristics. Fuel Cells - Application - Fuel cell usage for domestic power systems, large scale power generation, automobile and space.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Fuel cell Fundamentals, John Wiley and sons, Willey 3rd Edition, 2016.
2. Fuel cells: Principles and Applications, Viswanathan B and Aulice Scibioh, University Press, 2008
3. Tomorrow's Energy – Hydrogen Fuel Cells and the Prospects for Cleaner Planet, Peter Hoffman, MIT, 2002.
4. Hydrogen – A fuel for Automatic Engines, Prashukumar G P, ISTE.

R – 2019 B.E - EEE

TRANS-DISCIPLINARY ELECTIVE COURSES – SELF STUDY

19TD05E INDIAN ECONOMY

L	T	P	C
0	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: discuss the current economic development in India (K2)
- CO 2: describe the key indicators of estimation of national income (K2)
- CO 3: explain elementary concepts of economic planning and development in India (K2)
- CO 4: discuss the concept of public finance and preparation of budget (K2)
- CO 5: discuss the influence of infrastructure growth on economic development (K2)

UNIT I ECONOMIC DEVELOPMENT

Meaning - Measurement of Economic Development - Characteristic of underdeveloped and developed economies - Causes for Indian economic underdevelopment - Major issues in development - Strategies for economic development Import substitution and Export oriented strategies - Determinants of economic development.

UNIT II NATIONAL INCOME

The National Income and its estimates in India - Limitations of National income estimation - Trends in National income of India: Growth and Structure - Inter-state variations in National income - Income distribution - Measurement of poverty in India.

UNIT III ECONOMIC PLANNING

Planning and economic development in India - Planning models in India (Elementary concepts) - Capital formation - Growth of Public and Private sector in India – Industrial policies an assessment - Capital formation and domestic saving.

UNIT IV INDIAN PUBLIC FINANCE

Budgetary policies of the central government - Composition and trends in public revenue and expenditure - Expenditure control and government consumption expenditure - concepts of Budgetary deficits and implications - state budget.

UNIT V INFRASTRUCTURE AND ECONOMIC DEVELOPMENT

Power and energy - Transport system in India's economic development - Communication system in India - Urban infrastructure - Science and technology - Private investment in infrastructure - Outlook and prospects.

TEXT BOOKS

1. Dutt R, Sundaram K.P.M, "Indian Economy", S.Chand and Co., New Delhi, 65th edition, 2018.
2. Agarwal A.N, Agarwal M.K, "Indian Economy: Problems of Development and Planning", 41st Edition, New Age International Ltd., New Delhi, 2016.

REFERENCES

1. Paul A Samuelson, William D Nordhaus, Sudip Chaudhuri, Macroeconomic, McGraw-Hill Education, 20th edition, 2021
2. IC Dhingra, Indian Economy, Sultan Chand & Sons, 30th edition, 2019

19TD09E	**INDIAN HISTORY**	**L T P C** **0 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: illustrate the basics of Indian cultural heritage. (K2)
CO2: describe interaction between Ancient Indian cultural heritage and Islamic culture. (K2)
CO3: demonstrate Innovation by rulers of medieval period in the area of Administration, and their contact with the Europeans. (K2)
CO4: analyse modern Indian movements, Economic history and Impact of the British rule on India. (K2)
CO5: demonstrate the concepts of Indian National Movement and the history of freedom struggle in India. (K2)

UNIT I ANCIENTY INDIAN CULTURE

Ancient Indian Cultural Heritage - Social, Political, Legal and in the Area of Religion and Philosophy.

UNIT II LAW RELATING TO CULTURE

Law Givers and Dispute Resolution Systems in Ancient India (Administration of Justice in Ancient India - Pre-Islamic Period) - Law Relating to Culture - The Advent of Islam - Interaction between Ancient Indian Cultural Heritage and Islamic Culture - The Emergence of Synthetic Indian Culture.

UNIT III ADMINISTRATION IN ANCIENT INDIA

Innovation by Rulers of Medieval Period in the Area of General and Revenue Administration - District Administration - Court Systems - Indian Contact with the Europeans.

UNIT IV SOCIO-ECONOMIC HISTORY

Socio-Religious Reform Movements in Modern India and its Legal Culture - Economic History of India During British Period - Impact of the British Rule on India – Education.

UNIT EUROPEAN CULTURE IMPACT

Impact of European Culture and Liberal Thought on India – The Indian National Movement - The History of Freedom Struggle in India upto 1947.

TEXT BOOKS

1. Sreenivasa M.H.V, “History of India Part I and II”, JBA Publishers, New Delhi, 2015.
2. Agarwal R.C, Bhatnagar M, “Constitutional Development and National Movement of India”, S. Chand Publishers, New Delhi, revised edition, 2016.

REFERENCES

1. Altekar S, “State and Government in Ancient India”, Motilal Banarsidass Publishers, New Delhi, 7th edition, 2016.
2. B.R Grover, “A new look on Modern Indian History”, S. Chand Publishers, New Delhi, revised edition, 2016.

19TD10E SUSTAINABLE DEVELOPMENT AND PRACTICES

L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: recognize the sustainable development and the way to achieve the sustainable development. (K2)
CO 2: outline the concept, factors governing the sustainability and their linkages. (K2)
CO 3: explain the environmental impact assessment and environmental audit. (K2)
CO 4: describe the environmental planning and managing the resources. (K2)
CO 5: acquire the knowledge about the environmental problems and their solutions. (K2)

UNIT I SUSTAINABLE DEVELOPMENT

Need for Sustainability - 17 Sustainable Development Goals - Nine Ways to Achieve Sustainability - Economics as the Dismal Science - Population, Resources and Environment.

UNIT II CHALLENGES OF SUSTAINABLE DEVELOPMENT

Concept of Sustainability - Factors Governing Sustainable Development - Linkages among Sustainable Development, Determinants of Sustainable Development - Case Studies on Sustainable Development.

UNIT III ENVIRONMENT IMPACT ASSESSMENT AND AUDIT

Concepts-process-evaluation methodology-EIA and EMS integration-setting up of audit programme - typical audit process - carrying out the audit-benefits of environmental auditing-environmental audit programmes in India.

UNIT IV ENVIRONMENTAL PLANNING

Introduction - Perspective of Environmental Planning - land resource development planning - Planning and managing the natural resources - landscape ecological planning - information and decision of environmental planning - Land use policy in India.

UNIT V ENVIRONMENTAL EDUCATION

Knowledge about the environment - Knowledge about the environment and population growth -Knowledge about the solution and environmental problems - Environmental education (EE) – Strategies for EE – Models for future Environmental Education Systems.

TEXT BOOKS

1. Rogers P, Jalal K.F, Boyd J.A, “An Introduction to Sustainable Development”, Earth scan Publications Ltd., UK, 4th edition, 2013.
2. Santra S.C,” Environmental Science”, 3rd Edition, New Central Book Agency (P) Ltd., London, 2013.

REFERENCES

1. Stavins R.N. “Economics of the Environment: Selected Readings”, 5th Edition, W.W. Norton and Company, New York, 6th edition, 2012.
2. Sachs J.D, “The Age of Sustainable Development”, Columbia University Press, New York, 2015.

19TD11E WOMEN IN INDIAN SOCIETY L T P C

0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate historical perspective about women in Indian society. (K2)
CO2: Explain social problems of women. (K2)
CO3: Understand the legislation for women protection in India. (K2)
CO4: Demonstrate the involvement of women literacy, career and politics. (K2)
CO5: Analyze the role of NGO's in women empowerment. (K2)

UNIT I INTRODUCTION

A Historical Perspective - Early Vedic, Colonial and Modern Periods - Position of Women in Contemporary India.

UNIT II SOCIAL ISSUES

Issues of Girl Child - Female Infanticide and Feticide, Sex Ratio, Child Marriage, Dowry and Property Rights - Women's Health and Birth Control - Reproduction - Violence against Women - Domestic Violence - Female Headed Households - Women in the Unorganized Sector of Employment - Women's Work- Status and Problems - Problems of Dalit Women.

UNIT III PROTECTIVE LEGISLATION FOR WOMEN

Protective Legislation for Women in the Indian Constitution - Anti Dowry, SITA, PNDT, And Prevention Sexual Harassment At Workplace (Visaka Case) - Domestic Violence (Prevention) Act.

UNIT IV WOMEN AND EDUCATION

Formal and Non-Formal Literacy - Post Literacy - Vocational Training - Dual Career Modernization – Women and Politics - Political Status - Global Movements and Indian Movements.

UNIT V ROLE OF NGO'S IN WOMEN EMPOWERMENT

Gender Economy – Role of women in technology and education - All India Women's Conference (AIWC) – Women's India Association (WIA) - National Council of Women in India (NCWIE) - Indian Association of Women's Studies – Women Development Cells - Self Help Groups.

TEXT BOOKS

1. Majumdar M, "Social Status of Women in India", Wisdom Press, New Delhi, 2012.
2. Harish R, Harishankar V.B, "Re-Defining Feminisms", Rawat Publications, Jaipur, 2011.

REFERENCES

1. Rathod P.B, "An Introduction to Women's Studies", ABD Publishers, Jaipur, 2010.
2. Ray R, "Hand Book of Gender", Oxford University Press, New Delhi, 2012.

19TD13E LEADERSHIP AND PERSONALITY DEVELOPMENT

L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: identify the various leadership skills. (K2)
CO 2: understand group dynamics and factors influencing the team performance. (K2)
CO 3: describe the personality dimensions based on personality theories. (K2)
CO 4: explain personality determinants and personality types. (K2)
CO 5: apply effective training program for personality development. (K2)

UNIT I INTRODUCTION

Leadership – Meaning, Concepts and Myths about Leadership, Components of Leadership- Leader, Followers and Situations - Leadership Skills – Basic Leadership Skills - Building Technical Competency - Advanced Leadership Skills - Team Building for Work Teams - Building High Performance Teams.

UNIT II TEAMS AND LEADERSHIP

Assessing Leadership & Measuring Its Effects - Group- Nature, Size, Roles, Norms, Cohesion, and Stages of Group Development - Teams and their Leadership – Effective Team Characteristics and Team Building - Ginnetts Team Effectiveness Leadership Model.

UNIT III PERSONALITY

Personality - Meaning, Concept, Personality Patterns, Symbols of Self, Moulding the Personality Pattern, Persistence & Change - Personality & Personal Effectiveness - Psychometric Theories – Cattell and Big Five - Psychodynamic Theories - Carl Jung and MBTI - Transactional Analysis - Johari window - Personal Effectiveness.

UNIT IV PERSONALITY DETERMINANTS

Personality Determinants – Heredity and Environment – Types of personality.

UNIT V PERSONALITY TRAINING

Concept, Role, Need, Importance and types of personality Training - Understanding Process of Learning - Developing an Integrated Approach of Learning in Training Programme - Training Needs Assessment.

TEXT BOOKS

1. Yukl G, “Leadership in Organisations”, 8th Edition, Pearson Education Limited, England, 2013.
2. Girish Batra, Experiments in Leadership, Chennai: Notion Press, 2018

REFERENCES

1. Mitesh Khatri, Awaken the Leader in You, Mumbai: Jaico Publishing House, 2013.
2. Stephen P. Robbins and Timothy A. Judge, “Organizational Behavior”, Prentice Hall, 16th Edition, 2014

NATIONAL ENGINEERING COLLEGE

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REGULATIONS – 2019

CURRICULUM & SYLLABUS

B.Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

B.Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATIONS – 2019

CURRICULUM STRUCTURE AND SYLLABUS FOR FIRST YEAR

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	E	C
THEORY								
1.	19AD11C	English – I	HSMC	2	0	0	0	2
2.	19AD12C	Mathematical Foundations for Data Science	BSC	3	1	0	0	4
3.	19AD13C	Semiconductor Physics and Optoelectronics	BSC	2	0	0	0	2
4.	19AD14C	Chemistry for Artificial Intelligence and Data Science	BSC	2	0	0	0	2
5.	19AD15C	Engineering Graphics	ESC	2	0	4	0	4
6.	19AD16C	C Programming	ESC	3	0	0	0	3
PRACTICAL								
7.	19AD17C	Semiconductor Physics and Chemistry Laboratory	BSC	0	0	3	0	1.5
8.	19AD18C	C Programming Laboratory	ESC	0	0	3	0	1.5
TOTAL				**14**	**1**	**10**	**0**	**20**

SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	E	C
THEORY								
1.	19AD21C	English – II	HSMC	2	0	0	0	2
2.	19AD22C	Probability and Statistics	BSC	3	1	0	0	4
3.	19AD23C	Principles of Digital Electronics	BSC	3	0	0	0	3
4.	19AD24C	Environmental Science	MAC	3	0	0	0	3
INTEGRATED COURSE (Theory + Lab + Experiential Learning Practices)								
5.	19AD25C	Innovation through Design Thinking	EEC	1	0	2	0	2
6.	19AD26C	Data Structures	PCC	2	0	3	2	4.5
PRACTICAL								
7.	19AD27C	Communication and Soft Skills Laboratory	HSMC	0	0	2	0	1
TOTAL				**14**	**1**	**7**	**2**	**19.5**

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	E	C
THEORY								
1.	19AD31C	Discrete Mathematics for AI	BSC	3	1	0	0	4
2.	19AD32C	Fundamentals of Data Science	PCC	3	1	0	0	4
3.	19AD33C	Operating Systems	PCC	3	0	0	0	3
4.	19AD34C	Design and Analysis of Algorithms	PCC	3	1	0	0	4
5.	19AD35C	Professional Ethics and Human Values	PCC	3	0	0	0	3
6.	19AD36C	Object Oriented Programming	ESC	3	0	0	0	3
PRACTICAL								
7.	19AD37C	Data Science Laboratory	PCC	0	0	3	0	1.5
8.	19AD38C	Operating Systems Laboratory	PCC	0	0	3	0	1.5
9.	19AD39C	Object Oriented Programming Laboratory	ESC	0	0	3	0	1.5
			TOTAL	**17**	**3**	**9**	**2**	**25.5**

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	E	C
THEORY								
1.	19AD41C	Mathematics for Machine Learning	ESC	3	1	0	0	4
2.	19AD42C	Database Management Systems	PCC	3	0	0	0	3
3.	19AD43C	Problem solving in Artificial Intelligence	PCC	3	0	0	0	3
4.	19AD44C	Data Visualization Techniques	PCC	3	0	2	0	4
5.		Elective – I	PEC	3	0	0	0	3
PRACTICAL								
6.	19AD45C	Database Management Systems Laboratory	PCC	0	0	3	0	1.5
7.	19AD46C	Problem solving in Artificial Intelligence Laboratory	PCC	0	0	4	0	2
INTEGRATED COURSE (Theory + Lab +Experiential Learning Practices)								
8.	19AD47C	Java Programming	PCC	2	0	3	2	4.5
			TOTAL	**17**	**1**	**11**	**2**	**25**

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	E	C
THEORY								
1.	19AD51C	Finance and Accounting	HSMC	3	0	0	0	3
2.	19AD52C	Data Engineering	PCC	3	0	0	0	3
3.	19AD53C	Cloud Computing and Management	PCC	3	0	0	0	3
4.	19AD54C	Computer Networks	PCC	3	0	0	0	3
5.		Open Elective – I	OEC	3	0	0	0	3
6.		Elective – II	PEC	3	0	0	0	3
PRACTICAL								
7.	19AD55C	Cloud Computing Laboratory	PCC	0	0	3	0	1.5
8.	19AD56C	Networking Laboratory	PCC	0	0	3	0	1.5
INTEGRATED COURSE (Theory + Lab +Experiential Learning Practices)								
9.	19AD57C	Machine Learning	PCC	2	0	3	2	4.5
			TOTAL	**20**	**0**	**9**	**2**	**25.5**

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C
THEORY							
1.	19AD61C	Big Data Analytics	PCC	3	0	0	3
2.	19AD62C	Deep Learning	PCC	2	0	2	3
3.	19AD63C	Business Process Management	HSMC	2	0	0	2
4.	19AD64C	Professional readiness for Innovation, Employability, Entrepreneurship (Elective – III)	EEC	3	0	0	3
5.		Elective – IV	PEC	3	0	0	3
6.		Open Elective – II	OEC	3	0	0	3
7.	19MC01C	Constitution of India	MAC	3	0	0	0
PRACTICAL							
8.	19AD65C	Product Development Laboratory	PCC	0	0	6	3
9.	19AD66C	Big Data Analytics Laboratory	PCC	0	0	3	1.5
10.	19AD67C	Comprehension	SDC	0	0	2	1
			TOTAL	**16**	**1**	**13**	**22.5**

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C
THEORY							
1.		Elective – V	PEC	3	0	0	3
2.		Elective – VI	PEC	3	0	0	3
3.		Elective – VII	PEC	3	0	0	3
PRACTICAL							
4.	19AD71C	Project Work – I	SDC	0	0	6	3
5.	19AD72C	Research Paper and Patent Review – Seminar	SDC	0	0	2	1
			TOTAL	**9**	**0**	**8**	**13**

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C
THEORY							
1.		Elective – VIII	PEC	3	0	0	3
PRACTICAL							
2.	19AD81C	Project Work – II	SDC	0	0	12	6
3.	19AD82C	Internship	SDC	0	0	4	2
			TOTAL	**3**	**0**	**16**	**11**

Total Number of Credits: 162

LIST OF ELECTIVES

S. No	Course Code	Course Title	Category	L	T	P	C
INTELLIGENT SYSTEMS							
1.	19AD01E	Human and intelligent systems	PEC	3	0	0	3
2.	19AD02E	Intelligent Agents	PEC	3	0	0	3
3.	19AD03E	Business Intelligence	PEC	3	0	0	3
4.	19AD04E	Computational Intelligence	PEC	3	0	0	3
5.	19AD05E	Augmented Intelligence	PEC	3	0	0	3
6.	19AD06E	Swarm Intelligence	PEC	3	0	0	3
SOFTWARE							
7.	19AD07E	Software Testing and Quality Assurance	PEC	3	0	0	3
8.	19AD08E	Software Development Processes	PEC	3	0	0	3
9.	19AD09E	Software Architecture	PEC	3	0	0	3
10.	19AD10E	Agile Methodologies	PEC	3	0	0	3
ARTIFICIAL INTELLIGENCE							
11.	19AD11E	Cognitive Science and Decision Making	PEC	3	0	0	3
12.	19AD12E	Computer Vision	PEC	3	0	0	3
13.	19AD13E	Reinforcement Learning	PEC	3	0	0	3

14.	19AD14E	Natural Language Processing	PEC	3	0	0	3
OPTIMIZATION							
15.	19AD15E	Nonlinear Optimization	PEC	3	0	0	3
16.	19AD16E	Bio-inspired Optimization Techniques	PEC	3	0	0	3
DATA ANALYTICS							
17.	19AD17E	Speech Processing and Analytics	PEC	3	0	0	3
18.	19AD18E	Social Network Analysis	PEC	3	0	0	3
19.	19AD19E	Health care Analytics	PEC	3	0	0	3
20.	19AD20E	Engineering Predictive Analytics	PEC	3	0	0	3
21.	19AD21E	Data Analytics in Bioinformatics	PEC	3	0	0	3
COMPUTING							
22.	19AD22E	Parallel Computing	PEC	3	0	0	3
23.	19AD23E	Soft computing Techniques	PEC	3	0	0	3
24.	19AD24E	Distributed Systems	PEC	3	0	0	3
25.	19AD25E	Nature and Bio inspired computing	PEC	3	0	0	3
26.	19AD26E	Information Retrieval	PEC	3	0	0	3
27.	19AD27E	Information Extraction and Retrieval	PEC	3	0	0	3
SECURITY							
28.	19AD28E	Secure Cloud Computing	PEC	3	0	0	3
29.	19AD29E	Cyber Security	PEC	3	0	0	3
30.	19AD30E	Data and Information Security	PEC	3	0	0	3
31.	19AD31E	Security risk assessment and management	PEC	3	0	0	3
32.	19AD32E	Pattern and Anomaly Detection	PEC	3	0	0	3
DESIGNING/PROGRAMMING							
33.	19AD33E	Advanced Python Programming	PEC	3	0	0	3
34.	19AD34E	Web Services and API Design	PEC	3	0	0	3
35.	19AD35E	Mobile Applications Development	PEC	3	0	0	3
36.	19AD36E	Programming Paradigms	PEC	3	0	0	3
37.	19AD37E	Web design and development	PEC	3	0	0	3
MANDATORY ELECTIVE							
38.	19AD38E	Professional readiness for Innovation, Employability, Entrepreneurship	PEC	0	0	6	3
ROBOTICS							
39.	19AD39E	AI and Robotics	PEC	3	0	0	3
40.	19AD40E	Internet of Things	PEC	3	0	0	3
41.	19AD41E	Robotics and Intelligent systems	PEC	3	0	0	3
42.	19AD42E	Robotic Process Automation	PEC	3	0	0	3
Others							
43.	19AD43E	Ethics Of Artificial Intelligence	PEC	3	0	0	3
44.	19AD44E	Engineering Economics	PEC	3	0	0	3

OPEN ELECTIVE

S. No	Course Code	Course Title	Category	L	T	P	C
THEORY							
1.	19AD01N	Fundamentals of Machine Learning	OEC	3	0	0	3
2.	19AD02N	Fundamentals of Artificial intelligence	OEC	3	0	0	3
3.	19AD03N	Mobile application development	OEC	3	0	0	3
4.	19AD04N	Introduction to Virtual and Augmented Reality	OEC	3	0	0	3
5.	19AD05N	Programming for robotics	OEC	3	0	0	3

19AD11C	ENGLISH – I	L	T	P	C
		2	0	0	2

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: enhance their basic language skills to understand various aspects of communication skills (K3)

CO2: express their thoughts with correct usage of language in formal writings (K3)

CO3: understand various language components and develop pronunciation skills. (K2)

CO4: prepare effective technical documents and interpret any pictorial representation. (K3)

CO5: frame sentences and write effective reports. (K3)

UNIT I 6

Parts of Speech – Newspaper article presentation – Greetings and self-Introduction– Instruction writing–Technical vocabulary– Purpose of listening– Listening for general information.

UNIT II 6

Transformation of words into different grammatical forms – Letter to friends/ parents/ siblings – Process description –Letter writing (for Industrial visits and training) – Talks on technology– Listening to scientific talks.

UNIT III 6

Personality adjectives – Phonetics - (Vowels - Consonants – Diphthongs – Transcriptions) – Kinds of sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational conversation.

UNIT IV 6

Technical terms and extended definitions – Active and Passive Voices – Note-making – E-mail writing – Picture description – Checklists.

UNIT V 6

Homophones – Concord – Foreign words and phrases – Verbal analogies – Report writing (Types–Structure – Stages in report writing – Model report).

L:30; TOTAL:30 PERIODS

TEXT BOOKS

1. Anderson and Paul. V, “Technical Communication: A Reader Centered Approach,”9th Edition, New Delhi: Cengage, 2018.
2. Murphy. R, “Basic Grammar Practice on Tense,” New Delhi: Cambridge University Press, 2018.

REFERENCES

1. Lucantoni and Peter, “English as a Second Language,” Cambridge University Press, 2022.
2. McCarthy. M, “English Grammar, The Basics,” 1st Edition, New York: Routledge, 2021.
3. Raman. M, and Sharma. S, “Technical Communication: Principles and Practice”, 3rd Edition New Delhi: Oxford University Press, 2015.

19AD12C	MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE	L	T	P	C
		3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: make use of orthogonal transformation (K3)
CO2: interpret the ideas of orthonormal basis and perform matrix decomposition (K2)
CO3: solve ordinary differential equations (K2)
CO4: solve partial differential equations (K2)
CO5: evaluate area and volume using double and triple integrals (K3)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation- Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation - Cayley – Hamilton theorem.

UNIT II INNER PRODUCT SPACES AND MATRIX DECOMPOSITION 12

Inner Product and Norms – Orthonormal Vectors – Gram Schmidt Orthogonalization process - QR decomposition – Generalised Inverse - Singular Value Decomposition.

UNIT III ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order Ordinary Differential Equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non-homogeneous linear partial differential equations of second and higher order with constant coefficients.

UNIT V MULTIPLE INTEGRALS 12

Double integration – Cartesian and polar coordinates - Change of order of integration - Area as double Integral -Triple integration in cartesian coordinates – Volume as triple integration.

L:45;T:15; TOTAL:60 PERIODS

TEXTBOOKS

1. Grewal. B.S, “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, Delhi, 2018.
2. James E. Gentle, “Matrix Algebra”, 2nd Edition, Springer International Publishing, 2017.
3. Kenneth B. Howell, “Ordinary Differential Equations”, 2nd Edition, CRC Press Taylor and Francis, 2020
4. Shankar Rao. G, “Linear Algebra”, 1st Edition, Wiley, India, 2017

REFERENCE BOOKS

1. Bali. N.P and Manish Goyal, “A Textbook of Engineering Mathematics”,10th Edition, Laxmi Publications Private Limited, 2016.
2. Dennis G. Zill, “Advanced Engineering Mathematics”, 6th Edition, Jones & Bartlett Learning, 2018
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India, 2017

4. Richard Bronson, “Theory and Problems of Matrix Operations”, 2nd Edition, McGraw Hill, New York, 2011

19AD13C	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	0	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: recognize the different types of semiconductors and their properties (K2)
CO2: select the suitable semiconductor diode for a simple electronic circuit application (K2)
CO3: explain the constructional features and working of different types of transistors (K2)
CO4: discuss the basic principle, types, and applications of laser and display devices (K2)
CO5: describe the types, fabrication, losses, and applications of optical fibers (K2)

UNIT I SEMICONDUCTING MATERIALS 6

Energy band formation – Direct and indirect bandgap semiconductors - Intrinsic semiconductors; carrier concentration in intrinsic semiconductors, variation of Fermi level with temperature — Extrinsic semiconductors; carrier concentration in n-type & p-type semiconductors, variation of Fermi level with temperature and impurity concentration — Hall effect

UNIT II DIODES 6

Theory of PN junction diode - Energy Band Structure - Biasing of PN Junction – Forward bias and Reverse bias - Current equation – Zener diode; characteristics, voltage regulator – Half wave and full wave rectifiers

UNIT III TRANSISTORS 6

BJT: Construction and Operation of NPN and PNP Transistors - Study of CE, CB, and CC configurations and comparison of their characteristics

FET: Construction and Operation of N-Channel JFET – Expression for Drain Current, Comparison of JFET and BJT- MOSFET; enhancement and depletion mode, comparison with JFET

UNIT IV OPTICAL DEVICES 6

Principle of spontaneous emission and stimulated emission - Population inversion – Pumping - Einstein's A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG), semiconductor laser - Applications of lasers in science, engineering, and medicine - LED-OLED.

UNIT V FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications – Fiber optic sensors – Medical Endoscope

L:30; TOTAL:30 PERIODS

TEXT BOOKS

1. David A. Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2009.
2. John Wilson, John Hawkes, "Optoelectronics", 3rd Edition, Pearson Education, 2018.

REFERENCE BOOKS

1. Mathur. K.S, “Fiber Optic fundamentals and Advances in communications”, 1st Edition, Zorbabooks, 2021.
2. Renk, Karl. F “Basics of laser physics”, 2nd Edition, Springer international publishing, 2018.
3. Salivahanan. S, Suresh Kumar. N and Vallavaraj. A, “Electronic Devices and Circuits”, 2nd Edition, Tata McGraw Hill, 2018.

19AD14C	**CHEMISTRY FOR ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: express the mechanism of chemical bond formation in different molecules (K2)

CO2: identify the suitable novel organic materials used in various electronics industries (K2)

CO3: familiar with the structure of nucleic acids and proteins (K2)

CO4: interpret the results of various analytical methods to evaluate biomolecules in the biological systems (K2)

CO5: design and predict the molecular structure using artificial intelligence (K2)

UNIT I CHEMICAL BONDING 6

Introduction – Types of chemical bonds – Molecular interactions: van der waals forces and hydrogen bonding – Chemical bonding – Molecular orbitals as a linear combination of atomic orbitals - molecular orbital energy level diagram of homo and heteronuclear diatomic molecules - hybridization (sp, sp^2 and sp^3)

UNIT II ELECTRONIC MATERIALS 6

Organic semiconducting materials – Advantages - p-type and n-type semiconducting materials; pentacene and fullerenes - C-60 - Organic light emitting polymers; polythiophene and polyphenylene vinylene - Sensors – Fundamentals – Types; biosensors, chemical sensors - Microsensors – Nanosensors.

UNIT III DNA AND PROTEINS 6

Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes- the functional elements in DNA, Analysing DNA, DNA sequencing. Proteins: amino acids, protein structure, secondary, tertiary, and quaternary structure, protein folding and function - Nucleic acid and protein interaction.

UNIT IV ANALYTICAL TECHNIQUES FOR BIOLOGICAL SYSTEMS 6

UV-Visible and Circular dichroism (Principle, instrumentation, and applications) - Microscopy: fluorescence microscopy; confocal microscopy; (Principle, instrumentation, and applications) - Bioassay methods PCR and ELISA.

UNIT V CHEMINTELLIGENCE 6

Introduction – Molecular properties prediction: QSAR – retro synthesis – Databases; primary and secondary databases - PDB, Genbank, CATH, SCOP, NCBI - Sequence analyze methods – Molecular docking.

L: 30; TOTAL: 30 PERIODS

TEXTBOOKS

1. Bahl. B.S and Bahl. A, “A Textbook of Organic Chemistry”, 22nd Edition, S. Chand publications, 2021.
2. Nelson, D.L , and Cox. M.M, “Lehninger Principles of Biochemistry”, 7th Edition, W.H.Freeman, Macmillan Learning, 2017.

REFERENCE BOOKS

1. Clayden. J, Greeves. N and Warren. S, “Organic Chemistry”, 2nd Edition, Oxford University Press, 2014.
2. Engel. T and Gasteiger. J, “Chemoinformatics: Basic Concepts and Methods”, 1st Edition, Wiley-VCH, 2018.
3. Skoog. D, Holler. F and Crouch. S, “Principles of Instrumental Analysis” 7th Edition, Brooks / Cole, 2017.

19SH15C **ENGINEERING GRAPHICS** **L T P C**
(Common to all B.E. / B.Tech. Degree Programmes) **2 0 4 4**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
CO2: construct the orthographic projections of points, straight lines and lamina (K2)
CO3: draw the projections of simple solids in different positions. (K3)
CO4: visualize the sectional views and surface areas of various solids. (K3)
CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids.Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P:60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, “Engineering Drawing”, 53rdEdition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, “Engineering Drawing”, Pearson Education, 2ndEdition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2ndEdition, 2013

2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, “Engineering Drawing”, Subhas Publications, 32nd Edition, 2017.

19AD16C	C PROGRAMMING	L	T	P	E	C
		3	0	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: practice the fundamental programming concepts and terminologies. (K3)
- CO 2: use different control structures and understand how function calls are carried out. (K3)
- CO 3: solve problems using arrays and strings. (K3)
- CO 4: develop applications in C using structures and file handling. (K3)
- CO 5: structure how to store and manage the addresses of dynamically allocated blocks of memory (K3)

UNIT I FUNDAMENTALS OF C PROGRAMMING 9

Introduction to programming paradigms - Features of C language - Structure of C program - Compilation process - I/O statements - Tokens: Variables, Data Types, Identifiers, Keywords, Constants, Operators - Type Casting - Storage classes - Pre-processor directives.

UNIT II CONTROL STATEMENTS AND FUNCTIONS 9

Decision making statements: if, if-else , if-elseif-else, switch.
Looping statements: while, for, do-while, Nested loops, Infinite Loops, break, continue, goto
Functions: Introduction - Function prototype, Function definition, Function call, Built-in functions - Recursion - Math function - Example Programs in functions

UNIT III ARRAYS AND STRINGS 9

Array: Introduction, Declaration, Initialization - Types of array: One dimensional, Two Dimensional, Multi-Dimensional – Sorting and Searching in Array

String: Introduction, Ways to declare a string in C - String Functions

UNIT IV STRUCTURES AND FILE HANDLING 9

Structure: Introduction - typedef in C - Array of Structures - Nested Structure - Structure Padding – Union – Files: Introduction, Types of file processing: Sequential access, Random access - File Handling – Programs using File

UNIT IV POINTERS AND MEMORY ALLOCATION 9

Pointers: Introduction, Declaration - Pointer to array, Pointer to a function, Pointer to structure - Pointer operators and Pointer arithmetic - Arrays and pointers - Array of pointers - Structure pointer - Memory Allocation in C - Command line arguments

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Harsha Priya, R. Ranjeet, ”Programming and Problem Solving Through C Language”, Firewall/Laxmi Publications (P) Ltd., New Delhi, 2015.

REFERENCES

1. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, Second Edition, Oxford University Press, 2013.
2. M.G.Venkateshmurthy, “Programming Techniques through C”: A Beginner‗s Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, “Computer Programming”, Pearson Education, India, 2011.

19AD17C SEMICONDUCTOR PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

PART A – SEMICONDUCTOR PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: interpret the properties of the laser and verify the parameters of optical fiber (K3)

CO2: demonstrate the voltage-current characteristics of different diodes (K3)

CO3: analyze the characteristics of transistors (K3)

LIST OF EXPERIMENTS

1. Determination of angle of divergence of the laser beam and acceptance angle, the numerical aperture of optical fiber
2. Determination of wavelength of laser using grating and particle size of lycopodium powder
3. Determination of V-I characteristics of PN junction diode
4. Determination of V-I characteristics of Zener junction diode
5. Determination of V-I characteristics of light emitting diode
6. Determination of characteristics of BJT
7. Determination of characteristics of FET
8. Study of logic gates using transistors

- A minimum of FIVE experiments shall be offered.

TEXTBOOK

1. Sesha Sai Kumar Vemula, “Engineering Physics lab manual” 1st Edition, LAP LAMBERT Academic Publishing, 2017

REFERENCE BOOK

1. David Loyal, “ Physics laboratory” 4th Edition, Cengage Learning, 2013

PART-B CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Course outcome

Upon completion of this course, the students will be able to

CO1: determine the chemical parameters of the water sample (K3)

CO2: quantify the amount of acid by pH metric methods (K3)

CO3: identify the biomolecules (K3)

CO4: estimate the amount of biomolecules present in the given samples (K3)

LIST OF EXPERIMENTS

1. Estimation of Total hardness of water sample
2. Estimation of Alkalinity of water sample
3. Estimation of HCl by pH method
4. Qualitative analysis of biomolecules
5. Estimation of glycine
6. Estimation of Vitamin – C
7. Separation of amino acids by TLC method
8. Determination of DNA binding constant by UV-Visible spectroscopy (Demo)

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Biology

TEXTBOOKS

1. Bhujbal. N, Kolat. S and Kand. R, “Practical Organic Chemistry: A Laboratory experiments for Graduates and Post Graduates”, 1st Edition, Prashant Publications, 2020
2. Svehla and Sivasankar, “Vogel's Qualitative Inorganic Analysis”**,** 8th Edition, Pearson Education Limited, 2015.

19AD18C	C PROGRAMMING LABORATORY	L	T	P	E	C
		0	0	3	0	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: solve simple syntactical structures of C Language (K3)
CO 2: enhance the programming skills in C using arrays and functions (K3)
CO 3: develop programs using pointers, structures and file concepts (K3)

List of Experiments:

1. I/O statements, operators, expressions
2. Decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

P: 60; TOTAL: 60 PERIODS

Software Requirement: Turbo C

19AD21C	**ENGLISH – II**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: frame effective conditional and interrogative sentences. (K3)
CO 2: write effective letters and reports in any professional context. (K3)
CO 3: enhance the vital sub-functions of communication in any formal situation. (K3)
CO 4: participate actively in both informal and formal discussions. (K3)
CO 5: recall the acquired skills and apply them in the workplace. (K2)

UNIT I 6

Standard abbreviations – Tenses (Present, Past, and Future) – Question framing – Asking and answering Yes/No and Wh questions - If conditionals.

UNIT II 6

Single-Word substitution – Business letters for quotations and clarification – Chart description – Review of recent technologies – Listening to TED talks.

UNIT III 6

Idioms and Phrases – Direct & Indirect Speech– Business letters for placing orders and making complaints – Product description.

UNIT IV 6

Error spotting (Based on Concord, Pronouns, Articles & Adverb Placement) – Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples – Demo) – Proposal writing.

UNIT V 6

Job application letter & Résumé preparation –Circular and minutes of the meeting – Reading (Skimming, Scanning, and Inferring) – Reading comprehension.

L:30; TOTAL:30 PERIODS

TEXTBOOKS

1. Bovee. C.L, and Thill. J.V, “Business Communication Today,” 15th Edition, New Delhi: Pearson Education, 2021.
2. Digiacomo. M, “The English Grammar Workbook for Adults,” Emeryville, CA: Rockridge Press, 2020.

REFERENCE BOOKS

1. Lester. M and Larry. B, “Handbook of English Grammar and Usage”, 3rd Edition, McGraw Hill Education, 2018.
2. Meenakshi. R, Sangeeta. S, “Professional English”, Oxford university press, 2019.
3. Ravindra Nath. T, “Technical English-II”, Shaswat publication, 2020.
4. Sudharshana. N. P, “English for Engineers”, Cambridge University Press, 2018.
5. Walter. S, “Oxford English Grammar Course”, 2019.

19AD22C	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

CO1: recognize the concepts of random variables and standard distributions (K2)
CO2: perform the ideas of two-dimensional random variables (K2)
CO3: calculate the various measures of dispersion (K3)
CO4: apply the concepts of testing of hypothesis for small and large samples (K3)
CO5: grasp the principles of design of experiments and perform analysis of variance (K3)

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables - Moments - Moment generating functions and their properties. Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

UNIT III STATISTICS 12

Mean – Median – Mode - Moments - Skewness- Kurtosis- Correlation - Single and bivariate frequency distributions - Regression lines.

UNIT IV TESTING OF HYPOTHESIS 12

Large samples **-** Tests on means and proportions for large samples - Tests for single variance and equality of variances - Small samples – t-test - F- test – Chi-square test – Applications: Case study – Sampling.

UNIT V DESIGN OF EXPERIMENTS 12

One-way and two-way classifications - Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

L:45; T: 15; TOTAL:60 PERIODS

TEXTBOOKS

1. Dharmaraja Selvamuthu and Dipayan Das, "Introduction to Statistical Methods, Design of Experiments and Statistical Quality Control", Springer Nature Singapore Pvt. Ltd, 2018.
2. Gupta. S.C. and Kapoor. V.K., "Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons, Delhi, 2020
3. Peyton. Z. Peebles. J.R, "Probability, Random Variables, and Random Signal Principles", McGraw Hill, 4th Edition, 2017

REFERENCE BOOKS

1. John E. Freund's, "Mathematical Statistics with applications", 8th Edition, Pearson Education Ltd, 2014
2. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes", 2nd Edition, Elsevier, 2014
3. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education Private Ltd., 2020.

19AD23C	PRINCIPLES OF DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: summarize the basics of Boolean algebra and illustrate the Boolean functions by logic gates. (K2)
- CO 2: explain and design different types of adder and subtractor in combinational circuits. (K2)
- CO 3: explain and design multiplexers and encoders in combinational circuits. (K2)
- CO 4: illustrate the basics of synchronous sequential logic and Registers. (K2)
- CO 5: classify and explain different types of memories. (K2)

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Review of binary number systems - Binary arithmetic - Computer codes – BCD, Gray code, Excess 3 code - Boolean algebra and theorems - Boolean functions - Simplifications of Boolean functions using Karnaugh map – Logic gates.

UNIT II COMBINATIONAL LOGIC-I 9

Design procedure - Half adder - Full Adder - Half subtractor - Full subtractor - Parallel binary adder - Parallel binary subtractor - Fast Adder - Carry Look - Ahead adder - Serial Adder / Subtractor - BCD adder- BCD subtractor -Binary Multiplier - Binary Divider.

UNIT III COMBINATIONAL LOGIC-II 9

Parity Checker/Generator – Multiplexer – Demultiplexer – Encoder - Priority Encoder – Decoder -BCD to Seven segment Display Decoder/Driver - LCD Display and Comparators.

UNIT IV SYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential circuits - Latches – Flip-Flops - Analysis of clocked sequential circuits – State reduction and assignment – Design procedure - Registers – Shift Registers – Ripple counters – Synchronous Counters.

UNIT V MEMORY AND PROGRAMMABLE LOGIC 9

Memory – Introduction – Random-Access Memory – Memory Decoding – Read-only memory - Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

L:45; TOTAL:45 PERIODS

TEXTBOOKS

1. Morris Mano. M and Michael D. Ciletti., “Digital Design”, Pearson Education, 6th Edition, 2018.
2. Salivahanan S. and Arivazhagan S., “Digital Circuits and Design”, 5th Edition, Oxford University Press, 2018.

REFERENCE BOOKS

1. Charles H. Roth and Larry L Kinney, “Fundamentals of Logic Design” (with Companion CD-ROM), 7th Edition, Thomson Learning, 2013
2. Donald P Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and

Applications", 6th Edition, Tata McGraw Hill, 2008

3. Godse. D.A. and Godse. A.P, "Digital Electronics", Technical Publications, 4th Edition, 2017
4. Rishabh Anand, "Digital Electronics", Chand Publications, 2nd edition, 2021
5. Thomas L. Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2017

19AD24C	ENVIRONMENTAL SCIENCE	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: express the structure and functions of different ecosystems (K2)

CO2: identify the causes, impacts, and management of e-waste, municipal waste, and hazardous waste (K2)

CO3: recognize the causes, impacts, and preventive measures of various global issues (K2)

UNIT I ENVIRONMENT AND ECOSYSTEMS 9

Scope and importance of the environment – Need for public awareness – Ecosystem – Structure and function of an ecosystem – Energy flow in the ecosystem – Forest and aquatic ecosystems – A field study of simple ecosystems – Pond and forest.

UNIT II INTEGRATED WASTE MANAGEMENT IN SMART CITIES 9

Introduction – Generation and types of solid waste - Swachh Bharat Mission - Solid waste: collection, transportation, segregation and processing – Disposal: landfill, biochemical processes, and energy recovery - Municipal solid waste management rules 2016.

UNIT III E-WASTE MANAGEMENT 9

Introduction – Composition - Types – Generation – Environmental and health hazards of e-waste – Recycling - Recovery of metals: pyrometallurgical, hydrometallurgical, and biometallurgical process – e-waste management and handling rules 2016 – e-waste management companies in India.

UNIT IV HAZARDOUS WASTE MANAGEMENT 9

Sources – Hazard identification – Dose - Response assessment – Risk characterization: Impact on plants, animals, and human beings – Hazardous waste management act 1986 - Physical treatment methods: sedimentation, adsorption, aeration - Chemical treatments: neutralization, precipitation, and redox method – Biological method.

UNIT V GLOBAL AND REGIONAL ENVIRONMENTAL ISSUES 9

Global effects of air pollution: Global warming and climate change - Acid rain - Ozone hole- Biodiversity: types, threats, and conservation - Population - Energy consumption and environmental degradation.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Miller. G.T and Spoolman. S, “Environmental Science”, 16th Edition, Brooks/Cole Publishing Co., 2018.
2. Peavy. H.S, Rowe. D.R and Tchobanoglous. G, “Environmental Engineering”, 2nd Edition, McGraw Hill Education, 2020.

REFERENCE BOOKS

1. Kaushik. A and Kaushik. C.P, “Environmental Science and Engineering”, 6th Edition, New Age International Publishers, 2018.
2. Weller. K, “Environmental Science and Biological Engineering”, 1st Edition, WIT Press, 2015.

19AD25C INNOVATION THROUGH DESIGN THINKING

	L	T	P	C
	1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)

CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS 15

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS 30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, “Design Thinking: The Handbook”, WS Professional, 2020
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving”, Penguin Random House, 2020
3. D.M. Arvind Mallik, “Design Thinking for Educators”, Notion Press, 2019
4. Michael Lewrick, “The Design Thinking Playbook”, Wiley, 2019
5. Kathryn Christopher, “Design Thinking in Engineering”, Kendall Hunt Publishing Company, 2019
6. Robert Curedale, “Design Thinking Process & Methods” 5th Edition, Design Community College Inc, 2019
7. David Lee, “Design Thinking in the Classroom”, Ulysses Press, 2018
8. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, “The Little Booklet on Design Thinking: An Introduction”, 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, “Design Thinking: New Product Development Essentials”, Wiley-Blackwell, 2016
11. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies – presentation	10 Hours
Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions	20 Hours
Evaluating the students‘ activities through their presentations	

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19AD26C	**DATA STRUCTURES**	**L**	**T**	**P**	**E**	**C**
		2	**0**	**3**	**2**	**4.5**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply the concepts of array and linked list for solving problems. (K3)

CO2: apply stack and queue data structures to solve problems. (K3)

CO3: apply the tree concepts for efficient storage and retrieval of data. (K3)

CO4 recognize the various indexing techniques and distinguish various hashing and collision resolution techniques. (K2)

CO5: apply the graph algorithms to solve real-world challenges. (K3)

UNIT I LINEAR DATA STRUCTURES – ARRAYS AND LINKED LIST 21

Abstract Data Types (ADT) - List ADT - Array-based implementation - Linked list implementation - doubly-linked lists - Applications of Lists - Polynomial Operations.

Searching: Linear Search and Binary Search

Sorting: Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

UNIT II LINEAR DATA STRUCTURES – STACK AND QUEUE 21

Stack ADT - Array based and linked List based implementation - Postfix expression evaluation. Queue ADT - Circular queue and linked List based implementation - Applications of Queues

UNIT III NON-LINEAR DATA STRUCTURES – TREES 21

Trees – Implementation- Tree traversal with application- Binary trees - Expression tree - Threaded binary trees – Binary Search Tree – Applications of trees –Balanced Binary Search Trees: AVL trees and splay trees

UNIT III NON-LINEAR DATA STRUCTURES- INDEXING AND HASHING 21

Indexing: B Tree and B+ Tree - Priority Queues: Binary heaps with application to in-place sorting – Binomial Heaps - Hash Tables - Design of hash functions - Collision resolution schemes: chaining, open addressing schemes like linear probing, quadratic probing, double hashing.

UNIT V NON-LINEAR DATA STRUCTURES- GRAPH 21

Introduction - Representations (Matrix and Adjacency List) - Traversal techniques: Depth First Search, Breadth First Search (Stacks and Queues) – Prim‘s and Kruskal‘s Algorithm for Minimum Spanning Tree - Single Source Shortest Path algorithm, All Pair shortest path algorithm – Network Flow Problems – Biconnectivity.

LIST OF EXPERIMENTS

1. Implement sorting algorithms such as Merge sort, Quick sort, and Heap sort and analyze its complexities.
2. Implementation of singly linked lists
3. Represent a polynomial as a linked list and write functions for polynomial addition
4. Convert infix to postfix expression using Stack
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree
7. Implement insertion in AVL trees
8. Implement hashing with open addressing methods.
9. Implement Prim's algorithm and Kruskal‘s Algorithm to find MST of an undirected graph
10. Implement Dijkstra's algorithm to find the shortest path.

L: 30; P: 45; E: 30 TOTAL: 105 PERIODS

TEXT BOOK

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2016.

REFERENCES

1. Debasis Samanta, “Classic Data Structures”, 2nd Edition, Prentice Hall, 2012.
2. Reema Thareja, “Data Structures Using C”, 2nd Edition, Oxford University Press, 2019.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D.Ullman, “Data Structures and Algorithms”, Pearson Education, 2012.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press, 2008.
5. Richard Gilberg, Behrouz Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd Edition, Cengage Learning, 2004

19AD27C	COMMUNICATION AND SOFT SKILLS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1: enable learners to develop their communicative competence (K2)
CO2: participate in group discussions confidently (K3)
CO3: make presentations on general and technical topics (K3)
CO4: collaborate and work in teams successfully (K4)

UNIT I 6

Lab session: Listening and responding to audio files

Practice session: Mini Presentation related to Business English & Picture description.

UNIT II 6

Lab session: Role Play – News Reader

Practice session: Resume and cover letter Preparation

UNIT III 6

Practice session: Presentation, Group discussion

UNIT IV 6

Project: Preparing a project report with a team of five members on recent topics about technology.

L:30; TOTAL:30 PERIODS

REFERENCE BOOKS

1. Dhanavel, S. P. “English and Soft Skills” Vol.1, Orient BlackSwan, Chennai 2010
2. Lewis. S and Weintraub. R, “InCredible Communication: Uncover the Invaluable Art of Selling Yourself.” 1st Edition, London: Bloomsbury, 2022.
3. Sudha Rani, D. “Advanced Communication Skills Laboratory Manual.” New Delhi: Pearson, 2010.

NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai & Accredited by NAAC)

K.R.NAGAR, KOVILPATTI – 628 503
www.nec.edu.in

REGULATIONS – 2019

CURRICULUM & SYLLABUS

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

Accredited by NBA

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABUS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To produce Electronics and Communication Engineers capable of generating a knowledge economy with social responsibility

MISSION

- To impart high quality education with ethical behavior.
- To equip the students compatible with recent trends in Electronic industries.
- To develop leadership qualities with humanity, wisdom, creativity and team spirit.
- To provide a passionate environment for continual learning.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduate will have successful technical career in core and related fields.
2. Graduates will pursue higher education and work in Research and Development for solving real world problems.
3. Graduates will have leadership qualities with social consciousness and ethics.

PROGRAMMEOUTCOMES (POs)

1. An ability to apply knowledge of mathematics, science, engineering and technology to solve complex Electronics and communication Engineering problems.

2. An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering sciences.
3. An ability to provide solution and to design Electronics and Communication systems that meets out the social needs.
4. An ability to investigate the problems in an Electronics and Communication systems and rectifying it.
5. An ability to use latest hardware and software tools to solve complex engineering problems.
6. An ability to gain knowledge on contemporary issues which influence engineering design.
7. Awareness on society and environment to have sustainable solution for Electronics and Communication engineering problems.
8. An ability to demonstrate understanding of professional and ethical responsibilities.
9. An ability to work efficiently as an individual and in multidisciplinary teams.
10. An ability to communicate effectively and efficiently both in verbal and written form.
11. An ability to develop confidence for self education and understanding the value for life-long learning.
12. Able to implement Electronic system projects for real world applications.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **ECE programme** is designed with total number of credits ***166 (127***for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table-1.

TABLE – 1 CATEGORY OF COURSES

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	11
2.	Basic Science courses	27
3.	Engineering Science courses	20
4.	Programme Core courses	66
5.	Programme Elective courses relevant to chosen specialization / branch	15
6.	Open Elective courses from other technical and /or emerging subject areas	12
7.	Skill Development Courses	15
8.	Mandatory courses	(non – credit)
	TOTAL	**166**

i. **Humanities and Social Sciences(HSMC)**include English, Communication Skill laboratory and Management courses

ii. **Basic ScienceCourses (BSC)** include Chemistry, Physics, Biology and Mathematics

iii. **Engineering Science Courses (ESC)** include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering

iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.

vii. **Skill Development Courses (SDC)** includethe courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.

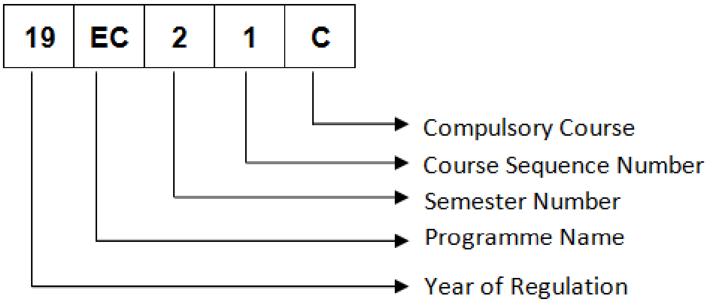
viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

TABLE – 2 QP – QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE


19
EC
2
1
C
Compulsory Course
Course Sequence Number
Semester Number
Programme Name
Year of Regulation

REGULATIONS – 2019 CURRICULUM AND SYLLABUS

SEMESTER – I

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19EC11C	Basic Electrical Engineering	3	0	0	3	A
PRACTICAL COURSES								
6.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	-
7.	ESC	19SH17C	Engineering Practice Laboratory* Part A – Mechanical Laboratory Part B – Electrical and Electronics Laboratory	0	0	4	2	-
8.	ESC	19EC12C	Basic Electrical Engineering Laboratory	0	0	4	2	-
			TOTAL	**12**	**1**	**11**	**18.5**	

SEMESTER – II

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1	HSMC	19EC21C	Professional English	2	0	0	2	B
2	BSC	19EC22C	Calculus and Laplace Transform	3	1	0	4	A
3	BSC	19EC23C	Electromagnetic Theory	2	0	0	2	B
4	BSC	19EC24C	Biology and Biomaterials	2	0	0	2	B
5	ESC	19EC25C	Problem Solving Techniques	3	0	0	3	A
6	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
PRACTICAL COURSES								
7.	BSC	19EC26C	Electromagnetism and Biology Laboratory Part A – Electromagnetism Laboratory Part B – Biology Laboratory	0	0	3	1.5	-
8.	ESC	19EC27C	Problem Solving Techniques Laboratory	0	0	4	2	-
9.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
			TOTAL	**15**	**1**	**13**	**22.5**	

SEMESTER – III

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19EC31C	Electronic Devices	3	0	0	3	A
2.	PCC	19EC32C	Digital System Design	3	0	0	3	A
3.	PCC	19EC33C	Signals and Systems	3	0	0	3	A
4.	PCC	19EC34C	Network Theory	3	0	0	3	A
5.	BSC	19EC35C	Fourier Series and Mathematical Transforms	3	1	0	4	A
6.	ESC	19EC36C	C++ and Data structures	3	0	0	3	A
PRACTICAL COURSES								
7.	PCC	19EC37C	Electronic Devices Laboratory	0	0	3	1.5	-
8.	PCC	19EC38C	Digital System Design Laboratory	0	0	3	1.5	-
9.	ESC	19EC39C	C++ and Data structures Laboratory	0	0	2	1	-
			TOTAL	**18**	**1**	**8**	**23**	

SEMESTER – IV

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19EC41C	Analog and Digital Communication	3	1	0	4	A
2.	PCC	19EC42C	Electronic Circuits	3	1	0	4	A
3.	PCC	19EC43C	Microprocessor & Microcontrollers	3	0	0	3	A
4.	BSC	19EC44C	Probability, Random Processes and Queuing Theory	3	1	0	4	A
5.	MAC	19MC02C	Constitution of India	3	0	0	0	D
PRACTICAL COURSES								
6.	PCC	19EC45C	Analog and Digital Communication Laboratory	0	0	3	1.5	-
7.	PCC	19EC46C	Electronic Circuits Laboratory	0	0	3	1.5	-
8.	PCC	19EC47C	Microprocessor and Microcontrollers Laboratory	0	0	3	1.5	-
9.	HSMC	19EC48C	Communication Skills Laboratory	0	0	2	1	-
			TOTAL	**15**	**3**	**11**	**20.5**	

SEMESTER – V

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19EC51C	Electromagnetic Waves	3	0	0	3	A
2.	PCC	19EC52C	Computer Architecture	3	0	0	3	A
3.	PCC	19EC53C	Linear Integrated Circuits	3	0	0	3	A
4.	PCC	19EC54C	Digital Signal Processing	3	0	0	3	A
5.	PEC		Programme Elective-1	3	0	0	3	A
6.	OEC		Open Elective - 1	3	0	0	3	A
7.	MAC	19MC01C	Environmental Science and Engineering	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19EC55C	Electromagnetic Waves Laboratory	0	0	3	1.5	-
9.	PCC	19EC56C	Digital Signal Processing Laboratory	0	0	3	1.5	-
10.	PCC	19EC57C	Linear IC and Measurements Laboratory	0	0	3	1.5	-
			TOTAL	**21**	**0**	**9**	**22.5**	

SEMESTER – VI

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19EC61C	Wireless Communication	3	0	0	3	A
2.	PCC	19EC62C	Control Systems	3	0	0	3	A
3.	PCC	19EC63C	Computer Networks	3	0	0	3	A
4.	PCC	19EC64C	VLSI Design	3	0	0	3	A
5.	PCC	19EC65C	Antenna and wave propagation	3	0	0	3	A
6.	PEC		Programme Elective – 2	3	0	0	3	A
PRACTICAL								
7.	PCC	19EC66C	Computer Networks Laboratory	0	0	3	1.5	_
8.	PCC	19EC67C	VLSI Design Laboratory	0	0	3	1.5	_
9.	SDC	19EC68C	Product Development Laboratory	1	0	2	2	_
			TOTAL	**18**	**0**	**10**	**23**	

SEMESTER – VII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY								
1	HSMC	19EC71C	Project Management and Finance	3	0	0	3	A
2	HSMC	19EC72C	Professional Ethics and Human Values	3	0	0	3	A
3	PEC		Programme Elective – 3	3	0	0	3	A
4	PEC		Programme Elective – 4	3	0	0	3	A
5	PEC		Programme Elective – 5	3	0	0	3	A
6	OEC		Open Elective – 2	3	0	0	3	A
7	OEC		Open Elective – 3	3	0	0	3	A
PRACTICAL								
8	PCC	19EC73C	Comprehension	0	0	2	1	-
9	SDC	19EC74C	Project work - I	0	0	6	3	-
			TOTAL	**21**	**0**	**8**	**25**	

SEMESTER – VIII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY								
1	OEC		Open Elective – 4	3	0	0	3	A
PRACTICAL								
2	SDC	19EC81C	Project work – II	0	0	12	6	-
3	SDC	19EC82C	Internship / In-Plant Training	0	0	4	2	-
			TOTAL	**3**	**0**	**16**	**11**	

TOTAL CREDITS: 166

LIST OF ELECTIVES

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
SIGNAL and IMAGE PROCESSING								
1.	PEC	19EC01E	Speech and Audio Processing	3	0	0	3	A
2.	PEC	19EC02E	Digital image and video processing	3	0	0	3	A
3.	PEC	19EC03E	Mixed Signal Design	3	0	0	3	A
4.	PEC	19EC04E	Adaptive Signal Processing	3	0	0	3	A
5.	PEC	19EC05E	Wavelet Transforms	3	0	0	3	A
6.	PEC	19EC06E	Digital Signal Processors	3	0	0	3	A
7.	PEC	19EC07E	Bio-signal Processing	3	0	0	3	A
RF and COMMUNICATION ENGINEERING								
8.	PEC	19EC18E	Introduction to MEMS	3	0	0	3	A
9.	PEC	19EC19E	Information Theory and Coding	3	0	0	3	A
10.	PEC	19EC20E	Satellite Communication	3	0	0	3	A
11.	PEC	19EC21E	Radar and Navigational Aids	3	0	0	3	A
12.	PEC	19EC22E	Statistical Theory of Communication	3	0	0	3	A
13.	PEC	19EC23E	Multimedia Compression and Communication	3	0	0	3	A
14.	PEC	19EC24E	Global Navigation Satellite System	3	0	0	3	A
15.	PEC	19EC25E	Electromagnetic Interference and Compatibility	3	0	0	3	A
16.	PEC	19EC26E	Advanced Wireless Communication	3	0	0	3	A
17.	PEC	19EC27E	Error control codes	3	0	0	3	A
18.	PEC	19EC28E	Microwave Theory and Techniques	3	0	0	3	A
19.	PEC	19EC29E	Fiber Optic Communications	3	0	0	3	A
VLSI and EMBEDDED SYSTEM								
20.	PEC	19EC35E	Nanoelectronics	3	0	0	3	A
21.	PEC	19EC36E	Advanced Microprocessors	3	0	0	3	A
22.	PEC	19EC37E	Fundamentals of Semiconductor Chip Testing	3	0	0	3	A
23.	PEC	19EC38E	ARM Processor Architecture and Programming	3	0	0	3	A
24.	PEC	19EC39E	Embedded and Real Time Systems	3	0	0	3	A
25.	PEC	19EC40E	PLC and SCADA	3	0	0	3	A

26.	PEC	19EC41E	Embedded System Architecture	3	0	0	3	A
27.	PEC	19EC42E	Embedded System Analysis and Risk Management	3	0	0	3	A
APPLIED ELECTRONICS								
28.	PEC	19EC45E	Bio-Medical Electronics	3	0	0	3	A
29.	PEC	19EC46E	Power Electronics	3	0	0	3	A
30.	PEC	19EC47E	High Speed Electronics	3	0	0	3	A
31.	PEC	19EC48E	Measurements and Instrumentation	3	0	0	3	A
32.	PEC	19EC49E	PCB Design and Fabrication	3	0	0	3	A
NETWORKS								
33.	PEC	19EC56E	Wireless Sensor Networks	3	0	0	3	A
34.	PEC	19EC57E	Mobile Adhoc Networks	3	0	0	3	A
35.	PEC	19EC58E	Cryptography and Network Security	3	0	0	3	A
36.	PEC	19EC59E	Fundamentals of Cyber Security	3	0	0	3	A
37.	PEC	19EC60E	Principles of Operating System	3	0	0	3	A
38.	PEC	19EC61E	Scientific Computing	3	0	0	3	A
39.	PEC	19EC62E	Edge Analytics and Internet of Things	3	0	0	3	A
40.	PEC	19EC63E	Machine Learning Techniques	3	0	0	3	A
41.	PEC	19EC64E	Blockchain and its applications	2	0	2	3	A
42.	PEC	19EC65E	Introduction to Internet of Things	3	0	0	3	A
43.	PEC	19EC66E	Database Management System for IoT	3	0	0	3	A
44.	PEC	19EC67E	IoT: Architecture, Standards and Protocols	3	0	0	3	A
45.	PEC	19EC68E	Wireless Technologies for IoT	3	0	0	3	A
46.	PEC	19EC69E	IoT Big Data Analytics	3	0	0	3	A
SKILL DEVELOPMENT COURSE								
47	SDC	19EC70E	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3	-

ONE CREDIT ELECTIVE COURSES (PEC)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
1.	PEC	19EC01L	Basic Device Driver Programming Practice	0	0	2	1	-
2.	PEC	19EC02L	Image Processing Practice using OpenCV	0	0	2	1	-

3.	PEC	19EC03L	Introduction to OFDM	1	0	0	1	C
4.	PEC	19EC04L	Wireless Communication System design using SDR	0	0	2	1	-
5.	PEC	19EC05L	OFDM System Design using SDR	0	0	2	1	-
6.	PEC	19EC06L	Spreading codes in Spread Spectrum Modulation	1	0	0	1	C
7.	PEC	19EC07L	Memory Built in Self Test (MBIST)	1	0	0	1	C
8.	PEC	19EC08L	Joint Test Action Group (JTAG)	1	0	0	1	C
9.	PEC	19EC09L	Network Traffic Analysis using Wireshark Laboratory	0	0	2	1	-
10.	PEC	19EC10L	Intrusion detection system using Snort Laboratory	0	0	2	1	-
11.	PEC	19EC11L	Vulnerability Assessment and Penetration Testing Laboratory	0	0	2	1	-
12.	PEC	19EC12L	Malware Analysis and Reverse Engineering Laboratory	0	0	2	1	-
13.	PEC	19EC13L	Cyber Security: Governance, Risk and Compliance	1	0	0	1	C
14.	PEC	19EC14L	Programming in JAVA	0	0	2	1	-
15.	PEC	19EC15L	Programming in Python	0	0	2	1	-
16.	PEC	19EC16L	Consumer Electronics	1	0	0	1	C
17.	PEC	19EC17L	Computational Electromagnetics Laboratory	0	0	2	1	-
18.	PEC	19EC18L	Advanced Communication Systems Laboratory	0	0	2	1	-
19.	PEC	19EC19L	Machine Learning Techniques Laboratory	0	0	2	1	-
20.	PEC	19EC20L	Web of Things Laboratory	0	0	2	1	-
21.	PEC	19EC21L	Database Management System Laboratory	0	0	2	1	-
22.	PEC	19EC22L	Internet of Things Laboratory	0	0	2	1	-

OPEN ELECTIVE COURSES

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
1.	OEC	19EC01N	Basics of Communication Systems	3	0	0	3	A
2.	OEC	19EC02N	Overview of Communication systems	3	0	0	3	A

3.	OEC	19EC03N	CMOS technology and Chip Testing	3	0	0	3	A
4.	OEC	19EC04N	Automotive Electronics	3	0	0	3	A
5.	OEC	19EC05N	Electronics and Microprocessors	3	0	0	3	A
6.	OEC	19EC06N	ARM processor and programming	3	0	0	3	A
7.	OEC	19EC07N	Fundamentals of Digital Signal Processing	3	0	0	3	A
8.	OEC	19EC08N	Embedded and Real Time Systems	3	0	0	3	A

19SH11C	**TECHNICAL ENGLISH**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply the basic language skills to understand various aspects of communication skills (K3)
CO2: express their thoughts with correct usage of language in formal writings (K3)
CO3: understand various language components and develop the pronunciation skill. (K2)
CO4: make effective technical writings and interpret any pictorial representation. (K3)
CO5: frame sentences and write effective reports. (K3)

UNIT I **6**

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, letter to Friend / Parent / Siblings - Greetings and Self Introduction – Situational Phrases - Tense (Present)

UNIT II **6**

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) –Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

UNIT III **6**

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

UNIT IV **6**

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

UNIT V **6**

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

Suggested Activity: Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Anderson, Paul V. “Technical Communication: A Reader - Centered Approach”, 9th Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. “A Comprehensive Grammar of the English Language”, Longman Inc., Newyork, 2014.

REFERENCES

1. Murphy Raymond, “Basic Grammar Practice on Tense”, Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., “Engineering English”, Orient Blackswan: Hyderabad, 2015.

19SH12C MATHEMATICAL FOUNDATIONS FOR ENGINEERS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make use of orthogonal transformation. (K3)
CO2: find the evolutes of various curves.(K2)
CO3: maxima and minima of real valued functions.(K3)
CO4: solve ordinary differential equations.(K2)
CO5: solve partial differential equations.(K2)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivative – Total derivative – Euler’s theorem on homogeneous functions – Taylor’s Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange’s multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order ordinary differential equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9th Edition, Dorling Kindersley Private Limited, 2010.

19SH13C ENGINEERING PHYSICS L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)
CO2: understand the principle and propagation of different types of waves (K2)
CO3: choose the appropriate Laser technique for industrial and medical applications (K2)
CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)
CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

UNIT I CRYSTALLOGRAPHY 6

Lattice, Unit cell, Bravais lattice, Lattice planes - Crystal system - Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

UNIT II WAVES 6

Simple harmonic oscillators - Damped harmonic oscillator - Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

UNIT III LASER 6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

UNIT IV FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

UNIT V QUANTUM PHYSICS 6

Black Body Radiation - Matter Waves - Heisenberg's uncertainty principle - Schrodinger's wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 11th Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", 7th Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D. J. Griffiths, "Quantum mechanics", 2nd Edition, Cambridge University Press, 2014.

REFERENCES

1. Renk, Karl.F "Basics of laser physics", 2nd Edition, Springer International publishing, 2017.
2. H. J. Pain,Patricia Rankin "Introduction to vibration and waves", 1st Edition, Wiley, 2015
3. K.S.Mathur, "Fundamentals of Fiber Optics", 1st Edition, Zorba books, 2018.

19SH14C ENGINEERING CHEMISTRY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)

CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)

CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)

CO4: familiar with the various novel organic material used in electronics industry. (K2)

CO5: understand the principle, components and working of various analytical instruments. (K2)

UNIT I WATER TREATMENT 6

Hardness - Estimation of hardness of water – Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

UNIT II SURFACE CHEMISTRY AND CATALYSIS 6

Adsorption – Types - Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – Kinetics of surface reactions - Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications - Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

UNIT III ELECTROCHEMISTRY AND CORROSION 6

Electrode potential-Nernst Equation-reference electrode - glass electrode - measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)
Corrosion: Types of corrosion - Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

UNIT IV ELECTRONIC MATERIALS 6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidene fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, biosensor - chemical sensors

UNIT V ANALYTICAL TECHNIQUES 6

Spectroscopy:Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20th Edition, 2018.

REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6th Edition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, "Organic Electronics: Materials, manufacturing and applications", Wiley - VCH, 2016

19EC11C BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the basic concepts of DC electrical circuits (K2)
CO2: infer the electrical quantities of AC electrical circuits (K2)
CO3: describe the working principles of DC electrical machines and transformers (K2)

CO4: recall the working characteristics of AC electrical machines (K2)
CO5: outline the functions of the instruments and component of low voltage electrical installations (K2)

UNIT I DC CIRCUITS 9

Electrical Circuit Elements – Ideal and Practical Sources – Charge – Electrical Quantities: Voltage, Current, Power and Energy – Ohms Law – Kirchoff Laws – Series and Parallel Circuit Connection – Star and Delta Circuit.

UNIT II AC CIRCUITS 9

AC Fundamentals: Impedance – Description of AC using Magnitude, Frequency and Phase – Peak, Average and RMS Values of AC Signal – Power and Power Factor – Single Phase Circuits and Three Phase Circuits – Voltage and Current in Star and Delta connection.

UNIT III DC ELECTRICAL MACHINES AND TRANSFORMERS 9

DC Machines: General Construction – Working Principles – DC Motor Starters – Speed Control of DC Motors with Power Converters.

Transformers: Construction and Working Principles, Types – Losses, Regulation and Efficiency - Three Phase Transformers Connections – Auto Transformers.

UNIT IV AC ELECTRICAL MACHINES 9

Three Phase Synchronous Generators: Principle of Operation, Types and Constructional Features.

AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Torque- Slip Characteristics - Starting and Speed Control of Induction Motors - Inverters.

UNIT V INSTRUMENTS AND ELECTRICAL INSTALLATION 9

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.

Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. D.P. Kothari and I.J. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 3rd Edition, 2010.
2. P.S. Bimbhra, "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.
3. A.K.Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2004.

REFERENCES

1. D.C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, Revised 1st Edition, 2011.
2. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill, 2003.

19SH16C ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY

		L	T	P	C
19SH16C	**ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY**	**0**	**0**	**3**	**1.5**

(Common to all B.E. / B.Tech. Degree Programmes)

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K2)
CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium.(K2)
CO3: illustrate the electrical properties of materials. (K2)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster's bridge.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. David Loyal, " Physics laboratory" 4th Edition, Cengage learning, 2013
2. Sesha Sai Kumar Vemula, "Engineering Physics lab manual" 1st Edition, LAP LAMBERT Academic Publishing, 2017

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: determine various water quality parameters. (K2)
CO 2: quantify different ions by different analytical techniques. (K2)
CO3: determine the rate of corrosion of mild steel plate. (K2)
CO4: verify the freundlich adsorption isotherm. (K2)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron (Fe^{2+}) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.
6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron (Fe^{2+}) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris "Quantitative Chemical Analysis: International Edition", W.H.Freeman, 9th Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford , P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19SH17C ENGINEERING PRACTICE LABORATORY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) **0 0 4 2**

PART A - MECHANICAL LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: prepare different carpentry joints. (K3)
CO2: prepare pipe connections with different joints for domestic applications. (K3)
CO3: make simple components using sheet metal (K3)
CO4: make components using machining operations (K3)
CO5: explain the types of welding processes (K2)
CO6: discuss the applications of 3D printing and injection moulding processes (K2)

LIST OF EXPERIMENTS

I. CARPENTRY PRACTICES 5

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands on exercise with application

II. PLUMBING PRACTICES 5

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands on exercise with application

III. SHEET METAL PRACTICES 5

1. Forming and Bending
2. Model making: Tray, Conical Funnel etc.

IV. MACHINING PRACTICES 5

1. Simple Turning
2. Drilling Practice
3. Model making: Shaft, stiffener plate, square flange, etc.
4. Demonstration of machining process in Vertical Machining Centre (VMC)

V. METAL JOINING PROCESS 5

1. Demonstration of Gas, Arc and TIG Welding

VI. ADDITIVE MANUFACTURING AND INJECTION MOULDING PROCESSES 5

1. Demonstration of 3D Scanning and Printing
2. Demonstration of Injection Moulding process

P: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Bawa H.S, “Workshop Practice”, Tata McGraw Hill Publishing Company Limited, 2007

REFERENCES

1. Ramesh Babu V, “Engineering Practices Laboratory Manual”, Revised Edition, VRB Publishers Private Limited, Chennai, 2014.
2. Jeyachandran K, Natarajan S. and Balasubramanian S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
3. Jeyapoovan T, Saravanapandian M. and Pranitha S, “Engineering Practices Lab Manual”, Vikas Publishing House Private Limited, 2006.
4. Rajendra Prasad A and Sarma PMMS, “Workshop Practice”, Sree Sai Publication, 2002
5. Kannaiah P and Narayana KL, “Manual on Workshop Practice”, Scitech Publications, 1999.

PART B – ELECTRICAL AND ELECTRONICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: perform residential house wiring (K2)

CO2: identify faults in any electrical appliances (K2)
CO3: measure energy and resistance to earth of electrical equipment (K2)
CO4: measure AC signal parameters using CRO (K2)
CO5: apply soldering for electronic circuit formation in PCB (K2)

LIST OF EXPERIMENTS

ELECTRICAL

1. Residential House Wiring using Switches, Fuse, Indicator, Lamp and Energy Meter.
2. Stair Case Wiring Connections
3. Measurement of Energy using Energy Meter for Single Phase System.
4. Measurement of Earth Resistance using Electrical Equipment.
5. Study of Emergency Lamp, Choke, Starter, Fan and Iron Box
6. Coil Rewinding for Transformer and Fan using Rewinding Machine.
7. Connection of protective devices

ELECTRONICS

8. Study of Resistor, capacitor and inductor
9. Study and Operation of Digital Multimeter, Function/Signal Generator and Regulated Power Supply.
10. Measurement of AC signal parameter (Peak-Peak, RMS, Period and Frequency) using CRO and DSO.
11. Soldering Practice
12. Study of logic gates AND, OR, NOT, NAND, NOR and EXOR.
13. Half Wave Rectifier and Full Wave Rectifier.

P: 30; TOTAL: 30PERIODS

REFERENCES

1. Jeyachandran K, Natarajan S and Balasubramanian S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Jeyapoovan T, Saravanapandian M and Pranitha S, "Engineering Practices Lab Manual", Vikas Publishing House Pvt. Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A and Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.
5. Kannaiah P and Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.

19EC12C BASIC ELECTRICAL ENGINEERING LABORATORY L T P C

0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the common components with different rating and use the instruments (K2)

CO2: analyze the basic electrical circuits (K2)
CO3: infer the characteristics of electrical machines (K2)

LIST OF EXPERIMENTS

1. Basic Safety Precautions, Practical Circuit Elements and Measuring Instruments – Voltmeter, Ammeter, Wattmeter and Energy Meter
2. Verification of Ohms Law and Kirchoff Laws
3. Star and Delta Configuration in electrical circuits.
4. Load test on DC shunt Motor
5. Load test on DC series Motor
6. Speed Control of DC shunt Motor.
7. Load test of single Phase Transformer
8. Load test on Single Phase Induction Motor
9. Load test on Three Phase Induction Motor
10. Measurement of Power and Power Factor with resistive and inductive Loads
11. Speed Control of Three Phase Induction Motor.

P:30; TOTAL: 30 PERIODS

19EC21C PROFESSIONAL ENGLISH L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: integrate and apply the acquired skills in real life situation. (K3)
CO 2: write effectively in any professional contexts. (K3)
CO 3: enhance the vital sub-functions of communication in any formal situation. (K3)
CO 4: participate actively in any informal and formal discussion. (K3)
CO 5: recall the acquired skills and apply them in their work place. (K2)

UNIT I 6

Standard Abbreviations - If Conditionals - Presenting articles based on newspaper reading - Listening for specific information - Argumentative essay.

UNIT II 6

One word substitution - Rearranging the jumbled phrases of sentences – Chart Description - Business Letters for Quotations and Clarification.

UNIT III 6

Idioms and Phrases - Direct & Indirect Speech - Business Letters for Placing orders and Making Complaints - Process Description.

UNIT IV 6

Synonyms **-** Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples - Demo) - Proposal Writing.

UNIT V 6

Error Spotting (Based on Concord, Pronouns, Articles & Adverb Placement) - Job Application Letter & Resume Preparation - Circular and Minutes of the meeting - Reading Comprehension.

Suggested Activity: Career Analysis – Herein the students will be required to submit a report about their dream career / company of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Board of editors. “Fluency in English A Course book for Engineering and Technology”, Orient Blackswan, Hyderabad, 2016.
2. Bovee, Courtland, L., John V.Thill. “Business Communication Today”, 13th Edition, Pearson Education, New Delhi, 2018.

REFERENCES

1. Lester Mark and Larry Beason, “Hand book of English Grammar and Usage”, McGraw Hill Education, 1st Edition, 2017.
2. Raman, Meenakshi and Sharma, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press, New Delhi, 2014.

19EC22C CALCULUS AND LAPLACE TRANSFORM

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: evaluate area and volume using double and triple integrals. (K3)
CO2: analyze the concepts related to vector calculus. (K3)
CO3: grasp Analytic functions and their properties.(K2)
CO4: evaluate complex integration over contour. (K3)
CO5: perform the ideas of Laplace transform. (K3)

UNIT I MULTIPLE INTEGRALS 12

Double integration – Cartesian and polar coordinates - Change of order of integration - Change of variables between Cartesian and polar coordinates - Triple integration in Cartesian coordinates - Area as double integral - Beta and Gamma functions and their properties.

UNIT II VECTOR CALCULUS 12

Gradient, Divergence and Curl –Directional derivatives – Irrotational and solenoidal vector fields -Vector integration–Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs)–Simple applications involving cubes and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+c, cz, 1/z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Cauchy's integral theorem and Cauchy‟s integral formula – Taylor's and Laurent's expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi- circular contour excluding poles on boundaries.

UNIT V LAPLACE TRANSFORM 12

Existence conditions -– Transforms of elementary functions – Properties – Transform of Derivatives and Integrals - Transforms of periodic functions - Inverse transforms – Initial and final value theorems – Convolution theorem.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publications, 44th Edition, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition, 2011.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", Laxmi Publications Private Limited, 9th Edition, 2017.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 6th Edition , 2008.
3. Jain RK and Iyengar SRK, "Advanced Engineering Mathematics", Narosa Publishing House Pvt. Ltd, 4th Edition, 2014.

19EC23C ELECTROMAGNETIC THEORY L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: know the basic mathematical concepts related to electromagnetic vector fields (K2)
- CO2: understand the perception of electrostatics and its applications.(K2)
- CO3: explain the concepts of electrostatics in dielectric medium (K2)
- CO4: summarize the concepts of magnetostatics and its applications.(K2)
- CO5: acquire knowledge on the laws in electrodynamics and apply them to electrical engineering problems (K2)

UNIT I VECTOR ANALYSIS 6

Scalar and vector fields - operator Del(∇) - gradient, divergence and curl of electrostatic field - Gauss Divergence theorem – Stoke’s theorem – coordinate systems – cartesian – cylindrical – spherical coordinate systems – vector identities.

UNIT II ELECTROSTATICS 6

Electric flux – displacement density – Gauss law – Coulomb’s law – electric field- electric potential – charged disc – charged ring – charged wire – Poisson’s and Laplace equations for electrostatic potential – uniqueness of solution – steady state diffusion and thermal conduction – Faraday’s cage – coffee- ring effect

UNIT III ELECTROSTATICS IN DIELECTRIC MEDIUM 6

Electrostatic potential and field due to dipole- Gauss law for dielectrics – electric polarization – displacement – dielectric boundary conditions (1st and 2nd) - electrostatic problems in presence of dielectric – point charge at the centre of sphere – capacitance – parallel plate capacitor – cylindrical capacitor – energy stored in capacitor – force of attraction between plates

UNIT IV MAGNETOSTATICS 6

Magnetic field – flux density – magneto motive force – Biot-Savart law – magnetic field due to finite conductor – circular loop – Ampere’s law – magnetic field due to lay wire – solenoid – magnetic boundary condition – inductance – Types and properties of magnetic materials –Dia, para and ferro magnetisation – hysteresis loss.

UNIT V ELECTRODYNAMICS AND ELECTROMAGNETIC WAVES 6

Faraday’s laws of electromagnetic induction – dynamically induced emf – lenz law – Faraday’s disc generator – emf equation of single loop generator (electromagnetic generator) – Electromagnetic breaking and its applications – Electromagnetic waves – Properties and Applications.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Griffiths,“Introduction to Electrodynamics” Cambridge University Press, 4th Edition, 2017
2. Mathew N. O. Sadiku, “Principles of Electromagnetics”, Oxford University Press, 6th Edition, 2015.
3. Ashutosh Pramanik, ‘Electromagnetism–Theory and Applications’, PHI Learning Private Limited, New Delhi, 2nd Edition, 2008.

REFERENCES

1. David Halliday, Robert Resnick,Jearl Walker, “ Fundamentals of Physics”, John Wiley & Sons Inc.USA, 10th Edition, 2014
2. Joseph. A.Edminister, “Schaum’s Outline of Electromagnetics”, 3rd Edition (Schaum’s Outline Series), Tata McGraw Hill, 2010
3. William H. Hayt and John A. Buck, “Engineering Electromagnetics”, 8th Revised edition Tata McGraw Hill, 2011.

4. Kraus and Fleish, "Electromagnetics with Applications", 5th Edition, McGraw Hill International Editions, 2010.

19EC24C BIOLOGY AND BIOMATERIALS

L	T	P	C
2	0	0	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe and comprehend the fundamental concepts of cell biology. (K2)
CO2: understand the various bimolecular interactions in living organisms. (K2)
CO3: familiar with various metabolic reactions in living organisms. (K2)
CO4: know the various biomaterials and its testing procedure. (K2)
CO5: understand the working methodology of various biosensors. (K2)

UNIT I CELL BIOLOGY 6

Cell: organization of prokaryotic and eukaryotic cells - structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus - cell division: mitosis and meiosis.

UNIT II BIO-MOLECULAR INTERACTIONS 6

DNA and RNA - hydrophobicity and hydrophilicity - Molecular interactions: covalent and non covalent interaction- partition coefficient: (Log p) octanol -water system -Lipinski's rule

UNIT III METABOLISM 6

Cell metabolism - regulation of blood glucose and homeostasis - glycogenesis and glycogenolysis and their regulation - measurement of blood glucose level.

UNIT IV BIOMATERIALS AND TESTING 6

Degradable biomaterials: PGA and PLA-Composite Biomaterials: Properties-classification-Applications: fabrication of biodevices and implants.
Testing: physiochemical test, mechanical test, Invitro and Invivo.

UNIT V BIOSENSORS 6

Biosensor – requirements – classification: amperometric enzyme electrodes and Potentiometric enzyme electrodes - construction and function – application: determination of enzyme activity and immunoassay – advantages.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Y. Nelson, L. David, Lehninger, "Principles of Biochemistry", International Edition. New York: W. H. Freeman, Macmillan Learning, 7th Edition, 2017.
2. Nagata, Kazuhiro, Real-Time Analysis of Biological Interactions, Springer, Japan, 3rd Edition, 2015.
3. I. Bertini, H.B Gray, Bioinorganic Chemistry, Viva Books Private Limited, 4th Edition, 2014.

REFERENCES

1. P.N.Bartlett, Bioelectrochemistry: Fundamentals, Experimental Techniques and Applications, 2nd Edition, John Wiley & Sons, 2014.
2. Ratner and Hoffmann, Biomaterial Science: An Introduction to Materials in Medicine, 2nd Edition, 2015.
3. D. V. Vranken, G.A. Weiss, Introduction to Bioorganic Chemistry and Chemical Biology, CRC, Taylor & Francis, 1st Edition, 2012.

19EC25C PROBLEM SOLVING TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: develop algorithmic solutions to simple computational problems. (K3)
CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
CO 3: solve problems using array and functions. (K3)
CO 4: implement various sorting techniques. (K3)
CO 5: implement various searching techniques. (K3)

UNIT I BASICS OF PROBLEM SOLVING 9

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

UNIT II BASIC TECHNIQUES 9

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

UNIT III ARRAYS AND FUNCTIONS 9

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV SORTING TECHNIQUES 9

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

UNIT V SEARCHING TECHNIQUES 9

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Maureen Sprankle and Jim Hubbard, "Problem Solving and Programming Concepts", Prentice Hall, 9th Edition, 2012.
2. Harsha Priya, R. Ranjeet, — Programming and Problem Solving Through C Language, Firewall / Laxmi Publications (P) Ltd., New Delhi, 2015.

REFERENCES

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, Oxford University Press, 2nd Edition, 2013.
2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner's Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

19SH15C	**ENGINEERING GRAPHICS**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2 0 4 4**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
CO2: construct the orthographic projections of points, straight lines and lamina (K2)
CO3: draw the projections of simple solids in different positions. (K3)
CO4: visualize the sectional views and surface areas of various solids. (K3)
CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.
Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P: 60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, "Engineering Drawing", 53rd Edition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2nd Edition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, "Engineering Drawing", Subhas Publications, 32nd Edition, 2017.

19EC26C	ELECTROMAGNETISM AND BIOLOGY LABORATORY	L T P C 0 0 3 1.5

PART A ELECTROMAGNETISM LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the magnetic properties of the materials (K2)
CO2: interpret the operation and the effects of series / parallel resonance circuit (K2)
CO3: illustrate the properties of electromagnetic waves (K2)

LIST OF EXPERIMENTS

1. Determination of Hysteresis loss in ferromagnetic material
2. Determination of magnetic flux density and Hall coefficient of a semiconductor crystal

3. Series LCR Resonance circuit
4. Parallel LCR Resonance circuit
5. Determination of wavelength of mercury spectrum using spectrometer & grating.
6. Determination of Radius of curvature of a Plano convex lens using Newton‟s rings Method
7. Determination of horizontal intensity of earth's magnetic field and moment of bar magnet –Deflection magnetometer

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. R.K.Shukla, Anchal Srivastava, "Practical Physics-Electricity and magnetism" New Age Pvt Ltd, 2014
2. David Loyal, " Physics laboratory", Cengage learning, 4th Edition, 2013
3. Sesha Sai Kumar Vemula, "Engineering Physics lab manual", LAP LAMBERT Academic Publishing, 1st Edition, 2017

PART B BIOLOGY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: identify the various biomolecule by suitable chemical analysis. (K3)
CO 2: quantify the amount of acid, sodium and antioxidant by different analytical techniques. (K2)
CO3: estimate the retention factor and log P value of paracetamol and aspirin. (K2)
CO4: identify the molecular interactions of amino acid with biomolecule. (K3)

LIST OF EXPERIMENTS

1. Qualitative analysis of biomolecule.
2. Calculation of retention factor of paracetamol and aspirin.
3. Estimation of acid by pH metric method.
4. Study of interaction of amino acids with DNA by gel electrophoresis.
5. Study of interaction of amino acids with proteins by fluorescence spectrophotometer.
6. Determination of partition coefficient (log P) value for paracetamol and aspirin.
7. Determination of antioxidant activity by invitro method.
8. Estimation of sodium in bio-fluids by flame photometry.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Biology.

REFERENCES

1. P.Worsfold, A.Townshend, C.Poole, M.Miro, Encylopedia of Analytical science, Elsevier, 3rd Edition, 2018

19EC27C PROBLEM SOLVING TECHNIQUES LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: solve simple and Complex problems. (K3)
CO 2: solve sorting and searching problems. (K3)

LIST OF EXERCISES

Programs using simple logics and switch cases

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

Programs using Control Structures

5. Perform the following operations:
   a. Generate Pascal‘s triangle.
   b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.
7. Compute Sine series and Cosine series.
8. Find the 2‘s complement of a binary number.

Programs using Arrays

9. Perform the following operations:
   a. Matrix addition.
   b. Transpose of a matrix.
   c. Matrix multiplication by checking compatibility

Programs to manipulate Strings

10. Perform the following operations on a string:
    a. Insert a sub-string into main string at a given position.
    b. Delete n characters from a given position in a string.
    c. Check whether the given string is palindrome or not.
    d. Replace a character of string either from beginning or ending or at a specified location.

Programs using Functions

11. Perform the following operations: (Use recursive functions)
    a. Find the factorial of a given integer.
    b. Find the GCD (Greatest Common Divisor) of two given integers.
    c. Solve the Towers of Hanoi problem.

Programs using sorting and searching techniques

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

P: 60; TOTAL: 60 PERIODS

Software Requirement: Turbo C / Python

19GN01C INNOVATION THROUGH DESIGN THINKING

L T P C
1 0 2 2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)
CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS 15

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS 30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, “Design Thinking: The Handbook”, WS Professional, 2020
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving”, Penguin Random House, 2020
3. D.M. Arvind Mallik, “Design Thinking for Educators”, Notion Press, 2019
4. Michael Lewrick, “The Design Thinking Playbook”, Wiley, 2019
5. Kathryn Christopher, “Design Thinking in Engineering”, Kendall Hunt Publishing Company, 2019
6. Robert Curedale, “Design Thinking Process & Methods” 5th Edition, Design Community College Inc, 2019
7. David Lee, “Design Thinking in the Classroom”, Ulysses Press, 2018
8. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, “The Little Booklet on Design Thinking: An Introduction”, 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, “Design Thinking: New Product Development Essentials”, Wiley-Blackwell, 2016
11. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies - presentation	10 Hours
Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions	20 Hours
Evaluating the students‘ activities through their presentations	

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19EC31C ELECTRONIC DEVICES

L T P C QP
3 0 0 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the principles of semiconductor Physics (K2)
CO2: Discuss the diode characteristics and its applications (K2)
CO3: Discuss the characteristics of BJT and MOS transistors (K2)
CO4: Describe the operation and characteristics of special semiconductor devices (K2)
CO5: Describe the operation and characteristics of advanced MOS devices (K2)

UNIT I INTRODUCTION TO SEMICONDUCTOR PHYSICS 9

Classification of semiconductors, Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity, Generation and recombination of carriers; Poisson and continuity equation

UNIT II PN JUNCTION DIODE AND ITS APPLICATIONS 9

P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Characteristics of Zener diode, Schottky diode, Applications of diodes

UNIT III TRANSISTORS 9

Bipolar Junction Transistor- I-V characteristics, Ebers-Moll Model, JFET, MOS capacitor-C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Characteristics of LED, photodiode, SCR, DIAC, TRIAC, UJT

UNIT V ADVANCED MOS DEVICES 9

Advanced MOS devices Double Gate MOSFET, Tri Gate MOSFET, Gate All AroundMOSFET, FinFet.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. G.Streetman and S.K.Banerjee, “Solid State Electronic Devices,” 7th Edition, Pearson, 2014.
2. D.Neamen, D.Biswas "Semiconductor Physics and Devices," McGraw-Hill Education.

REFERENCES

1. S.M.Sze and K.N.Kwok, “Physics of Semiconductor Devices,” 3^{rd} Edition, John Wiley & Sons, 2006.
2. C.T.Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co.Inc,1991
3. Y.Tsividis and M.Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ. Press, 2011.
4. J.-P. Colinge, FinFETs and Other Multi-Gate Transistors, Springer 2008.

19EC32C DIGITAL SYSTEM DESIGN

	L	T	P	C	QP
	3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand and represent Logic function and simplify it (K2)
CO2 : Design and analyze combinational circuits (K3)
CO3 : Design and analyze sequential circuits (K3)
CO4 : Understand Logic families, working of Memory elements and ProgrammableLogic devices (K2)
CO5 : write simulation codes for digital circuits using Verilog HDL (K3)

UNIT I DIGITAL LOGIC AND ITS SIMPLIFICATION 9

Boolean algebra, Number systems, De Morgan’s theorem, Binary arithmetic, SOP, POS, Universal gates, Canonical forms, Duality, Binary codes, Code conversions, Boolean expression simplification using Karnaugh Maps

UNIT II COMBINATIONAL LOGIC 9

Adder, Subtractor, BCD Adder, Decoder, Encoder, Multiplexer, Function realization using Multiplexer & Decoder, Comparator, Parity generator & checker, Barrel shifter, ALU, Driver and Multiplexed display, Parallel adder

UNIT III SEQUENTIAL LOGIC 9

SR, JK, Master-slave, Edge triggered FFs, Ripple & Synchronous counter, Shift register, Design of synchronous sequential circuits- Moore, Mealy, Serial Adder Design, Generation of Pulse train, Pseudo random sequence and clock signals, Asynchronous sequential design- Hazards, Races

UNIT IV LOGIC FAMILIES, MEMORY ELEMENTS AND PLDs 9

TTL specifications, TTL, ECL, CMOS Logic Family and its Interfacing, Characteristics, Memory Elements – static RAM, dynamic RAM, ROM, EPROM, FPGA, Programmable Logic devices – PLA, PAL, PLD

UNIT V HDL PROGRAMMING 9

HDL, Verilog data types and objects, Modeling – Gate level, Data flow and behavioral, Programming for Adder, Multiplexer, Flipflops, Registers and Counters.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. M. Morris Mano, Michael D. Ciletti, "Digital Design with an introduction to VerilogHDL", PHI, 6th Edition, 2018
2. Charles Roth, L.K.John, B.K.Lee, "Digital System Design using Verilog", Cengage, 1st Edition, 2016.

REFERENCES

1. R.P. Jain, "Modern digital Electronics", Tata Mc-Graw Hill, 4th Edition, 2010.
2. Donald P.Leach, A.P.Malvino, GoutamSaha, "Digital Principles and Applications", Tata Mc-Graw Hill, 8th Edition, 2014
3. James E. Palmer, David E. Perlman, "Schuams Outlines-Introduction to Digital Systems", Tata McGraw Hill, 2nd Edition, 2003
4. Thomas L.Floyd, "Digital Fundamentals", PHI, 11th Edition, 2017.

19EC33C	SIGNALS AND SYSTEMS	L T P C QP
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Classify and analyze the types of signals, their responses and properties. (K2)
- CO2: Analyze the continuous time signals using Fourier series, Fourier transform and Laplace transform and also understand their properties (K3)
- CO3: Analyze the continuous time systems using Fourier transform and Laplace transform and to solve the frequency response of LTI-CT systems. (K3)
- CO4: Explore the sampling concepts and the effects of aliasing. (K2)
- CO5: Analyze the discrete time signals using Fourier transform and Z transform and to understand their properties. (K3)
- CO6: Analyze the discrete time systems using Fourier transform and Z- transform in order to solve the frequency response of LTI-DT systems. (K3)

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous time signals (CT signals), Discrete time signals (DT signals), Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals, periodic and aperiodic, random signals, CT systems and DT systems, Basic properties of systems, Linear Time Invariant systems and properties.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series analysis- trigonometric, cosine and Exponential Fourier series, Spectrum of CT signals, Fourier Transform properties, Fourier transform signal analysis, Laplace Transform properties, Laplace transform Signal Analysis.

UNIT III LINEAR TIME INVARIANT - CONTINUOUS TIME SYSTEMS 9

Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response, LTI systems analysis using Fourier and Laplace transforms, State space representation.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Sampling of CT signals and aliasing, DTFT properties, DTFT signal analysis, Z transform properties, Z transform signal analysis, Inverse Z transform.

UNIT V LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS 9

Difference equation, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms, State space representation.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Alan V.Oppenheim, Alan S.Willsky and S.H.Nawab, “Signals and Systems”, Pearson Education, 2nd Edition, 2015.
2. Edward W Kamen and Bonnie S. Heck, “Fundamentals of Signals and Systems using the Web and MATLAB”, Pearson Education, 3rdEdition, 2013.

REFERENCES

1. Rodger E.Ziemer, William H.Tranter and D.Ronald Fannin, “Signals & Systems-continuous and discrete”, Pearson Education, 4th Edition, 2014.
2. Simon Haykin and Barry Van Veen, “Signals and Systems”, 2nd Edition, Willey Publication, 2010.
3. Hwei P. Hsu, “Signals and Systems- Schaum's Outline Series”, Tata McGraw Hill, 3rd Edition, 2013.
4. M.J.Roberts, “Signals and systems- Analysis using transform methods and MATLAB”, Tata McGraw Hill, 2nd Edition, 2011.

19EC34C NETWORK THEORY

L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Analyze dc and steady state ac networks using various techniques and network theorems. (K3)
CO2: Determine time domain response of series RL, RC and RLC circuits for DC and AC excitation (K3)
CO3: Appreciate the frequency domain analysis of resonant circuits and design passive filters. (K3)
CO4 : Apply Laplace transform for analysis and synthesis of network. (K3)
CO5: Understand two port networks and their parameters. (K2)

UNIT I STEADY STATE DC & AC CIRCUIT ANALYSIS 9

Mesh current method, Node voltage method, Source Transformation, Superposition theorem, Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem.

UNIT II TRANSIENT RESPONSE ANALYSIS 9

Transient Analysis: Step response and sinusoidal response of first order (series RL and series RC) and second order circuits (Series RLC), sinusoidal steady state analysis

UNIT III RESONANCE CIRCUITS 9

Series resonance, Parallel resonance, Bandwidth, Quality factor, Selectivity, Passive filters

UNIT IV CIRCUIT ANALYSIS & SYNTHESIS USING S-DOMAIN 9

Application of Laplace transforms – Circuit Element models, circuit analysis, transfer function, state variables, Applications - network stability, and network synthesis.

UNIT V LINEAR TWO PORT NETWORKS 9

Impedance parameters, Admittance parameters, Hybrid parameters, Transmission parameters, Relationships between parameters, Interconnection of two port networks

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Robert L. Boylestad, "Introductory circuit analysis", 13th Edition, Pearson, 2016
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5thEdition, McGraw Hill, 2012.

REFERENCES

1. John Bird, "Electrical Circuit Theory and Technology", 5th Edition, Newness Publication, 2014.
2. William H. Hayt, Jack, E.Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 8th Edition, Tata Mc-Graw Hill, 2012.
3. Joseph A. Edminister, Mahmood, Nahvi, "Electric Circuits", Schaum's Series, 5th Edition, Tata Mc-Graw Hill, 2010.

19EC35C FOURIER SERIES AND MATHEMATICAL TRANSFORMS

L	T	P	C	QP
3	1	0	4	A

COURSE OUTCOMES

Upon completion of this course, the students should be able to

CO1 : perform Fourier series analysis of the functions(K2)
CO2: compute the Fourier transforms of various functions (K2)
CO3: calculate the Fourier series solution of Wave and Heat equations (K3)
CO4: solve difference equations using Z–Transforms (K2)
CO5: solve the differential equations using Transforms (K3)

UNITI FOURIER SERIES 12

Dirichlet's conditions–General Fourier series–Half range series–Complex form of Fourier series–Parseval‟s identity–Harmonic analysis.

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12
Classification of second order partial differential equations–Fourier series solutions of one dimensional wave equation–One dimensional equation of heat conduction–Steady state solution of two dimensional equation of heat conduction excluding Insulated edges.

UNITIII FOURIER TRANSFORMS 12
Fourier Integral theorem (without proof)–Fourier transform pair–Fourier Sine and Cosine transforms–Properties–Transforms of simple functions–Convolution theorem–Parseval's identity.

UNITIV Z–TRANSFORMS 12
Z-transform – Transform of Elementary functions- properties –Initial and Final value theorem – InverseZ-transform– Partial fraction method – Residue method – Convolutiontheorem– Formationofdifferenceequations.

UNIT V APPLICATIONS OF TRANSFORMS 12
Introduction to Laplace Transform – Solutions of Integro-differential equations – Solutions of linear ordinary differential equations of second order with constant coefficients-Solutions of simultaneous differential equations of first order with constant coefficients – Solutions of difference equations using Z-transform- Solving partial differential equation Fourier Transform.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2011.
3. K.Sankara Rao, "Introduction to Partial Differential Equations", PHI Learning Pvt.Ltd, 3rd Edition, New Delhi, 2011

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Private Ltd., 2014.
2. Ramana B.V, "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company, New Delhi, 2007.
3. Jain.R.K. and Iyengar.S.R.K., "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing House Private Limited, 2016.

19EC36C C++ AND DATA STRUCTURES L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1 : Understand the fundamentals of object-oriented programming (K2)
CO2 : Explore the concepts of inheritance and polymorphism (K2)
CO3 : Apply the principles of linear data structures for various applications. (K3)
CO4 : Implement the non linear data structure concepts (K3)
CO5 : Design and develop sorting and searching techniques. (K4)

UNIT I CLASS, OBJECT AND DATA ABSTRACTION 9

Overview of C++ – Concepts – Class Scope and accessing Class Members – Reference Variables – Initialization – Constructors – Destructors – Member Functions and Classes – Friend Function – Static Class Members – Container Classes and Integrators – Proxy Classes – This Pointer–String Manipulation-Dynamic Memory Allocation

UNIT II INHERITANCE AND POLYMORPHISM 9

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overloading: Function overloading and Operator Overloading-Class Object to Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – Abstract Base Classes and Concrete Classes –Templates-Exception handling.

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked list –Polynomial Manipulation - Stack –Applications of Stack-infix to post fix conversion-Evaluation of postfix expression-Queue - Case study: Music Player Implementation Using Linear Data Structures

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees – Binary tree – Binary tree Representation and traversals –Binary Search tree - Application of tree: Set representation and Union-Find operations – Graph and its representations – Dijkstra’s shortest path Algorithm - Prim's and Kruskal's Algorithms. Case study: Usage of Non-Linear Data structure for social network like Facebook

UNIT V SORTING AND SEARCHING 9

Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search – Binary Search-Hashing techniques. Case study: Rabin-Karp Algorithm for Pattern Searching

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. BjarneStroustrup, “The C++ Programming Language”, 4th Edition, Pearson Education, 2013.
2. E.Balagurusamy, “Object Oriented Programming with C++”, 7th Edition, McGraw Hill Company Limited, 2013.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Edition, Addison Wesley, 2013.

REFERENCES

1. V.Aho, J.E.Hopcroft, and J.D.Ullman, “Data Structures and Algorithms”, 3rdEdition, Pearson Education, Reprint 2009.
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Edition The MIT Press,2013
3. https://www.tutorialspoint.com/cplusplus/
4. https://www.javatpoint.com/cpp-tutorial
5. https://www.geeksforgeeks.org/c-plus-plus/
6. http://www.cs.bu.edu/teaching/c/tree/binary/
7. https://www.geeksforgeeks.org/design-data-structures-for-a-very-large-social-network like-facebook-or-linkedln/
8. https://www.geeksforgeeks.org/rabin-karp-algorithm-for-pattern-searching
9. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
10. https://visualgo.net/en/mst
11. https://nptel.ac.in/courses/106106127/41

19EC37C ELECTRONIC DEVICES LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 : Demonstrate the properties of optical materials. (K2)
CO 2 : Analyze the characteristics of semiconducting materials and devices. (K3)
CO 3 : Design the rectifier using PN diode (K3)

LIST OF RECOMMENDED EXPERIMENTS

1. Characteristics of PN junction and Zener diode.
2. Input, Output and Transfer characteristics of CE and CC Amplifier.
3. Characteristics of LDR, Photo-diode and Photo transistor.
4. Transfer characteristics of JFET.
5. Transfer characteristics of MOSFET (with depletion and enhancement mode)
6. Characteristics of LED with three different wavelengths.
7. Half wave rectifier.
8. Full wave rectifier with 2 diodes.
9. Full wave rectifier with 4 diodes (Bridge rectifier).
10. Series voltage Regulator.
11. Shunt voltage Regulator.
12. Simulation experiments using PSPICE or Multisim.

P: 45; TOTAL: 45 PERIODS

19EC38C DIGITAL SYSTEM DESIGN LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Design and demonstrate the combinational and sequential circuits using digital ICs. (K2)
CO 2: Design and simulate combinational circuits using verilog HDL. (K3)

LIST OF EXPERIMENTS

1. Design and implementation of Adder and Subtractor using logic gates.
2. Design and implementation of code converters using logic gates.
3. Perform binary Addition/ subtraction and BCD addition.
4. Design and implementation of Multiplexer and De-multiplexer using logic gates.
5. Design and implementation of encoder and decoder using logic gates.
6. Construction and verification of ripple counter and Decade counters.
7. Implementation of shift registers using Flip- flops.
8. Design and simulation of Adder, Subtractor, Multiplexer, Demultiplexer using Verilog Hardware Description Language.
9. Design and simulation of ripple counter, Mod-10 ripple counter and Shift registers using Verilog Hardware Description Language.

P: 45; TOTAL: 45 PERIODS

19EC39C C++ AND DATA STRUCTURES LABORATORY LTPC 0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 : Implement basic concepts of OOP (K3)
CO 2 : Solve real world problems using advanced concepts of OOP. (K3)
CO 3 : Develop programs using dynamic memory allocation and linked list ADT. (K3)
CO 4 : Apply Stack ADT and Queue ADT to solve problems. (K3)
CO 5 : Implement Programs for various trees ADT and Sorting and Searching techniques. (K3)

LIST OF EXPERIMENTS

1. A) Design simple C++ classes using static members, methods, default arguments and friend functions.
   B) Design matrix and vector classes with static allocation and use friend function to do matrix vector multiplication
2. Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor and overloading of assignment operator to copy a matrix into another variable.
3. Assume a bank maintaining two kinds of accounts savings account and current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides compound interest and withdrawal facilities but no cheque book facility and no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed. Create a class account that stores customer name, account number and type of account. From this derive the classes

current_acct and saving_acct to makethem more specific to their requirements. Design a C++ class for the above scenario

1) Include necessary member functions in order to achieve the following tasks: (Don't use constructors to initialize)
    - a. Accept deposit from a customer and update the balance
    - b. Display the balance
    - c. Compute and deposit interest
    - d. Permit withdrawal and update the balance
    - e. Check for the minimum balance, impose penalty, necessary and update the balance
2) Use constructors to initialize members for the three classes account, cur_acct and sav_acct

4. Create a base class shape. Use this class to store two double type values that could beused to compute the area of figures. Derive two specific classes called triangle andrectangle from the base shape. The member function get_data() of the base class is usedto initialize base class data members and another member function display_area() to compute and display the area of figures. Make display_area() as a virtual function and redefine this function in the derived classes to suit their requirements. Design a C++program that will accept dimensions of a triangle or a rectangle interactively and display the area. Note: The two values given as input will be treated as lengths and breadth in the case of rectangles and as base and height in case of triangles.
5. Design stack and queue classes with necessary exception handling
6. A) Create a list. While creating, the new nodes should be added in the front of the list by default.
    - i. Delete the specified node
    - ii. Find the specified node and return its position
    - iii. Display the list and the number of nodes after each operation

   B) Create a list with n nodes. Each node contains data and time tick information.
    - i. Insert the node based on the sorted order of time tick.
    - ii. Display the list in the reverse order and number of nodes in the list.
    - iii. Delete the specified node from the list and display the resultant list.
7. Represent a polynomial as a linked list and write functions to add the polynomials and display the resultant polynomial.
8. Develop a program to convert infix expression into postfix expression using Stack ADT.
9. Develop functions to perform the following:
    - a) Create a binary search tree of integers.
    - b) Traverse the above Binary search tree:Produce its pre-order, in-order, and post-order traversals.
10. Implement the following sorting methods to arrange a list of integers in ascending order:
    - a) Insertion sort
    - b) Merge sort

11. Implement the following sorting methods to arrange a list of integers in ascending order:
    a) Quick sort
    b) Selection sort
12. Implement the program for Knuth-Morris- Pratt pattern matching algorithm by using hashing technique.

P: 30; TOTAL: 30 PERIODS

19EC41C ANALOG AND DIGITAL COMMUNICATION **L T P C QP**
3 1 0 4 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Analyze the performance of analog communication system. (K2)
CO2: Understand waveform coding, compression and limits of information theory (K2)
CO3: Design channel encoder and decoder. (K2)
CO4: Analyze the performance of digital pass band modulation techniques. (K2)
CO5: Comprehend the various components of digital communication systems. (K2)

UNIT I ANALOG COMMUNICATION SYSTEM 12

Need for modulation, Amplitude Modulation (DSBFC, DSBSC, SSBSC) – Modulation index, spectral analysis, power relations, bandwidth, Envelope detector, Frequency modulation –Modulation index, Transmission Bandwidth, PLL FM demodulator, Superheterodyne receiver.

Noise sources, Thermal noise model, AWGN – Noise figure, noise temperature and noise bandwidth –– Noise performance analysis in AM & FM systems – qualitative analysis – FM Threshold, Pre-emphasis and de-emphasis for FM

UNIT II WAVEFORM & SOURCE CODING 12

Block diagram of digital communication system, Sampling, aliasing, quantization, encoding, line coding, pulse code modulation, bandwidth of PCM, Differential PCM, linear prediction coding, Audio compression Information, entropy, discrete memoryless channels, Mutual information, channel capacity, Information capacity theorem, Source coding - Shannon-Fano coding, Huffman coding, LZW coding

UNIT III CHANNEL CODING 12

Block Codes (linear block code & cyclic Code) – error detection and correction capability, convolutional encoding and decoding.

UNIT IV SIGNAL SPACE ANALYSIS AND PASSBAND MODULATION 12

Geometric representation of signals, Gram Schmidt orthogonalization procedure. Digital modulation techniques (BPSK, QPSK, QAM, FSK) – mathematical modeling, signal constellation, generation, detection, bit error rate analysis

UNIT V DIGITAL COMMUNICATION SYSTEM DESIGN 12

Inter symbol interference, eye pattern, Nyquist criterion, pulse shaping filters, matched filters, ML detector, Channel estimation and equalization.
Synchronization – ML based carrier phase and timing estimation, PLL, Carrier recovery for M-PSK using decision feedback PLL.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Simon Haykin, Communication Systems, 4th Edition, Wiley, 2014
2. J.G.Proakis, M.Salehi, Fundamentals of Communication System, 2nd Edition, Pearson Education, 2014.
3. Bernard Sklar, "Digital Communications: Fundamentals and Applications", Pearson Education, 2013.

REFERENCES

1. Leon W. Couch, II, "Digital & analog communication systems", 8th Edition, Pearson Education, 2013.
2. Rodzer E. Ziemer and William H. Tranter, “Principles of Communications – Systems, Modulation and Noise”, 7th Edition, Wiley, 2015.
3. Krzysztof Wesołowski, “Introduction to Digital Communication Systems", Wiley,2009.

19EC42C ELECTRONIC CIRCUITS

L	T	P	C	QP
3	1	0	4	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Design the biasing circuit for a transistor to work as amplifier. (K2)
CO2 : Design and analyze the small signal BJT and FET amplifier. (K2)
CO3 : Understand the frequency response of BJT amplifier. (K2)
CO4 : Design the power amplifiers and large signal tuned amplifiers for the desired specification. (K3)
CO5 : Design sinusoidal oscillator for audio and radio frequency oscillators. (K2)

UNIT I TRANSISTOR BIASING AND STABILITY ANALYSIS 12

BJT biasing – DC Load line and AC Load line, Quiescent point – Different Types of biasing circuits: Fixed Bias Circuit, Collector to base bias, Voltage divider bias (Self Bias) – Stability Factors – Bias compensation: Diode, Thermistor and Sensistor compensations – Biasing circuits for JFET and MOSFET.

UNIT II SMALL SIGNAL AMPLIFIERS 12

Small signal model and operation of BJT, FET and MOSFET amplifiers – Analysis of BJT amplifier, FET, MOSFET amplifiers – Increase in input impedance of BJT amplifiers – Feedback topologies – Effects of feedback on gain, bandwidth, input impedance, output impedance etc – Analysis of negative feedback amplifiers.

UNIT III FREQUENCY RESPONSE OF AMPLIFIERS 12

High frequency equivalent circuits of single stage CE (Hybrid - Π model) and MOSFET CS amplifier – Determination of short circuit current gain, cutoff frequency and bandwidth – Bandwidth calculation of multistage amplifiers – Amplifier rise time, sag and their relation to cutoff frequencies. Tuned amplifiers – single tuned, double tuned and Stagger tuned amplifiers. (qualitative analysis only). Frequency response of tuned amplifiers.

UNIT IV LARGE SIGNAL AMPLIFIERS 12

Classification of amplifiers – Conversion efficiency of class A transformer coupled class A, class B and distortion in power amplifier – Classification of tuned amplifier – Class C large signal tuned amplifier and its efficiency – Stability of tuned amplifiers and neutralization technique.

UNIT V OSCILLATORS 12

Classification - Barkhausen Criterion - General form of an Oscillator - Analysis of LC oscillators - Hartley, Colpitts, Clapp, Tuned collector oscillators. RC oscillators - phase shift, Wien bridge, Twin-T Oscillators. Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Donald.A. Neamen, “Electronic Circuit Analysis and Design”, 2nd Edition, Tata Mc-Graw Hill, 2009.
2. Millman.J and Halkias.C, “Electronic Devices and Circuits”, TMH, 2008.
3. Millman.J and Halkias.C., “Integrated Electronics”, Tata McGraw-Hill, 2010 (Re-print).
4. Schilling and Belove, “Electronic Circuits”, TMH, 3rd Edition, 2002.

REFERENCES

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10th Edition, Prentice Hall, 2009.
2. Thomas L. Floyd and David M.Buchla, “Electronics Fundamentals: Circuits, Devices and Applications”, 8th Edition, Pearson College Div, 2010.
3. David A. Bell, “Fundamentals of Electronic Devices and Circuits”, Oxford University Press, 2009.
4. Chenming Hu, “Modern Semiconductor Devices for Integrated Circuits”, Prentice Hall, 2009

19EC43C MICROPROCESSOR AND MICROCONTROLLERS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the internal architecture and organization of 8085 Microprocessor (K2)
CO2 : Develop assembly language programming using microprocessor (K2)
CO3 : Understand the internal architecture and organization of 8051 Microcontroller (K2)
CO4 : Design microcontroller-based system (K3)
CO5 : Understand the basics of RISC processor (K2)

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 12

Instruction -format and addressing modes – Assembly language format – Programming: Loop structure with counting & Indexing – Look up table – Subroutine instructions – stack. Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer Programming and applications Case studies: Traffic Light control, LED display, LCD display

UNIT III MICROCONTROLLER 8

Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.

UNIT IV INTERFACING MICROCONTROLLER 10

Interrupts, Timer/Counter and Serial Communication, Programming Timer Interrupts, Programming External H/W interrupts, Programming the serial communication interrupts, Interrupt Priority in the 8051,Programming 8051 Timers and Counters. Applications of Micro Controllers, Interfacing 8051 to LED’s, Push button, Relay’s and Latch Connections

UNIT V HIGH PERFORMANCE RISC ARCHITECTURE-INTRODUCTION6

ARM organization and implementation, The ARM instruction set-The thumb instruction set (Elementary treatment only) Basic ARM ALP -32-bit addition, subtraction, multiplication, binary sorting.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, 5th Edition, Penram International Publishing, 2002
2. K.Uma Rao, Andhe Pallav, The 8051 Microcontrollers, Architecture and Programming and Applications, 3rd Edition, Pearson, 2014.

REFERENCES

1. Muhammed Ali Mazidi, Janice Gillisple Maidi, Rolin.D. McKinlay, “The 8051 Microcontroller and Embedded Systems, Using Assembly and C”, 2nd Edition, Pearson Prentice Hall, 2015.
2. Kenneth J Ayala, “The 8051 Microcontroller”, 3rd Edition, Cengage Learning, Reprint 2014.
3. A.K.Ray and K.M. Bhurchandi, “Advanced Microprocessor and Peripherals”, Tata McGraw Hill, 3rd Edition, 2013.
4. Andrew N. Sloss, Dominic Symes, Chris Wright and John Rayfield, “ARM System Developer's Guide, Designing and Optimizing System Software”, Elsevier, 2009

19EC44C PROBABILITY, RANDOM PROCESSES AND QUEUEING THEORY

L T P C QP
3 1 0 4 A

COURSE OUTCOMES

Upon completion of this course, the students should be able to

CO 1: Grasp basic probability concepts and standard distributions.(K2)
CO 2: Perform the ideas related to two dimensional random variables.(K2)
CO 3: Understand various Random processes. (K3)
CO 4: Evaluate spectral densities of functions.(K3)
CO 5: Interpret the basic characteristic features of Markovian queues.(K3)

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables–Moments-Moment generating function and their properties. Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNITII TWO DIMENSIONAL RANDOM V ARIABLE 12

Joint distributions-Marginal and conditional distributions – Covariance - Correlation and Regression–Transformation of random variables.

UNITIII CLASSIFICATIONOFRANDOMPROCESSES 12

Classification of Random Processes – First order, second order, strictly stationary, wide-sense stationary and ergodic processes–Markov process –Poisson processes.

UNITIV CORRELATION AND SPECTRAL DENSITIES 12

Auto correlation-Cross correlation – Power spectral density–Cross spectral density-Properties–Wiener – Khintchine theorem (without proof)–Relationship between cross power spectrum and cross correlation function.

UNIT V QUEUEING THEORY 12

Markovian models – Birth and Death Queuing models- Steady state results: Single and multiple server queuing models- queues with finite waiting rooms- Finite source models- Little's Formula

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Oliver C.Ibe,"Fundamentals of Applied Probability and Random processes",Elsevier, 2nd Edition, 2014.
2. PeeblesJr.P.Z.,"Probability Random Variables and Random Signal Principles", 4th Edition,TataMcGraw-HillPublishers,NewDelhi,2002.
3. D. Gross and C.M. Harris, "Fundamentals of Queueing Theory", Wiley and Sons Publication Limited, 5th Edition, 2018.

REFERENCES

1. Miller.S.Land Childers, S.L, "Probability and Random Processes with applications to Signal Processing and Communications", Elsevier Inc., 2nd Edition,2012.

2. Hwei Hsu, “Schaum‟s Outline of Theory and Problems of Probability, Random Variables and Random Processes”,Tata McGraw-Hill, 3rd Edition, New Delhi, 2017.
3. Yates and D.J.Goodman,“Probability and Stochastic Processes”, 3rd Edition, John Wiley and Sons,2014.

19MC02C CONSTITUTION OF INDIA

		L	T	P	C
19MC02C	CONSTITUTION OF INDIA	3	0	0	0

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: describe the salient features of the Indian Constitution. (K2)
- CO2: discuss the structure and functions of parliament. (K2)
- CO3: elaborate the structure and functions of state legislature. (K2)
- CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
- CO5: discuss the foreign policy of India. (K2)

UNIT I INDIAN CONSTITUTION 9

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM 9

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM 9

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT IV THE JUDICIARY 9

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS 9

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Basu D.D,” Introduction to Indian Constitution”, Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, “Indian Government and Politics”, Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, “Introduction to the Constitution of India”, Vikas Publishing House, New Delhi, 2011.

2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.
3. Shukla V N, "Constitution of India", Eastern Book Company Ltd., New Delhi, 2011.

19EC45C ANALOG AND DIGITAL COMMUNICATION LABORATORY L T P C

0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate various analog and digital modulation techniques using LabVIEW. (K3)
CO2: Demonstrate the analog to digital conversion process and encoding techniques. (K3)
CO3: Analyze the error performance of various digital modulation techniques using MATLAB. (K3)

LIST OF EXPERIMENTSUsing Lab VIEW

1. Introduction to Lab VIEW
2. Amplitude Modulation
3. Frequency Modulation
4. Sampling and Quantization
5. Pulse Code Modulation
6. Digital Modulation – I
7. Digital Modulation – II

Using MATLAB

8. Demodulation and Performance Evaluation of digital modulation schemes.
9. Digital Link simulation: Error introduction & error estimation in a digital link using MATLAB.

P: 45; TOTAL: 45 PERIODS

19EC46C ELECTRONIC CIRCUITS LABORATORY L T P C

0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 : Design and demonstrate various biasing circuits for an amplifier (K2)
CO 2 :Design and construct BJT and MOSFET amplifier for the desired specification.(K3)
CO 3 : Design and construct audio and radio frequency oscillator. (K3)

LIST OF EXPERIMENTS

1. Design the biasing circuit for the desired specification for BJT amplifier.
2. Design and construction of BJT amplifier for audio frequency applications
    - (i) To plot the frequency response.
    - (ii) Measure input and output impedance
3. Design and Construction of negative feedback amplifiers with and without feedback.
    - (i) To plot the frequency response.
    - (ii) To determine the input and output impedance.
4. Design and Construct MOSFET amplifiers for the desired specification.
5. Design and construction of Class A and class B power amplifier and study its performance
6. Design and construction of audio frequency oscillator.
7. Design and construction of radio frequency oscillator.

P: 45; TOTAL: 45 PERIODS

19EC47C MICROPROCESSOR AND MICROCONTROLLERS LABORATORY L T P C

0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Write Assembly Language programs for simple application using 8085 and 8051 instruction set. (K3).

CO2: Interface Microprocessor / Microcontroller with various peripherals. (K3)

LIST OF EXPERIMENTS

1. Programs for Arithmetic and Logical Operations using 8085 & 8051processor / controller
2. Programs for Sorting and searching using 8085& 8051 processor/controller
3. Interfacing of 8255, 8253, 8279 with 8085 Microprocessor
4. Interfacing of LED and LCD with 8085 & 8051 Microcontroller.
5. Interfacing of ADC and DAC with 8085 & 8051 Microcontroller
6. Demonstration of Timer, Interrupts operations in 8051 Microcontroller
7. Serial Communication between Microcontroller kit and PC

P: 45; TOTAL: 45 PERIODS

19EC48C COMMUNICATION SKILLS LABORATORY L T P C

(Common to all B.E. / B.Tech., Degree Programmes) **0 0 2 1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Listen and respond effectively to interact at different situations fluently (K2)

CO2: Excel appropriately in professional contexts.(K3)

CO3: Acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3)

UNIT I **10**

Lab session: Listening and responding to audio files

Practice session: Mini Presentation related to Business English & Picture description.

UNIT II **10**

Lab session: Role Play – News Reader

Practice session: Resume Preparation

UNIT III **10**

Lab session: Listening to audio files related to soft skills.

Practice session: Practicing Power point presentation, Group discussion.

P:30; TOTAL: 30 PERIODS

REFERENCES

1. Dutt P. Kiranmai and RajeevanGeeta, “Basic Communication Skills”, Foundation Books, 2013.
2. Comfort, Jeremy, et al. “Speaking Effectively, Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge: Reprint 2011.
3. Rizvi.M.Ashraf, “Effective Technical Communication”, The MC-Graw Hill Education Private Limited Companies, New Delhi, 2010.

19EC51C ELECTROMAGNETIC WAVES

L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the static field and magnetic field concepts. (K2)

CO2: Describe the Maxwell’s equation and transmission of waves between boundaries. (K2)

CO3: Understand characteristics and wave propagation on high frequency transmission lines. (K2)

CO4: Characterize the uniform plane wave. (K2)

CO5: Describe different waveguide system. (K2)

UNITI STATIC ELECTRIC AND MAGNETIC FIELDS 9

Coulomb's Law in Vector Form, Definition of Electric Field Intensity, Principle of Superposition, Electric field due to continuous charge distribution, Electric Field due to charges distributed uniformly on an infinite and finite line, Electric Field on the axis of a uniformly charged circular disc and charged circular ring, Electric Field due to an infinite uniformly charged sheet.

The Biot-Savart Law in vector form, Magnetic Field intensity due to a finite and infinite wire carrying a current I, Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I.

UNIT II BOUNDARY CONDITIONS AND MAXWELLS EQUATION 9

Boundary conditions for electric fields between dielectric and conductor, and between two different dielectrics, Magnetic field boundary condition, Faraday's law, Maxwell's Second Equation in integral form from Faraday's Law, Equation expressed in point form. Displacement current, Ampere's circuital law in integral form, Modified form of Ampere's circuital law as Maxwell's first equation in integral form, Equation expressed in point form. Poynting Vector and the flow of power, Power flow in a co-axial cable.

UNIT III UNIFORM PLANE WAVES 9

Derivation of Wave Equation, Uniform Plane Waves, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Wave polarization.

UNIT IV TRANSMISSION LINES 9

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

UNIT V WAVEGUIDES 9

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the Waveguide walls, Field visualization, Attenuation in waveguide.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd Edition, Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

19EC52C COMPUTER ARCHITECTURE

LTPCQP
3003A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic organization of computer and different instruction formats and addressing modes. (K2)
CO2: Interpret the representation and manipulation of data on the computer. (K3)
CO3: Illustrate about implementation schemes of control unit and pipeline performance. (K2)
CO4: Summarize the various types of parallelism architectures. (K2)
CO5: Compare the various memory hierarchy and I/O systems. (K2)

UNIT I INTRODUCTION TO COMPUTER ORGANIZATION 9

Architecture and function of general computer system - Basic Operational Concepts, Bus Structures, Software Performance – Memory locations & addresses – Memory operations – Instruction and instruction sequencing – addressing modes – assembly language - System buses, Multi-bus organization

UNIT II DATA REPRESENTATION 9

Signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder - multiplication - shift-and-add, Booth multiplier, carry save multiplier - Division - non-restoring and restoring techniques, floating point arithmetic.

UNIT III PROCESSOR ARCHITECTURE AND CONTROL UNIT 9

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Hardwired control – micro programmed control - Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

Processor Architecture: Very Long Instruction Word (VLIW) Architecture, Digital Signal Processor Architecture, System on Chip (SoC) architecture, MIPS Processor and programming

UNIT IV PARALLEL PROCESSING 9

Parallel processing challenges – Flynn‘s classification – Single Instruction Single Data (SISD), Multiple Instruction Multiple Data (MIMD), Single Instruction Multiple Data (SIMD), Single Program Multiple Data (SPMD), and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT V MEMORY & I/O SYSTEMS 9

Memory Hierarchy – memory technologies – cache memory – measuring and improving cache performance – virtual memory, Translation Lookaside Buffer‘s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – Universal Serial Bus.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, Morgan Kaufmann / Elsevier, 5th Edition, 2014.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “Computer Organization and Embedded Systems”, Tata McGraw Hill, 6th Edition, 2012.

REFERENCES

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Pearson Education, 8th Edition, 2010.
2. John P. Hayes, “Computer Architecture and Organization”, Tata McGraw Hill, 3rd Edition, 2012.

3. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier Publishers, 5th Edition, 2012.

19EC53C LINEAR INTEGRATED CIRCUITS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Describe the fabrication of IC and also DC, AC characteristics of OP- AMP.(K2)
- CO2: Discuss the various applications of OP- AMP. (K2)
- CO3: Discuss analog multipliers, PLL and its application.(K2)
- CO4: Infer the different types of digital to analog converter and Analog to Digital converter. (K3)
- CO5: Describe the various operating modes of timer IC & Different types of voltage regulator. (K2)

UNIT I OVERVIEW OF LINEAR ICs 9

Advantages of IC over discrete components, manufacturing process of monolithic IC, Construction of Monolithic Bipolar transistor, Monolithic diodes, Integrated Resistors, Monolithic Capacitors, Inductors. General operational amplifier stages, Current mirror and current sources, Current sources as active loads, BJT Differential amplifier with active loads, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, Adder, Subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, Peak detector, Clipper and Clamper, Low-pass, High-pass and Band-pass Butterworth filters, Sine-wave generators, Triangular wave generator, Saw-tooth wavegenerator, Astable and MonostableMultivibrators.

UNIT III ANALOG MULTIPLIER AND PHASE LOCKED LOOP 9

Analog Multiplier using Emitter Coupled Transistor Pair, Gilbert Multiplier cell, Variable transconductance technique, Analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, PLL phase noise, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog and Digital Data Conversions, D/A converter, specifications, weighted resistor type, R-2R Ladder type, Voltage Mode and Current Mode R-2R Ladder types, Switches for D/A converters, High speed sample and hold circuits, A/D Converters, specifications, Flash type, Counter type, Servo tracking type, Successive Approximation type, Dual Slope type, A/D converter, Figure of merit, Static Parameters: DNL, INL.

UNIT V TIMER AND VOLTAGE REGULATOR 9

Timer IC 555 - Description and Functional Diagram, Monostable operation, Astable operation, Linear Regulators, IC Voltage regulators, Three terminal fixed and adjustable voltage regulators, IC 723 General purpose regulator, SMPS.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Sergio Franco, “Design with operational amplifiers and analog integrated circuits”, 3rd Edition, Tata McGraw Hill, 2007.
2. D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Private Limited, 4th Edition, 2010.

REFERENCES

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons Inc, 5th Edition, 2009.
2. S.Salivahanan & V.S.Kanchana Bhaskaran,“Linear Integrated Circuits”, TMH, 1st Edition, 2008.
3. Ramakant A. Gayakwad, “Op-amps and Linear Integrated Circuits”, Prentice Hall, 4th Edition, 2000.

19EC54C DIGITAL SIGNAL PROCESSING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1:Correlate the relationship between DTFT, DFT and FFT and compute DFT.(K2)
CO2: Design analog and digital IIR filters and realize them (K2)
CO3: Design digital FIR filters and realize them (K2)
CO4: Analyze the finite word length effects in signal processing (K2)
CO5: Explain the concepts of Multi rate signal processing (K3)

UNIT I DISCRETE FOURIER TRANSFORM 9

DFT and its properties, Relation between DTFT, DFT and Z-transform, DFT computations using Decimation in time and Decimation in frequency algorithms, Inverse DFT using FFT algorithms, Use of FFT in linear filtering, Sectionalized convolution-overlap add and save procedure.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Review of design of analog Butterworth and Chebyshev Filters, Frequency transformation in analog domain - Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform – pre warping - Realization using direct, cascade and parallel forms

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 9

Symmetric and Antisymmetric FIR filters - Linear phase FIR filters – Design using Hamming, Hanning, Blackman and Kaiser Windows – Frequency sampling method– Realization of FIR filters - Transversal, Linear phase and Polyphase structures

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error – Product quantization error - Overflow error, Saturation arithmetic – Round-off noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling

UNIT V MULTIRATE SIGNAL PROCESSING 9

Introduction to Multi-rate signal processing-Decimation-Interpolation- Polyphase implementation of FIR filters for interpolator and decimator - Multistage implementation of sampling rate conversion- Design of narrow band filters – Applications: Sub band coding, Quadrature Mirror filter bank.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. John G Proakis and Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson Education, 4thEdition, 2014.
2. Alan. V. Oppenheim, R. Schafer, “Digital Signal Processing”, Pearson Education, 1st Edition, 2015.

REFERENCES

1. E.C.Ifeachor and B.W.Jervis, “Digital signal processing - A practical approach”, Pearson, 2nd Edition, 2002.
2. S.K. Mitra, “Digital Signal Processing- A Computer Based approach”, Tata McGraw-Hill, 4th Edition, 2013.
3. Johny R.Johnson, “Introduction to Digital Signal Processing”, PHI, 2006.
4. Lonnie C.Ludeman, “Fundamentals of Digital Signal Processing”, Wiley, 1st Edition, 2009

19MC01C ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C	QP
3	0	0	0	D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: explain the structure and function of ecosystem. (K2)
CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)
CO 3: explain the causes and effects of pollution. (K2)
CO 4: describe social issues related to the environment and the environment act. (K2)
CO 5: identify the nutrients in food and impact of metals on human health. (K2)

UNIT I ENVIRONMENT AND ECOSYSTEMS 9

Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

UNIT II BIODIVERSITY AND NATURAL RESOURCES 9

Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over - exploitation – deforestation – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

UNIT III ENVIRONMENTAL POLLUTION 9

Causes, effects and control measures of air pollution, water pollution, noise pollution and nuclear hazards – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9

Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; Environment laws: environmental (protection) act 1986-the wild life (protection) act 1972.

UNIT V FOOD AND HUMAN HEALTH 9

Carbohydrates, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, cadmium, mercury and chromium on human health.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Miller G. and Spoolman S, “Environmental Science”, 14th Edition, Brooks/Cole Publishing Co., 2014.
2. Maczulak A.E., “Environmental Engineering”, Facts on file Inc., 2009.
3. Han D, “Concise Environmental Engineering”, Ph.D & Ventus Publishing ApS, 2012.

REFERENCES

1. Weller K. “Environmental Science and Biological Engineering”, 1st Edition, WIT Press, 2015
2. Strange C., “Environmental Science and production”, Nason Trest Publisher, 2014.

19EC55C ELECTROMAGNETIC WAVES LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: analyze the surface current distribution of coaxial, Rectangular, microstrip and coplanar waveguides using HFSS simulator. (K2)

CO2: study the excitation of various boundaries using HFSS simulator. (K2)

CO3: analyze the impedance matching of an antenna using smith chart. (K2)

LIST OF EXPERIMENTS

1. Design of a coaxial waveguide using ANSYS HFSS and analysis of surface current distribution.
2. Design of a rectangular waveguide using ANSYS HFSS and analysis of surface current distribution.
3. Study of various boundary conditions and excitations using ANSYS HFSS.
4. Impedance matching of an antenna and analysis using smith chart.
5. Design of microstrip transmission line using ANSYS HFSS and analysis of surface current distribution.
6. Design of Substrate Integrated Waveguide (SIW) using ANSYS HFSS.
7. Design of Coplanar waveguide using ANSYS HFSS and analysis of surface current distribution.
8. Design of scattered wave of metal sphere due to incident EM field using ANSYS HFSS

P: 30; TOTAL: 30 PERIODS

19EC56C DIGITAL SIGNAL PROCESSING LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: simulate continuous-time and discrete-time signals. (K2)
CO2: Plot the impulse response and step response of a system. (K2)
CO3: compute convolution and correlation of a signal. (K2)
CO4: Simulate the signal with different sampling rates and analyse the effect of under sampling (K2)
CO5: Design and simulate digital IIR and FIR filters and plot its frequency response.(K2)

LIST OF EXPERIMENTS

1. Generation of Signals.
2. Convolutionand correlation
3. FFT and its properties
4. LTI system response of system
5. Single-rate and multi-rate sampling and analysis of the effects of aliasing
6. Design of IIR and FIR filters
7. Analysis of finite word length effects in filter design
8. Waveform generation using TMS320C6x Processor.
9. Convolution using TMS320C6x Processor
10. DFT computation of a signalusing TMS320C6x Processor
11. Image analysis using TMS320C6x Processor

P: 30; TOTAL: 30 PERIODS

19EC57C LINEAR IC AND MEASUREMENTS LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design and Construct the Operational Amplifier (OPAMP) – based application circuits for given Specifications. (K3-K4)
CO2: measure the various parameters of application circuits. (K2)
CO3: handle Computer Aided Design (CAD) tool for analyzing the performanceof application circuits. (K3)

LIST OF EXPERIMENTS

1. Inverting and Non-inverting amplifiers using OPAMP.
2. Input Impedance and Loading effect of OPAMP.
3. Integrator and Differentiator using OPAMP.
4. Differential amplifier and Instrumentation amplifier using OPAMP.
5. Active low pass, High pass and band pass filters using OPAMP.
6. Waveform Generation using OPAMP and 555 Timer
7. Characteristic Measurements of OPAMP
8. Parametric Measurements of regulated DC Power supply.
9. Parametric Measurements of Analog to Digital Converter.
10. Designing bridge Circuit for Resistance Measurement
11. Designing bridge Circuit for capacitance measurement
12. Designing signal Conditioning circuit for Temperature Measurement
13. Designing signal Conditioning circuit for Strain Measurement

P: 30; TOTAL:30 PERIODS

19EC61C WIRELESS COMMUNICATION

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 :Illustrate the cellular concept and identify the suitable Multipleaccess techniques (K2)
CO2 :Understand the large scale propagation model for determining pathloss (K2)
CO3 :Describe the various types of small scale fading. (K2)
CO4 :Comprehend the techniques to improve the signal quality (K2)
CO5 :Understand the principles OFDM wireless system (K2)

UNIT I INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS 9

Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems, Multiple Access in cellular System- TDMA- FDMA-CDMA SDMA.

UNIT II MOBILE RADIO WAVE PROPAGATION - LARGE SCALE FADING 9

Radio wave Propagation – Transmit and receive Signal Models – Free Space pathloss – Ground ray propagation model – Shadow fading – Combine path loss and Shadowing – Outage Probability underpath loss & shadowing – Cell coverage area.

UNIT III MOBILE RADIO WAVE PROPAGATION - SMALL SCALE FADING AND MULTIPATH 9

Small Scale Multipath Propagation – Impulse response model of a Multipath Channel Small Scale Multipath Measurements – Parameters of Mobile Multipath Channels – Types of fading (fading effects due to Multipath Time Delay Spread &Doppler spread) – Rayleigh and Ricean Distribution**.**

UNIT IV DIVERSITY AND EQUALIZATION IN WIRELESS SYSTEM 9

Capacity in AWGN – Capacity of Flat Fading and frequency selective Channels. Diversity Technique – Selection combining – Equal Gain Combining – Maximum Ratio Combining – Feedback – Time – Frequency – Rake Receiver – Interleaving. Equalization – Linear Equalization – Non linear (DFE & MLSE) – Algorithm of Adaptive Equalization – Zero Frequency algorithm – LMS algorithm – Recursive Least Square algorithm.

UNIT V PRINCIPLES OF MIMO AND OFDM WIRELESS COMMUNICATION 9

Multiple Input Multiple Output system – MIMO Receivers – capacity of MIMO wireless system. Orthogonal Frequency Division Multiplexing – Transmission in Multicarrier systems – FFT – Cyclic Prefix in OFDM system – Schematic representation of OFDM Transmitter and Receiver. BER Performance of OFDM system.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Rappaport T.S, “Wireless Communications: Principles and Practice”, Pearson Education, 2ndEdition, 2010.
2. William Stallings, “Wireless Communication Network and Systems”, Pearson Education Asia, 2016.

REFERENCES

1. Andrea Goldsmith, “Wireless Communications”, Cambridge UniversityPress, Aug 2005.
2. Lee W.C.Y., “Mobile Communications Engineering: Theory &Applications”, McGraw Hill, New York 2nd Edition, 1998
3. Jochen Schiller, “Mobile Communication”, Pearson Education Asia Ltd, 2ndEdition, 2008.
4. Rakhesh Singh Kshetrimayum, “Fundamentals of MIMO WirelessCommunication”, Cambridge University press, 2017.

19EC62C	**CONTROL SYSTEMS**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the mathematical model of electrical systems and describe the transfer function for a given control system using block diagram reduction techniques and signal flow graph method (K2)
CO2: Determine the time domain specifications for first and second order systems (K2)
CO3: Determine the stability of a system in the frequency domain using various plots (K3)
CO4: Determine the stability of a system in the time domain using Routh Hurwitz criterion and Root-locus technique. (K3)
CO5: Develop a control system model in continuous and discrete time using state variable techniques (K2)

UNIT I SYSTEM COMPONENTS AND THEIR REPRESENTATION 9

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems- Electrical Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.

UNIT II TIME DOMAIN ANALYSIS 9

Standard test signals, Unit step response of First and second order Systems. Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers.

UNIT III FREQUENCY DOMAIN ANALYSIS 9

Polar plots, Bode plot, stability, Nyquist plots. Performance specifications in frequency-domain. Frequency-domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation.

UNIT IV STABILITY ANALYSIS 9

Concept of stability-Bounded – Input Bounded – Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Nagarath and M.Gopal, “Control Systems Engineering”, New Age International (P) Limited, Publishers, 8th Edition, 2018.
2. M.Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 2nd Edition, 2002.

REFERENCES

1. Charles L. Phillips and John Parr, “Feedback Control Systems”, Prentice Hall, 5th Edition, 2010.

2. Farid Golnaraghi and Benjamin C.Kuo, “Automatic Control Systems”, Wiley Publications, 9th Edition, 2009.
3. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Prentice Hall, 12th Edition, 2010.
4. K.Ogata, “Modern Control Engineering”, Pearson Education Asia/PHI, 4th Edition, 2002.

19EC63C	**COMPUTER NETWORKS**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1:Describe the network model and physical layer concepts (K2)
CO2:Recognize error free transmission of data and analyze data collision with various protocols. (K3)
CO 3: Describe the various network layer protocols. (K3)
CO 4: Select the addressing entities of a network with implementation of TCP, UDP Protocols. (K2)
CO 5: Illustrate the real time applications of networks and explain the fundamentals of SDN & its operation. (K2)

UNIT I FUNDAMENTALS AND PHYSICAL LAYER 9

Data Communications – Networks - Networks models – OSI model – Layers in OSI model – Addressing – Types of Transmission Media, Line Coding, Switching in networks: Classification and requirements of switches, a generic switch, Crossbar switch and evaluation of blocking probability, Circuit switched networks – Packet switched networks.

UNIT II DATA LINK LAYER 9

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels. Error Detection: Parity, LRC, VRC, CRC – HDLC. Multiple Accesses: Random access – Controlled access. Wired LANS: IEEE standards – standard Ethernet – changes in the standard. Wireless LANS: IEEE 802.11: Architecture, MAC Sub layer, Addressing Mechanism.

UNIT III NETWORK LAYER 9

Logical addressing: IPv4, IPv6 addresses - Internet Protocol: Internetworking – IPv4, IPv6 – Address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP, Delivery - Forwarding - Routing protocols – DSDV, OSPF.

UNIT IV TRANSPORT LAYER 9

Process-to-Process delivery - User Datagram Protocol (UDP) – Transmission Control Protocol (TCP)/ Internet Protocol (IP) Suite – Congestion Control – Quality of services (QoS) – Techniques to improve QoS.

UNIT V APPLICATION LAYER AND SOFTWARE DEFINED NETWORKS 9

Domain Name System (DNS) – E-mail – HTTP – FTP - WWW, Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Evolution of SDN –SDN operations.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Larry Peterson Bruce Davie, “Computer Networks: A system Approach, 5thEdition, the Morgan Kaufmann Series in Networking- Publisher, 2011.
2. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw-Hill, 4th Edition, 2011.

REFERENCES

1. Paul Goransson and Chuck Black, “Software Defined Networks: A comprehensive Approach”, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. William Stallings, “Wireless Communication & Networking”, Pearson Education Asia, 2009.

19EC64C	VLSI DESIGN	L T P C QP
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain MOS transistor theory and CMOS process technology. (K2)
CO 2: Estimate the delay, power dissipation of CMOS circuits. (K2)
CO 3: Design Combinational and Sequential circuits. (K2)
CO 4: Describe the classification of ASIC and FPGA architectures and performance of the arithmetic building blocks. (K2)
CO 5: Model the digital system components using Verilog HDL (K3)

UNITI CMOS TECHNOLOGY 9

MOS Transistor Theory - Ideal I-V and C-V Characteristics of MOS Transistor, Non-ideal I - V Effects, DC Transfer Characteristics of CMOS Inverter, n well, twin tub and SOI CMOS processes, Lambda based design Rules, CMOS Process Enhancements, Technology- related CAD Issues, Manufacturing Issues.

UNITII CMOS CIRCUIT CHARACTERIZATION 9

Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Interconnect, Reliability, Scaling – Introduction to SPICE - Device models, Device characterization, Circuit characterization.

UNITIII COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN 9

Combinational Circuit Design: Circuit Families – Static CMOS, Ratioed Circuits, Dynamic CMOS Circuits, Pass-transistor logic Circuits, Low power Logic Design, Comparison of CMOS Circuit Families Sequential Circuit Design: Sequencing Static Circuits, design of Latches and Flip-Flops.

UNITIV DESIGN OF ARITHMETIC BUILDING BLOCKS AND IMPLEMENTATION STRATEGIES 9

Data path circuits: Architecture for ripple carry adder, carry look ahead adder, high speed adder, Multiplier, Barrel shifter, Full Custom ASICs, Standard-Cell Based ASICs, Gate-Array-Based ASICs, Channeled, Channelless, Structured Gate Array and Architecture of Generic FPGA.

UNITV INTRODUCTION TO HDL 9

Design Methodologies – Modules – Instances – Test bench – Operators – Number Specification – Identifiers and Keywords – Data Types – Modules and Ports – Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multiway Branching, Loops, Sequential and Parallel Blocks - Design of combinational and sequential circuits using Gate-Level Modeling, Dataflow Modeling and Behavioral Modeling.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Weste and Harris, “CMOS VLSI DESIGN:A Circuit and Systems Perspective”, 4th Edition, Pearson Education, 2015.
2. Samir Palnitkar,"Verilog HDL, A Guide to Digital Design and Synthesis", 2nd Edition, Pearson Education, 2005.

REFERENCES

1. M.J.SSmith, "Application Specific integrated circuits", Pearson Education, 2008. (5th reprint)
2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, “Digital Integrated Circuits: A Design Perspective”, PHI, 2nd Edition, 2013 (reprint).
3. D.A. Pucknell & K.Eshraghian, “Basic VLSI Design”, PHI, 3rd Edition, 2006.
4. Wayne Wolf, “Modern VLSI design”, Pearson Education, 3rd Edition, 2007.
5. Uyemura J.P, “Introduction to VLSI circuits and systems”, Wiley, 2009.

19EC65C ANTENNA AND WAVE PROPAGATION

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the various Parameters of antenna- wire antenna. (K2)
CO 2: Describe the various types of array antenna.(K2)
CO3: Explain the aperture and special antennas for the given specification. (K2)
CO4: Design broadband patch antenna and explain various antenna measurement techniques. (K2)
CO5: Explain various radio wave propagation mechanism. (K2)

UNIT I ANTENNA FUNDAMENTALS 9

Basic properties of transmitting and receiving antenna, Antenna parameters: Radiation pattern, Directivity, Gain, Radiation resistance, Mutual impedance, Input impedance, Polarization, Bandwidth, Beamwidth, Effective aperture, Vector effective length, Antenna temperature. Reciprocity principle and its applications, Friss transmission formula. Wire antennas: Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas.

UNIT II THEORY OF ARRAY ANTENNAS AND SMART ANTENNAS 9

Two-element Array, Linear Array and Pattern Multiplication, Uniform Array, Array with non-uniform Excitation - Binomial Array and Yagi-uda arrays. Basic Concepts of Smart Antennas -Beamforming- Fixed weight beamforming - Adaptive beamforming Antenna-MIMO antenna- study of 2 X 2 MIMO antenna system

UNIT III APERTURE ANTENNAS AND SPECIAL ANTENNAS 9

Aperture Antennas: Babinet's Principle, Slot antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector, Corner Reflector, Common curved reflector shapes, Lens Antenna. Special Antennas: Broadband antenna, Frequency independent antenna, log periodic antennas, Helical geometry, transmission radiation modes, practical design considerations, wide band characteristics of helical antenna.

UNIT IV ANTENNAS FOR MODERN AND WIRELESS APPLICATIONS AND ANTENNA MEASUREMENTS 9

Microstrip Patch Antenna-design of rectangular and circular patch - impedance matching of microstrip antennas, Antenna for Radar systems. Adaptive antenna, RFID antenna, Ultra wideband antenna, Terahertz antenna. Measurements: Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber.

UNIT V RADIO WAVE PROPAGATION 9

Ground Wave Propagation - Free-space Propagation - Ground Reflection, Tropospheric Propagation- Ionospheric propagation - Structure of ionosphere, skip distance, Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Faraday rotation, Whistlers.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. John D Kraus, Ronald J Marhefka and Ahmad S Khan, “Antennas for all Applications”, Tata McGraw-Hill Book Company, 4th Edition, 2010.
2. K.D Prasad, “Antennas and Wave Propagation”, Satya Prakashan Publications, 2nd Edition, 2008.

REFERENCES

1. Constantine A. Balanis, “Antenna Theory: Analysis and Design”, John Wiley, 3rd Edition, 2005.
2. C.Rowell, E.Y.Lam, “Mobile Phone Antenna Design”, IEEE Antenna & Propagation Magazine, Vol 54, No.4, Pages (14-34), 2012.
3. A.R.Harish, M.Sachidananda, “Antennas and Wave propagation”, Oxford University Press, 1st Edition, 2007.
4. S.R.Saunders, “Antennas and Propagation for Wireless Communication”, 2nd Edition, John Wiley, 2007.

5. Yi Huang and Kevin Boyle, “Antenna From Theory to Practice”, 1st Edition, John Wiley, 2008.

19EC66C COMPUTER NETWORKS LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1:Describe the concepts of computer networking and analyze the Operations of various Error Detection algorithms. (K2)
CO2: Demonstrate the protocols in network layer and transport Layer. (K3)
CO3: Exemplify the concepts of CIA and create network environment. (K3)

LIST OF EXPERIMENTS

1. Topology orientation and building a small network
2. Analysis of logical link control layer protocols- Stop & wait, Sliding Window
3. Examining the protocols in the Network layer
4. Analysis of Network Data Traffic.
5. Observing TCP & UDP using Netstat and Wireshark
6. Study and Configuration of Subnetting
7. Implementation of Routing Protocols (RIP & OSPF).
8. Implementation of VLAN & NAT

P: 30 TOTAL: 30 PERIODS

19EC67C VLSI DESIGN LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Write verilog HDL code for various digital circuit. (K3)
CO2 : Synthesize and implementation of digital Circuits in FPGAs. (K3)
CO3 : Analyze the characteristics of Inverter, Current source, Current Mirrors and Differential Amplifier. (K2)

LIST OF EXPERIMENTS

Experiments using HDL simulator and FPGA implementation software

1. Design entry and simulation of combinational logic circuits (8 bit adder, 4 bit multiplier, address decoders, multiplexers), test bench creation, functional verification, and concepts of concurrent and sequential execution to be highlighted
2. Design entry and simulation of counters, shift registers and state machines. Critical paths and static timing analysis to be identified.
3. Synthesis, Place and Route and Post Place and Route simulation of the components simulated in I and II.
4. Implementation of the digital circuits such as 8 bit adder, 4 bit multiplier, address decoder, multiplexer, counters and shift registers on FPGA.

Experiments using full custom/semi custom IC design software

1. Design and simulation of a CMOS inverter. Perform layout simulation and parasitic extraction.
2. Schematic Entry and simulation of MOS differential amplifier, Determination of gain, bandwidth, output impedance and CMRR.
3. Schematic Entry and simulation of Current source and Current Mirror.

P: 45; TOTAL: 45 PERIODS

19EC68C PRODUCT DEVELOPMENT LABORATORY

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)

CO2: verify the functionality of the concept through prototyping (K4)

UNIT I NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION 20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

UNIT II PROTOTYPING AND DEMONSTRATION 25

Prototype development and demonstration - cost estimation - product documentation

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Michael G Luchs, Scott Swan, Abbie Griffin, “Design Thinking: New Product Development Essentials from the PDMA”, Willey, 2015
2. Christian Muller-Roterberg, “Design Thinking”, Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata Mc Graw Hill Education, 4th Edition, 2011.
4. George E Dieter, Linda C Schmidt, “Engineering Design”, Mc-Graw Hill International Edition, 5th Edition, 2013.
5. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2013

Mentor Activities

- Forming multidisciplinary/interdisciplinary batches among the students
- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students’ activities through demonstration and presentations

End semester Assessments can be made through

- Product demonstration and presentation

Other points

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four
- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

19EC71C PROJECT MANAGEMENT AND FINANCE L T P C
(Common to all Programmes) 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the concept of operational and project management. (K2)
CO2: Define the scope of a project and develop the project plan. (K2)
CO3: Evaluate the technical, business and social environment related to the project. (K3)
CO4: Formulate and manage project team successfully. (K5)
CO5: Monitor and control projects using tools and techniques. (K3)

UNIT I BASIC CONCEPT 9

Concept and categories of project - Project development cycle - Concept, tools and techniques of project management - Logistics and supply chain management - Forms of project organizations.

UNIT II THE VERTICAL STRUCTURE PLANE 9

Project identification, formulation and preparation. Market and demand estimation - Market survey techniques - Demand forecasting. Materials management - Analysis of materials input, technology, production, plant capacity, location and site, civil works, charts, layouts and work schedule. Cost of project - Means of financing, estimates of cost - Financial projections.

UNIT III PROCESS OF PROJECT APPRAISAL 9

Technical, Economic, Financial, Legal and Social appraisal of the Industrial Projects. Problems due to rate of discount, wage-rate, exchange rates, treatment of taxes, social cost-benefits - treatment of risk and uncertainty - sensitivity analysis and probability approach - Single as well as multiple projects - Big data analytics - PLM and SLM.

UNIT IV PROJECT TEAM FORMULATION AND MAXIMIZING PARTICIPATION 9

Project Team frame works - Project Team cultures - Barriers and challenges - Selecting

Team Members- Key skills of effective project leaders - Giving / receiving feedback from different members of the project.

UNIT V IMPLEMENTATION, MONITORING AND CONTROL OF PROJECTS 9

Project scheduling, network techniques for resource, cost budgeting and scheduling - project management teams and coordination - Monitoring and post implementation, evaluation of the project - ERP - Project financing.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Gobalakrishnan P and Ramamoorthy V.E., “Textbook of Project Management”, Macmillan Publications, 2014.
2. Maylor “Project Management”, 3rd Edition, Pearson, 2010.

REFERENCES

1. Gido, “Effective project management”, 3rd Edition, Cengage Learning, 2008.
2. Gray and Larson, “Project Management: The Managerial Process”, 3rd Edition, TMH, 2010.
3. Choudhury S, “Project Management”, Tata Mc-Graw Hill Publishing Co.,1st Edition, 2007.

19EC72C PROFESSIONAL ETHICS AND HUMAN VALUES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
- CO2: Expose awareness on professional ethics. (K2)
- CO3: Analyze the engineering ethical breach from past study. (K2)
- CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)
- CO5: Discuss about the global issues with regard to ethics. (K2)

UNIT I HUMAN VALUES 9

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility

L: 45 TOTAL:45 PERIODS

TEXT BOOKS

1. Mike W Martin and Roland Schinzinger, “Ethics in Engineering”, 4th Edition, McGraw-Hill, New York 2017.
2. Govindarajan M, Natarajan S and Senthil Kumar VS, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2013.

REFERENCES

1. John R Boatright, “Ethics and the Conduct of Business”, 4th Edition, Pearson Education, New Delhi, 2017.
2. Charles D and Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2012.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, “Engineering Ethics - Concepts and Cases”, Fourth Edition, Wadsworth Thompson Learning, United States, 2005.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford 2001.

19EC73C	**COMPREHENSION**	**L T P C**
		0 0 2 1

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO1: recollect the technical knowledge acquired during the course of study.(K2)

CO2: demonstrate the comprehensive knowledge in technical interviews.(K4)

COURSE CONTENT AND ASSESSMENT PATTERN

The students will review the following subjects to improve their competency level:

1. Electron Devices
2. Circuit Theory
3. Signals and Systems
4. Control Systems
5. Analog and Digital Communication
6. Digital Circuits and Microprocessor
7. Computer Networks
8. VLSI Design

9. Data Structures and OOPS
10. General Aptitude

- The staff-coordinator is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
- The technical seminars and group discussions will be assisted by subject experts in the department.
- Each student must participate in all the activities and their performance assessment must be recorded.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Dr.R.S.Aggarwal, “Quantitaive Aptitude for Competitive Examinations”, S Chand Publications, New Delhi, 20th edition, 2013
2. BARRON's GRE, Barron's Educational Series Inc., U.S., 20th Edition, 2013
3. Yashavant P. Kanetkar, “Let Us C”, BPB Publications, 2011
4. E.Balagurusamy, “Object Oriented Programming with C++”, McGraw Hill Company Limited, 2007
5. Shakuntala Devi, “Puzzles To Puzzle To You” Orient Paperbacks, 1st Edition, 2001
6. www.indiabix.com

Assessment procedure and pattern may be structured and well defined as follows.

No. of Assessments: **Three**

Continuous Assessment Test 1 - (50 Marks) - Duration : 90 Min

General Aptitude Questions - 20 Marks
Core Subject Questions - 20 Marks
C/C++ - 10 Marks

Continuous Assessment Test 2 - (50 Marks) - Duration : 90 Min

General Aptitude Question - 20 Marks
Core Subject Questions - 20 Marks
C/C++ - 10 Marks

Continuous Assessment Test 3 - (50 Marks) - Duration : 90 Min

General Aptitude Questions - 20 Marks
Core Subject Questions - 20 Marks
C/C++ - 10 Marks

19EC74C PROJECT WORK – I L T P C
0 0 6 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify an innovate or creative idea / concept / solution to a problem (K3)
CO2: perform the detailed literature survey related to concept / idea (K2)
CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modeling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

P: 90; TOTAL:90 PERIODS

19EC81C PROJECT WORK – II

L T P C
0 0 12 6

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design and develop the working model (K3)
CO2: work independently to complete the project along with team members (K2)
CO3: demonstrate the results and documents the report (K4)

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

P: 180; TOTAL:180 PERIODS

19EC82C INTERNSHIP / IN-PLANT TRAINING

L T P C
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: acquire the knowledge of different industrial / organizational activities (K2)
CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department
2. A report should be submitted after the successful completion of internship / in-plant training.

P: 60; TOTAL: 60 PERIODS

R-2019 B.E. ECE

PROGRAMME ELECTIVE COURSES

19EC01E SPEECH AND AUDIO PROCESSING

	L	T	P	C	QP
	3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Understand the process of speech production system and auditoryperception system (K2)
- CO2: Understand the speech signal using deterministic and stochasticprocess models (K2)
- CO3: Determine the linear prediction coefficients for the speech samples (K2)
- CO4: Understand the audio processing and acoustic effects (K2)
- CO5: Design speech and audio coding algorithm (K2)

UNIT I SPEECH PRODUCTION AND AUDITORY PERCEPTION 9

Speech Production and Modeling- Origin, Classification, Modeling the Speech Production System, Human Auditory System- Structure, Absolute Threshold, Masking and Phase Perception.

UNIT II SPEECH ANALYSIS 9

Pitch Period Estimation, All-Pole and All-Zero Filters, Stochastic Processes and Models-Periodogram, Autoregressive Model, Autocorrelation Estimation.

UNIT III LINEAR PREDICTION AND QUANTIZATION 9

The Problem of Linear Prediction, The Leroux–Gueguen Algorithm, Long-Term Linear Prediction, Synthesis Filters, Scalar Quantization, Vector Quantization, Scalar Quantization of Linear Prediction coefficients.

UNIT IV AUDIO PROCESSING AND ACOUSTIC EFFECTS 9

Studio Technology, Digital Transmission Systems, Storage Media, Audio Components for Home Entertainment, Room Acoustics, Early Reflections, Reverberation, Approximation of Room Impulse Response.

UNIT V AUDIO CODING 9

Lossless Audio Coding, Lossy Audio Coding, Psychoacoustics, MPEG Layer I, II and III, The CELP Speech Production model, The Principle of Analysis-by-Synthesis, Encoding and Decoding.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Dr. Shaila D. Apte, “Speech and Audio Processing”, Wiley, 2019.
2. Wai C. Chu, “Speech Coding Algorithms - Foundation and Evolution of Standardized Coders” John Wiley & Sons, 2003.
3. Tokunbo Ogunfunmi, Roberto Togneri, Madihally (Sim) Narasimha, “Speech and Audio Processing for Coding, Enhancement and Recognition”, Springer-Verlag New York, 2015.

REFERENCES

1. Umesh Gupta R.S. Kaler, M. Kulkarni, “Digital Signal Processing”, Wiley, 2019.
2. NilanjanDey, “Intelligent Speech Signal Processing”, First Edition, 2019.
3. Ken.C.Pohlmann, “Principles of Digital Audio”, McGraw-Hill, Sixth edition, 2011.
4. Andreas Spanias, Ted Painter, Venkatraman Atti, “Audio Signal Processing and Coding”, Wiley, 2007.

19EC02E	DIGITAL IMAGE AND VIDEO PROCESSING	L T P C QP
		3 0 0 3 A

Pre-requisites : Signal Processing

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the fundamentals in image processing (K2)
CO2 : Describe different image enhancement techniques (K2)
CO3 : Understand the fundamentals of image restoration techniques (K2)
CO4 : Understand various steps in video processing (K2)
CO5 : Describe different two-dimensional motion estimation methods in video processing (K2)

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems –Elements of visual perception, brightness, contrast, hue, saturation, mach band effect –Color image fundamentals –RGB, HSI models, Image sampling, Quantization –Two–dimensional mathematical preliminaries, 2D transforms –DFT, DCT, KLT, DWT and SVD.

UNIT II IMAGE ENHANCEMENT 9

Spatial filtering –Intensity Transformation –Histogram equalization and specification techniques, Noise distributions, Image Smoothing, Image sharpening, Median, Geometric mean, Harmonic mean –Contraharmonic mean filters –Homomorphic filtering –Color image enhancement.

UNIT III IMAGE RESTORATION 9

Model of the Image Degradation/Restoration Process –Noise Models –Restoration in the Presence of Noise Only –Spatial Filtering –Periodic Noise Reduction by Frequency Domain Filtering –Linear, Position–Invariant Degradations –Estimating the Degradation Function –Inverse Filtering –Minimum Mean Square Error (Wiener) Filtering –Constrained Least Squares Filtering –Geometric Transformations.

UNIT IV BASIC STEPS OF VIDEO PROCESSING 9

Analog video, Digital Video, Time varying image formation models : 3D motion models, Geometric Image formation, Photometric Image formation, Sampling of video signals, Filtering operations.

UNIT V 2D MOTION ESTIMATION 9

Optical flow, General methodologies, Pixel based motion estimation, Block matching algorithm, Mesh based motion estimation, global motion estimation, Region based motion estimation, multi resolution motion estimation, Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Rafael C. GonzalezandRichard E. Woods, "Digital Image Processing', 3rd Edition, Prentice Hall, 2009.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, 2003.
3. Yao wang, Joem Ostarmann and Ya-quin Zhang, "Video processing and communication", 1stEdition, PHI

REFERENCES

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods and Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
3. D. E. Dudgeon and RM. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference,1990.
4. William K. Pratt, "Digital Image Processing", 4th Edition, John Wiley, New York, 2007
5. Milan Sonkaet.al, "Image Processing, Analysis and Machine Vision", 3rdEdition, Vikas Publishing House, 2007.

WEB REFERENCES

1. www.digitalimageprocessingplace.com
2. www.ou.edu/class/.../articles/CompressionMethods_Gif_Jpeg_PNG.html

19EC03E MIXED SIGNAL DESIGN

		L	T	P	C	QP
19EC03E	MIXED SIGNAL DESIGN	3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the working of analog filters (K2)
CO2 : Discuss the working of switched-capacitor filters (K2)
CO3 : Describe the conversion from analog to digital data and vice versa (K2)
CO4 : Analyze the design systems involving mixed signals (K2)
CO5 : Discuss about frequency synthesizers and synchronization (K2)

UNIT I ANALOG FILTERS 9

Introduction to sampling theory- Analog continuous-time filters-Overview: passive and active filters; Basics of analog discrete-time filters and Z-transform

UNIT II SWITCHED CAPACITOR FILTERS 9

Switched-capacitor filters - Non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications

UNIT III DATA CONVERTERS 9

Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs

UNIT IV SIGNALING MODES9

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission

UNIT V FREQUENCY SYNTHESIZERS AND SYNCHRONIZATION 9

Basics of PLL,Analog PLLs; Digital PLLs; DLLs.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, 2009.
2. BehzadRazavi, Design of analog CMOS integrated circuits, 2nd Edition, McGraw-Hill, 2017.

REFERENCES

1. R. Jacob Baker, CMOS circuit design, layout and simulation, 4th Edition, IEEE press, 2019.
2. Rudy J, Van. De Plassche, CMOS Integrated ADCs and DACs, Springer, Indian Edition, 2005
3. Arthur B. Williams, Frd J Taylor, Electronic Filter Design Handbook, 4th Edition, McGraw-Hill, 2006.
4. R. Schauman, Design of analog filters, 2nd Edition, Prentice-Hall, 2010.
5. M. Burns et al., An introduction to mixed-signal IC test and measurement, Oxford university press, 1st Indian Edition, 2008

19EC04E ADAPTIVE SIGNAL PROCESSING

L	T	P	C	QP
3	0	0	3	A

PRE-REQUISITES: Signal Processing, Probability and Random Process

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Model systems to estimate power spectrum (K2)
CO2 : Determine filter coefficients from the auto correlation and cross correlation of random sequences (K2)
CO3 : Design adaptive filters and to study the applications of adaptive filtering (K3)
CO4 : Apply the concept of Wiener filter for channel equalization (K3)
CO5 : Employ wavelet transforms for various applications (K2)

UNIT I PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION 9

Discrete random process –Autocorrelation and Auto covariance properties –Relationship between the auto correlation and the model parameters –White noise, Power Spectral Density–Spectrum estimation

UNIT II FILTERING 9

Wiener filter-Principle of orthogonality – Minimum mean square error, Wiener Hopf Equations- Error-Performance Surface- Kalman Filter.

UNIT III ADAPTIVE SIGNAL PROCESSING 9

FIR adaptive filters –Steepest descent adaptive filter –LMS algorithm –Convergence of LMS algorithms –Application: Noise cancellation –Channel equalization –Adaptive recursive filters –Recursive least squares – ARMA, AR and MA Model parameters.

UNIT IV APPLICATIONS 9

Signal enhancement and prediction –System Identification- Channel equalization – Beamforming- Echo cancellation.

UNIT V ADVANCED TRANSFORM TECHNIQUES 9

Short Time Fourier Transform –The Gabor Transform –Discrete Wavelet Transform – Perfect Reconstruction Filter Banks and wavelets –Recursive multi–resolution decomposition –Haar Wavelet –1 D and2 D decomposition

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Monson H.Hayes, “Statistical Digital Signal Processing and Modeling”, Wiley India Pvt. Ltd, 2008.
2. Raghuveer. M. Rao, Ajit S.Bopardikar, “Wavelet Transforms, Introduction to Theory and applications”, Pearson Education, 2000.

REFERENCES

1. L.R.Rabiner and R.W.Schafer, “Digital Processing of Speech Signals”, Pearson Education, 2009.
2. Roberto Crist, “Modern Digital Signal Processing”, Thomson Brooks/Cole, 2004.
3. K.P. Soman, N.G.Resmi and K.I. Ramachandran, “Insight into Wavelets: From Theory to Practice”, 3rdEdition, PHI Learning, 2010.

WEB REFERENCES

1. http://ee.lamar.edu/gleb/adsp/Lecture%2009%20–%20Parametric%20SE.pdf2
2. http://www.dspalgorithms.com/aspt/asptnode29.htm

19EC05E	**WAVELET TRANSFORMS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the concepts of vector spaces and signal spaces (K2)

CO2 : Implement Multiresolution processing (K3)

CO3 : Understand Continuous wavelet transform (K4)
CO4 : Understand Discrete wavelet transform (K4)
CO5 : Understand with the wavelets to specific applications (K3)

UNIT I VECTOR SPACES AND SIGNAL SPACES 9

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence – Hilbert spaces for energy signals - Generalised Fourier Expansion

UNIT II MULTI RESOLUTION ANALYSIS 9

Definition of Multi Resolution Analysis (MRA) - Haar basis - Construction of general orthonormal MRA-Wavelet basis for MRA - Continuous time MRA interpretation for the DTWT - Discrete time MRA- Basis functions for the DTWT - PRQMF filter banks

UNIT III CONTINUOUS WAVELET TRANSFORMS 9

Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) - Tiling of time -scale plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORMS 9

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks - Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Mallat's algorithm for DWT.

UNIT V WAVELET APPLICATIONS 9

Signal Compression - Image Compression techniques: EZW-SPIHT Coding - Image denoising techniques: Noise estimation – Shrinkage rules - Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Rao.R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theoryand Applications”, Prentice Hall PTR, 3rdEdition, 2012.
2. K.P.Soman and K.I.Ramachandran, “Insight into Wavelets – From Theoryto practice”, PHI Learning Private Limited, 3rd Edition, 2013

REFERENCES

1. Prasad, "Wavelet analysis with applications to image processing”, T & FIndia, 2015
2. Vetterli M, Kovacevic J, "Wavelets and Sub-band Coding", CreateSpace Independent Publishing Platform, Second Edition, 2013
3. Mallat S, "A Wavelet Tour of Signal Processing”, Academic Press, 3rdEdition, 2008.
4. Bachman, “Fourier and Wavelet Analysis “, G, Springer, Edition 2019

19EC06E	DIGITAL SIGNAL PROCESSORS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 :Recognize the fundamentals of Real time DSP.(K2)
CO2 :Explain the architecture details of BLACKFIN Processor (ADSP BF533) (K2)
CO3 :Understand the functional blocks of ADSP SC570 processor(K1)
CO4 :Write simple programs using BLACKFIN Processor Instructions (K3)
CO5 :Describe about the memory system and data transfer types (K2)

UNIT I OVERVIEW OF REALTIME DSP 9

Number formats in DSP systems – Dynamic Range and Precision-Quantization error in DSP implementations, A/D Conversion errors, DSP Computational errors - Real time Vs Offline processing-sample by sample processing mode-Block processing mode-performance parameters for real time DSP implementations.

UNIT II BLACKFIN PROCESSOR ARCHITECTURE 9

Introduction to Micro Signal Architecture –BLACKFIN processor family- functional blocks of ADSP BF533-data formats, data types and register files-Computational units–operating modes and states-program sequencer-data address generator

UNIT III INTRODUCTION TO SHARC PROCESSOR ADSP SC570 9

Trends in multi core DSP platforms-multi core DSP processor classification-functional blocks of ADSP SC570-general purpose ports-timer-mobile storage interface-media interface-two wire interface-audio interface-enhanced DMA interface

UNIT IV INSTRUCTION SET 9

Load/Store, move, Arithmetic and Logical operations, Bit operations, Shift/Rotate operations, Program flow control - Programs for working on Load-Store – Move – Buffers – Loops-Programs for working on Arithmetic and Logical instructions-Programs for working on Program flow control and Bit operations

UNIT V MEMORY SYSTEM AND DATA TRANSFER 9

Overview of signal acquisition and data transfer to memory: understanding CODEC, interfacing ADI 836A with ADSP BF533, data communication through serial port-Cache memory concept in ADSP BF533 Processor-DMA operations and configuration setup for data transfer.

L:45TOTAL:45 PERIODS

TEXT BOOKS

1. Woon-SengGan, Sen.M.Kuo, “Embedded Signal Processing with Micro-Signal Architecture”, John Wiley Sons, 2007
2. Venkataramaniand M.Bhaskar, “Digital Signal Processors, Architecture,Programmingand Applications”,TMH, 2ndEdition,2011.
3. ADSP-BF533 Blackfin Processor Hardware Reference (Rev3.6),2013.
4. ADSP-SC570Blackfin Processor Hardware Reference (Rev1.0),2018.

REFERENCES

1. Steven K smith, “The scientist and engineers guide to DSP”, California technical publishing, USA, 2nd Edition, 1993
2. K.Padmanabhan, R.Vijayarajeswaran, Ananthi.S, “A Practical Approach to Digital Signal Processing”, New Age International, 2nd Edition, 2013.
3. JonathamStein, “Digital Signal Processing”,John Wiley, 2005.
4. Lapsley, “DSP Processor Fundamentals, Architectures and Features”, S.Chand &Co., 2000
5. IEEE Signal Processing Magazine, Special Issue on Signal Processing on Platforms with Multiple Cores, Nov. 2009
6. www.analog.com

19EC07E	BIO-SIGNAL PROCESSING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Explain the model of bio-medical signals. (K2)
CO2 : Analyze and process neurological signals (K2)
CO3 : Classify the cardiological signals. (K2)
CO4 : Investigate optimal and adaptive filtering techniques for removingartifacts. (K2)
CO5 :Explain pattern recognition technique for bio-medical signalclassification (K2)

UNIT I INTRODUCTION TO BIO-MEDICAL SIGNAL 9

Nature of Bio-medical Signals, Typical Sources of Bio-medical Signals, Bio-medical Signal Analysis: Objectives and Difficulties-Computer Aided Diagnosis. Concurrent, Coupled and Correlated Processes: Illustration with case studies, Application-segmentation of PCG.

UNIT II NEUROLOGICAL SIGNAL PROCESSING 9

The Brain and its potentials, Electrophysiological origin of brain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, AR Method for EEG, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination, Overall Performance.

UNIT III CARDIOLOGICAL SIGNAL PROCESSING 9

Basic electrocardiography, ECG Data Acquisition, ECG lead systems, ECG parameters and their estimation, Use of multi scale analysis for parameter estimation, Arrhythmia analysis monitoring, Long-term continuous ECG recording.

UNIT IV FILTERING FOR REMOVAL OF ARTIFACTS 9

Time-domain Filters, Frequency-domain Filters, Optimal Filtering - Wiener Filter, Adaptive Filters for Removal of Interference, Selecting an Appropriate Filter, Application: Removal of Artifacts in the ECG, Maternal - Fetal ECG and Muscle-contraction Interference.

UNIT V BIO-SIGNAL CLASSIFICATION AND DIAGNOSTIC DECISION 9

Diagnostic of bundle-branch block-Illustration, Pattern classification, Supervised and Unsupervised pattern classification, probabilistic models and statistical decision. Training test steps, Neural Networks and Applications.

L:45TOTAL:45 PERIODS

TEXT BOOKS

1. D.C. Reddy, “Bio-medical Signal Processing Principles and Techniques”, Tata McGraw-Hill, 2nd Edition reprint, 2016.
2. Rangaraj M.Rangayyan, “Bio-medical Signal Analysis: A Case-Study Approach”, Wiley, 2ndEdition Reprint 2015.

REFERENCES

1. Willis J Tompkins, “Bio-Medical Digital Signal Processing”, Prentice Hall of India, New Delhi, 3rd Edition Reprint 2013.
2. Eugene N. Bruce, “Bio-medical Signal Processing and Signal Modeling”, John Wiley & Sons, 2nd Edition 2014.
3. John L.Semmlow, “Bio-signal And Bio-medical Image processing Matlab Based Applications”, Marcel Dekker Inc., 2nd Edition Reprint 2014.
4. Leif Sörnmo and Laguna, “Bio-electrical Signal Processing in Cardiac andNeurological Applications”, Elsevier, 1st Edition, Reprint 2015.

19EC18E INTRODUCTION TO MEMS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Develop electrical and mechanical model of MEMS and understand materials and fabrication aspects of MEMS and Microsystems (K2)
CO2 : Analyze the mechanics of MEMS design (K2)
CO3 : Analyze electrostatic model and circuit issues in MEMS (K2)
CO4 : Explain the general concept and applications of MEMS (K2)
CO5 : Illustrate the concepts of Optical and RF MEMS (K2)

UNIT I MEMS AND MICROSYSTEMS 9

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS Materials: Substrates and Wafers, Active substrate materials, Silicon, Silicon compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Polymers, Packaging materials, Micro fabrication-Substrate, wafer cleaning, Pattern transfer.

UNIT II MECHANICS FOR MEMS DESIGN 9

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

UNIT III ELECTRO STATIC DESIGN AND SYSTEM ISSUES 9

Electrostatic Actuators : charge control, voltage control, spring suspended C, pull-in voltage, linearization methods, comb drive actuators, levitation, equivalent circuits, Piezoelectric, Thermal, Magnetic actuators, gap closers, rotary finger pull up, inch worms, Electronics Interface, Feedback systems, Noise, circuit and system issues.

UNIT IV FABRICATION ISSUES, DESIGN CHALLENGES ANDAPPLICATION OF MEMS 9

Scaling issues for MEMS- Scaling issues of Physical systems, Computational issues, Fabrication issue, and Material issue. Design rules: Manufacturing issues and design rule checking.

MEMS systems in industrial and automotive applications- Sensors and analysis systems, Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics for Biological application, Microelectrode arrays, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS 9

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies- MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems – design basics, case study – Capacitive RF MEMS switch, performance issues, Case Study: Micro machined Antennas, Micro strip antenna, Micromachining for antennas fabrication, Reconfigurable antennas

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Stephen D Senturia, "Microsystems Design", Kluwer Academic Publishers Springer, 2016.
2. Nadim Maluf, "An Introduction to Micro Electro Mechanical System Engineering", Artech House, 2nd Edition, 2004.

REFERENCES

1. Ai QunLiu,"Photonic MEMS Devices", CRC press, Taylor & Francis group, Boca Raton, 2009.
2. Chang Liu, "Foundations of MEMS", Pearson Education, 2012.
3. A.R.Jha, "MEMS and Nanotechnology-Based Sensors and Devices forCommunications,Medical and Aerospace Applications", CRC press, Taylor & Francis, (2008).

19EC19E	INFORMATION THEORY AND CODING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Comprehend fundamentals required for subsequent development ofinformation theory (K2)

CO2: Understand the compression of data without any loss in information using source coding techniques (K2)
CO3: Describe various binary channels and analyze the channel capacity (K2)
CO4:Understand the essentials of information theory for Gaussian channels (K2)
CO5:Explain the basic concepts of rate distortion theory (K2)

UNIT I FUNDAMENTALS OF INFORMATION THEORY 9

Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Chain Rules for Entropy, Jensen's Inequality and its consequences, Log Sum Inequality and its applications, Data-Processing Inequality, Fano's Inequality, Markov Chains, Entropy Rate.

UNIT II DATA COMPRESSION 9

Kraft Inequality, Variable Length Codes, Prefix Codes, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Source Coding Theorem, Huffman Codes and its optimality, Shannon–Fano–Elias Coding, Arithmetic codes, Lempel Ziv codes, Run Length codes.

UNIT III CHANNEL CAPACITY 9

Noiseless Binary Channel, Noisy Channel with Non overlapping Outputs, Binary Symmetric Channel, Binary Erasure Channel, Symmetric Channels, Properties of Channel Capacity, Channel Coding Theorem, Zero-Error Codes, Hamming Codes, Feedback Capacity, Source–Channel Separation Theorem.

UNIT IV DIFFERENTIAL ENTROPY AND GAUSSIAN CHANNEL 9

Differential Entropy, AEP for Continuous Random Variables, Joint and Conditional Differential Entropy, Properties of Differential Entropy, Gaussian Channel, Converse to the Coding Theorem for Gaussian Channels, Band limited Channels, Parallel Gaussian Channels, Gaussian Channels with Feedback.

UNIT V RATE DISTORTION THEORY 9

Quantization, Definitions, Calculation of the Rate Distortion Function – Binary function, Gaussian function, Simultaneous Description of Independent Gaussian Random Variables, Converse to the Rate Distortion Theorem, Strongly Typical Sequences and Rate Distortion, Characterization of the Rate Distortion Function, Computation of Channel Capacity and the Rate Distortion Function.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Thomas M. Cover, Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2012.
2. Monica E. Borda, "Fundamentals in Information Theory and Coding", Springer, 2011.

REFERENCES

1. PredragIvanis, Dusan Drajic, "Information Theory and Coding - Solved Problems", Springer International Publishing, 2017
2. A. B. Robert, Information Theory, Dover Special Priced Titles, 2007.

3. R. M. Roth, Introduction to Coding Theory, Cambridge University Press, 2006.
4. R. E. Blahut, Algebraic Codes for Data Transmission, Cambridge University Press, 2002.

19EC20E	SATELLITE COMMUNICATION	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the orbital mechanics. (K2)
CO2 : Classify different launch vehicles and describe the working of thespace segment subsystems. (K2)
CO3 : Evaluate the satellite link budget and estimate the performanceimpairments. (K2)
CO4 : Understand different earth station parameters and its measures.(K2)
CO5 : Illustrate the different applications of satellite. (K2)

UNIT I SATELLITE ORBITS 9

Kepler's Laws, Newton's laws, orbital parameters, orbital perturbations, Station keeping, Geostationary and non-Geo-stationary orbits - Look Angle Determination- Limits of visibility –eclipse - Sub satellite point -Sun transit outage.

UNIT II SPACE SEGMENT AND LAUNCH VEHICLES 9

Launching Procedures, Hohmann Transfer, Different types of latest Indian Launch Vehicles, Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Telemetry, Tracking and Command. Thermal control and Propulsion, Communication, Payload and supporting subsystems.

UNIT III SATELLITE LINK DESIGN 9

Satellite uplink and downlink Analysis and Design, link budget, C/N calculation, Performance impairments-system noise, inter modulation distortion, interference, Propagation Characteristics and Frequency considerations- System reliability and design life time.

UNIT IV EARTH SEGMENT 9

Earth Station Technology - Terrestrial Interface, Transmitter and Receiver, Antenna Subsystems, DBS, DTH, TVRO, MATV, CATV, Test Equipment, Measurement of G/T,C/N0, EIRP, Antenna Gain.

UNIT V SATELLITE APPLICATIONS 9

GSAT Series, INSAT, VSAT, Mobile Satellite Services: GSM, GPS, IRNSS, INMARSAT,LEO, MEO, Satellite Navigational System, Digital Audio Broadcast (DAB), Remote sensing satellites, Weather forecasting satellites, RADARSAT.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Dennis Roddy, “Satellite Communication”, McGraw Hill International, 4th Edition, 2006.
2. Anil K. Maini, Varsha Agrawal, “Satellite Communication”, Wiley India, 3rd Edition, 2014.
3. T.Pratt, C.W.Boastian, Jere my Allnutt, Satellite Communication, 2013, 2nd Edition, John Willey & Sons, New Jersy.

REFERENCES

1. Bruce R. Elbert, “Introduction to Satellite Communication”, Artech House Bostan London, 3rdEdition, 2008.
2. M.Richharia, “Satellite Communication Systems-Design Principles”, Macmillan, 2nd Edition, 2006.
3. Tri T. Ha, “Digital Satellite Communication”, McGraw Hill, 2nd Edition, 2009.

19EC21E	RADAR AND NAVIGATIONAL AIDS	L	T	P	C	QP
		3	0	0	3	A

PRE REQUISITE

A) Antennas and Wave Propagation
B) RF and Microwave Engineering

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the concepts of radar measurements, radar functionsand range equation (K2)
CO2: Understand threshold detection and constant false alarm ratedetectors (K2)
CO3 : Understand Doppler processing (K2)
CO4 : Understand Pulse Compression technique (K2)
CO5 : Get acquainted with navigational aids (K2)

UNIT I BASICS OF RADAR 9

Radar concept, basic radar measurements, basic radar functions, radar range equation: Amplitude model, simple point target radar range equation, distributed target radar range equation, noise model and signal to noise ratio, search mode fundamentals, overview of detection fundamentals, General characteristics of clutter and clutter modeling.

UNIT II THRESHOLD DETECTION AND CONSTANT FALSE ALARM RATE DETECTORS 9

Detection strategies for multiple measurements, Introduction to optimal detection: Hypothesis testing and Neyman-Pearson criterion, statistical models for noise and target RCS in radar, threshold detection of radar signals, Overview of detection theory, false alarm impact and sensitivity, CFAR detectors, Cell averaging CFAR, robust CFARs, adaptive CFARs.

UNIT III DOPPLER PROCESSING 9

Review of Doppler shift and pulsed radar data, Pulsed radar Doppler data acquisition and characteristics, Moving Target Indication, Pulse Doppler Processing, Tracking Radar.

UNIT IV FUNDAMENTALS OF PULSE COMPRESSION WAVEFORMS 9

Pulse compression waveforms, Linear Frequency Modulated Waveforms, Phase coded waveforms.

UNIT V NAVIGATION SYSTEMS 9

Four Methods of Navigation, Hyperbolic Navigation System, LORAN – DECCA navigation system, Inertial Navigation System, Instrument Landing System, GPS principle of operation – Position location determination – GPS receiver – Differential GPS.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark A.Richards, James A.Scheer, William A.Holm," Principles of Modern Radar", Scitech Publishing Pvt Ltd, 2nd Edition, 2014.
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, Tata McGraw–Hill, 2004.

REFERENCES

1. Mark A.Richards, "Fundamentals of Radar Signal Processing", Tata McGraw Hill, 2nd Edition, 2014.
2. Skolnik M, "Introduction to Radar Systems", Tata McGraw–Hill, 2nd Edition, 2015.
3. Bassem R.Mahafza, "Radar Systems Analysis and Design Using MATLAB", 3rd Edition, Chapman and Hall/CRC, 2013
4. Lee Andrew Harrison, "Introduction to Radar With Python and Matlab", Artech House; Illustrated Edition, 2019.

19EC22E	STATISTICAL THEORY OF COMMUNICATION	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Demonstrate the basics of classical detection and estimation theory. (K2)
CO2 : Estimate the signal parameters. (K2)
CO3 : Understand the receiver filter for detecting deterministic signal. (K2)
CO4 : Estimate random signal with unknown parameters (K2)
CO5 : Explain the signal estimation in discrete time (K2)

UNIT I CLASSICAL DETECTION AND ESTIMATION THEORY 9

Introduction –Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain. Simple binary hypothesis tests – M Hypothesis – Estimation theory – Composite hypothesis – General Gaussian problem – Performance bounds and approximations

UNIT II DETECTION OF SIGNALS – ESTIMATION OF SIGNALPARAMETERS 9

Detection and Estimation in White Gaussian and Non-White Gaussian noise – Signals with unwanted parameters: The Composite hypothesis problem – Multiple channels – Multiple parameter estimation.

UNIT III DETECTION OF DETERMINISTIC SIGNALS 9

Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.

UNIT IV DETECTION OF RANDOM SIGNALS 9

Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection.

UNIT V SIGNAL ESTIMATION IN DISCRETE TIME 9

Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Harry L. Van Trees, “Detection, Estimation and Modulation theory”, Part I, John Wiley & Sons, NY, USA, 2nd Edition, 2013.
2. P.Eugene Xavier, “Statistical theory of Communication”, New Age International Ltd. Publishers, New Delhi, 2007.

REFERENCES

1. L. L. Scharf, “Statistical Signal Processing: Detection, Estimation, and Time Series Analysis”, Addison Wesley, 2012
2. H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2nd Edition, 1998.
3. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.
4. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.

19EC23E MULTIMEDIA COMPRESSION AND COMMUNICATION

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Analyze the algorithms used for individual samples and block of text compression (K2)

CO2: Analyze the algorithms used for lossy and lossless image compression (K3)

CO3: Describe the different audio compression principles for speech synthesis and analysis (K2)

CO4: Discuss the different video compression principles (K2)

CO5:Illustrate the service requirements, protocols and mechanisms used for different multimedia applications (K2)

UNIT I TEXT COMPRESSION 9

Compression Principles - Huffman coding –Adaptive Huffman coding –Arithmetic coding –Shannon-Fano coding–Dictionary techniques–LZW family algorithms – Vector quantization.

UNIT II IMAGE COMPRESSION 9

Image Compression: Fundamentals –Lossy compression-JPEG Standard –Wavelet Based compression –EZW, SPIHT coders–Lossless compression-CALIC-JPEG LS-Facsimile encoders.

UNIT III AUDIO COMPRESSION 9

Audio compression Techniques –law, A-Law companding –Frequency domain and filtering –Basic sub-band coding –Application to speech coding –G.722 –MPEG audio –progressive encoding –Silence compression, Speech compression –Formant and CELP vocoders.

UNIT IV VIDEO COMPRESSION 9

Video compression techniques and Standards –MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4 –Motion estimation and compensation techniques –H.261 Standard –DVI technology –DVI real time compression –Current Trends in Compression standards

UNIT V MULTIMEDIA NETWORKING 9

Multimedia networking applications, Streaming stored audio and video, Making the best Effort service, Protocols for real time interactive Applications, Distributing multimedia, Beyond best effort service, Scheduling and policing mechanisms, Integrated services, Differentiated Services, RSVP.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. David Salomon, G. Motta, “Handbook of DataCompression”, 5th Edition, Springer-Verlag, London, 2010.
2. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman, 4th Edition, 2012.
3. Kurose and W.Ross, “Computer Networking - a Top down approach”, Pearson Education, 8th Edition, 2020.

REFERENCES

1. Ze-Nian Li, Mark S Drew, “Fundamentals of Multimedia”, Springer, 3rd Edition, 2020.
2. Fred Halshall, “Multimedia communication - Applications, networks, protocols and standards”, Pearson Education, 1st Edition, 2011
3. Yun Q.Shi and Huifang Sun, “Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards”, CRCpress, 2nd Edition, 2017.
4. Peter Symes, “Digital Video Compression”, McGraw Hill, 1st Edition, 2004.
5. Mark Nelson, “Data compression”, BPB Publishers, New Delhi, 2nd Edition, 2008.

19EC24E GLOBAL NAVIGATION SATELLITE SYSTEM

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Describe the working of GPS (K2)
CO2 : Explain the satellite constellation, signal structure and errors in GPS (K2)
CO3 : Illustrate the applications of GPS (K2)
CO4 : Explain the principle of differential GPS (K2)
CO5 : Compare different navigational satellite system (K2)

UNIT I OVERVIEW OF GPS 9

Introduction to Global navigation satellite system, Kepler's law and orbital dynamics, Satellite Orbital parameters, Orbital Perturbations, GPS observables, Basic Equations for finding user position, pseudorange measurement in receiver, user position determination from pseudo ranges.

UNIT II GPS SATELLITE CONSTELLATION AND SIGNAL STRUCTURE 9

GPS System segments -signals -signal generation –Signal characteristics –signal power levels, Determination of GPS satellite coordinates, GPS data formats: Receiver Independent Exchange format (RINEX).

UNIT III GPS RECEIVERS AND ERRORS 9

GPS receiver, Signal conditioning, Signal Acquisition, Carrier and code tracking, Converting tracking outputs to Navigation data, Subframe matching and Parity check, GNSS antennas, Weak signals and their Acquisition, GPS Error sources, Error correction models, Receiver noise, Ionospheric effects on GPS signals.

UNIT IV DIFFERENTIAL GPS 9

Basic concepts of DGPS, Local area DGPS, Extension of Range of Accurate DGPS, Real time and Post processing DGPS, Data link, Radio Technical Commission for Maritime services format (RTCM)

UNIT V GLOBAL NAVIGATION SATELLITE SYSTEM 9

GLONASS components –Constellation details –Signal structure –Time and Co-ordinate systems, NAVSTAR GPS, GALILEO.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. G S Rao, "Global Navigation Satellite Systems", McGraw-Hill publications, New Delhi, 2010.
2. Madry, Scott, "Global Navigation Satellite Systems and Their Applications", Springer-Verlag New York, 2015

REFERENCES

1. Margaret Ziegler, "Global Navigation Satellite Systems", Clanrye International, 2015
2. Asher Clark, "Global Navigation Satellite Systems and Their Application", Larsen and Keller Education, 2017.

3. Shusen Tan, “GNSS Systems and Engineering”, Wiley, 2017.
4. B. Bhatta, “Global Navigation Satellite Systems”, B.S publications, 2010.

19EC25E ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : describe EMI/EMC concepts to practical electronic design. (K2)
CO2 : discuss various EMI coupling principles. (K2)
CO3 : understand the concepts of EMI control techniques. (K2)
CO4 : describe the various standards and regulations. (K2)
CO5 : Analyze EMI test methods and instrumentation. (K2)

UNIT I BASIC THEORY 9

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories, Radiation hazards to humans, Various issues of EMC, EMC Testing categories, EMC Engineering Application.

UNIT II COUPLING MECHANISM 9

Electromagnetic field sources and Coupling paths, Coupling via the supply network, Common mode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling, Cable related emissions and coupling, Transient sources, Automotive transients.

UNIT III EMI MITIGATION TECHNIQUES 9

Working principle of Shielding and Murphy‟s Law, LF Magnetic shielding, Apertures and shielding effectiveness, Choice of Materials for H, E, and free space fields, Gasketting and sealing, PCB Level shielding, Principle of Grounding, Isolated grounds, Grounding strategies for Large systems, Grounding for mixed signal systems, Filter types and operation, Surge protection devices, Transient protection.

UNIT IV STANDARDS AND REGULATION 9

Need for Standards, Generic/General Standards for Residential and Industrial environment, Basic Standards, Product Standards, National and International EMI Standardizing Organizations; IEC, ANSI, FCC, AS/NZS, CISPR, BSI, CENELEC, ACEC. Electro Magnetic Emission and susceptibility standards and specifications, MIL461E Standards.

UNIT V EMITEST METHODS AND INSTRUMENTATION 9

Fundamental considerations, EMI Shielding effectiveness tests, Open field test, TEM cell for immunity test, Shielded chamber , Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilization networks, Feed through capacitors, Antennas, Current probes, MIL -STD test methods, Civilian STD test methods.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Clayton Paul, "Introduction to Electromagnetic Compatibility", Wiley Interscience, 2006
2. V. Prasad Kodali, "Engineering Electromagnetic Compatibility", IEEE Press, Newyork, 2001.

REFERENCES

1. C.R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, Second Edition, 2006.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", Artechhourse, Norwood, Third Edition, 1989.
3. Henry W.Ott. "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, New York, Second Edition, 1988.
4. Donald R. J. White, William G. Duff, "A Handbook Series on Electromagnetic Interference and Compatibility: Electrical noise and EMI specifications, Standards and Regulations", Don White Consultants, 1981.

19EC26E	**ADVANCED WIRELESS COMMUNICATION**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the multiple access technique and physical layer parameters for Long Term Evolution. (K2)

CO2:Apply MIMO basics for the fourth Generation wireless communication technologies. (K2)

CO3:Understand the concept of multiple access technique required for5G wireless communications. (K2)

CO4:Explain the significance and implementation of mm-Wave communication for the next generation wireless networks. (K2)

CO5 : Understand the concepts of Massive MIMO. (K2)

UNIT I EVOLUTION OF WIRELESS COMMUNICATION TOWARDS LTE 9

Evolution of mobile systems before LTE, 3GPP Process, Higher Data rate in mobile Communication, Single Carrier Vs Multi Carrier Transmission, Principles of OFDM - Modulation and Demodulation, Guard Interval, Guard Band, Bit Error Rate, Water-Filling Algorithm, Training symbol based and DFT based channel estimation, PAPR, OFDMA, Physical Layer Parameters for LTE.

UNIT II TECHNOLOGY FOR LTE–MIMO 9

Antenna Diversity, Space-Time Coding, Space-Time Block Code, SDMA, BLAST

Architectures, MIMO Signal Model, Single User MIMO techniques, Multi-User MIMO techniques, Capacity of MIMO Communication Systems. MIMO schemes in LTE

UNIT III EVOLUTION OF WIRELESS COMMUNICATION TOWARDS 5G 9

Evolution of LTE technology beyond 4G -Demands, Challenges and 5G Roadmap, Candidate Waveform for 5G –Filter Bank Multicarrier Modulation, Universal Filtered OFDM, Generalized Frequency Division Multiplexing, Non-orthogonal schemes for efficient multiple access.

UNIT IV MILLIMETER WAVE COMMUNICATIONS 9

Spectrum and regulations –Channel propagation –Hardware technologies for mmWave Systems-Deployment scenarios-Architecture and Mobility -Beamforming -Physical layer techniques-Transmission schemes.

UNIT V MASSIVE MIMO COMMUNICATION 9

Multiple Base Station Antennas and Multiple Terminals -single-Cell System and Multi-Cell System, Capacity, Pilot design, Resource allocation and transceiver algorithms, Fundamentals of baseband and RF implementations, Channel models.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Simon Haykin, Michael Moher and David Koilpillai, “Modern Wireless Communication”, 1st Edition, Pearson Education, 2015.
2. Yong Soo Cho, Jaekwon Kim, Won Young Yang and Chung G. Kang, “MIMO-OFDM Wireless Communications with MATLAB”, John Wiley &Sons (Asia) Pvt Ltd., 2010.
3. Stefania Sesia, Issam Toufik, Matthew Baker, “LTE-The UMTS Long Term Evolution from theory to practise, John Wiley & Sons Ltd, 2011.
4. AfifOsseiran, Jose F.Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016

REFERENCES

1. Andreas F.Molisch, “Wireless Communications”, John Wiley & Sons Limited,2016.
2. Jochen Schiller, “Mobile Communications”, 2ndEdition, Pearson Education, 2012.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. Tzi-Dar Chiueh and Pei-Yun Tsai, “OFDM Baseband Receiver Design for Wireless Communications” John Wiley & Sons (Asia) PrivateLimited, 2007.
5. Erik Dahlman, Stefan Parkvall, and Johan Sköld, “4G LTE/LTE-Advancedfor Mobile Broadband”, Academic Press, Elsevier, 2011.
6. Athanasios G.Kanatas, Konstantina S. Nikita and Panagiotis Mathiopoulos, “New Directions in Wireless Communications Systems From Mobile to 5G”, CRC Press, Taylor & Francis Group, 2018.

19EC27E ERROR CONTROL CODES

19EC27E	ERROR CONTROL CODES	L T P C QP
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Understand linear algebra essential for channel coding (K2)
- CO2: Design a convolutional encoder and decoder for error control (K2)
- CO3: Comprehend error correction methods implemented in a digital communication system which involves convolution codes (K2)
- CO4 : Design a turbo encoder and decoder for error control (K2)
- CO5 : Explain the fundamentals of Low Density Parity Check codes (K2)

UNIT I CHANNEL CODING ALGEBRA 9

Types of codes, Modulation and coding, Maximum likelihood decoding, Types of error, error control strategy, Performance measures, Coded modulation, Groups, Fields, Binary field arithmetic, construction of Galois Field (GF), properties of GF, Computations using GF arithmetic, vector spaces, matrices, Case study: CRC Encoding and Decoding.

UNIT II CONVOLUTIONAL CODES 9

Encoding methods, Structural and distance properties, Catastrophic encoders, polynomial and rational encoders, constraint length and minimal encoders, systematic encoders, Optimum decoding, Implementation issues, add-compare-select method, decoding streams of data, output decisions, Hard and soft decoding, quantization, synchronization issues, asymptotic coding gain, puncturing.

UNIT III ERROR CORRECTION STRATEGIES 9

Burst-error-correcting codes, Single and Phased Burst-error-correcting codes, Bunds on Burst-error-correcting capability, Burst-error-correcting convolutional codes, Interleaved convolutional codes, Burst-and-Random-error-correcting convolutional codes, Basic Automatic-Repeat-Request (ARQ) schemes, Selective-Repeat ARQ, Hybrid ARQ, Hybrid ARQ systems using Convolutional codes.

UNIT IV TURBO CODES 9

Parallel concatenated codes, Turbo encoding, distance properties of Turbo codes, performance analysis, design of turbo codes, Iterative decoding of turbo codes.

UNIT V LOW DENSITY PARITY CHECK CODES 9

LDPC codes, Tanner Graph, Geometric Construction, EG-LDPC and PG LDPC codes, decoding of LDPC codes, Code construction by column and row splitting, Breaking cycles in Tanner graph, Shortened finite geometry LDPC codes, Construction of Gallager LDPC codes, random LDPC codes, Irregular LDPC codes.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Shu Lin, Daniel J. Costello, “Error Control Coding: Fundamentals and Applications”, Second Edition, Pearson, 2011
2. W. Cary Huffman, "Fundamentals of Error-Correcting Codes", Cambridge University Press, June 2012

REFERENCES

1. Juane Li, Shu Lin, Khaled Abdel-Ghaffar, William E. Ryan, and Daniel J. Costello, "LDPC Code Designs, Constructions, and Unification", Cambridge University Press, December 2016
2. R. M. Roth, Introduction to Coding Theory, Cambridge University Press, 2006.
3. Tood.K. Moon, “Error Correction Coding: Mathematical Methods and Algorithms”, John Wiley 2005.
4. S.B. Wicker, “Error Control Systems for Digital Communication and Storage”, Prentice-Hall 1995

19EC28E	**MICROWAVE THEORY AND TECHNIQUES**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the basics of RF and Microwave transmission line (K2)
CO2 : Explain various microwave network parameters and devices. (K2)
CO3 : Describe the design of microwave circuit. (K2)
CO4 : Describe the application based antenna system and measurement of network antenna parameter. (K2)
CO5 : Explain different applications of microwave systems. (K2)

UNIT I RF AND MICROWAVE TRANSMISSION LINE 9

Introduction to Microwaves – History and Applications, Mathematical model of Microwave Transmission – Concept of mode, Characteristics of TEM, TE and TM modes, Losses associated with microwave transmission, Concept of impedance in microwave transmission, Analysis of RF and Microwave Transmission lines – Coaxial line, Rectangular waveguide, Circular waveguide, Microstrip line.

UNIT II MICROWAVE NETWORK ANALYSIS AND DEVICES 9

Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters, Microwave Passive Components – Power divider, Resonator, Microwave Active Components – Oscillators, Mixers.

UNIT III MICROWAVE DESIGN PRINCIPLES 9

Impedance transformation, Impedance matching, Microwave Filter design, RF and Microwave amplifier design, Microwave power amplifier design, Low noise amplifier design, Microwave Mixer and Oscillator design

UNIT IV MICROWAVE ANTENNA AND MEASUREMENTS 9

Microwave antenna parameters, Microwave antenna – Ground based systems, Airborne based systems, Satellite borne systems, Microwave planar antenna. Measurements – Network Analyzer and Measurement of scattering parameters, Spectrum Analyzer and Measurement of spectrum of a microwave spectrum of a microwave signal.

UNIT V MICROWAVE SYSTEM AND MODERN TRENDS 9

Radar systems, Cellular phone, Satellite communication, RFID, GPS, Effect of Microwaves on human body, Medical and Civil applications of microwaves, EMI/EMC, MMIC, RF MEMS, Microwave Imaging.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India.
2. S.Ramo, J.R.Whinnery and T.V.Duzer, "Fields and Waves in Communication Electronics", Third Edition, Wiley India

REFERENCES

1. R.E.Collin, "Foundations for Microwave Engineering", 2ndEdition, IEEE Press.
2. Samuel Y Liao, “Microwave Devices and Circuits”, Pearson Education, 3rdEdition, 2003.
3. M. M. Radmanesh, “RF and Microwave Electronics illustrated”, Pearson Education, 2007.

19EC29E	**FIBER OPTIC COMMUNICATIONS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 : Understand the concept of light propagation through optical fiber.(K2)
CO 2 : Explain the various losses and dispersion in optical fiber. (K2)
CO 3 : Describe the different optical sources and receivers.(K2)
CO 4 : Measure various fiber optic parameters.(K2)
CO 5 : Explain different types of optical networks.(K2)

UNIT I RAY THEORY IN FIBER OPTICS 9

Introduction**,** Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation – EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers – SM fibers.

UNIT II TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS 9

Attenuation – Material absorption losses in silica glass fibers – Linear and Nonlinear Scattering losses - Fiber Bend losses – Mid band and far band infrared transmission –Intra and Inter Modal Dispersion – Over all Fiber Dispersion – Polarization – Nonlinear effects – Overview - SPM,CPM,SBS,SRS.

UNIT III OPTICAL SOURCES AND RECEIVERS 9

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, monoand hetero structures - quantum efficiency, injection laser diode - ILD structures - comparison of LED and ILD. Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance - Fundamental receiver operation, Pre amplifiers, Error sources, Receiver Configuration.

UNIT IV FIBER OPTIC MEASUREMENTS AND DEVICES 9

Fiber Refractive index profile– Fiber alignment and Joint Losses – Fiber Splices – Fiberconnectors – Expanded Beam Connectors – Fiber Couplers. Fiber cut- off Wavelength –Fiber Numerical Aperture– Fiber diameter, OTDR: OTDR Field application - OTDR Trace-OTDR Attenuation measurement - Fiber fault location.

UNIT V OPTICAL NETWORKS 9

Basic Networks – SONET / SDH – Broadcast and select WDM Networks –Wave length Routed Networks – Performance of WDM - Solutions – Optical CDMA – Ultra High Capacity Networks.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. John M. Senior, “Optical Fiber Communication”, Pearson Education, 3rd Edition, 2014.
2. Gerd Keiser, “Optical Fiber Communication”, McGraw Hill, 4th Edition, 2015.

REFERENCES

1. J.Gower, “Optical Communication System”, Prentice Hall of India, 2nd Edition, 2003.
2. Rajiv Ramaswami, “Optical Networks”, 3rd Edition, Elsevier, 2012.
3. Govind P. Agarwal, “Fiber-optic communication systems”, 3rd Edition, John Wiley & sons, 2004.
4. R.P. Khare, “Fiber Optics and Optoelectronics”, Oxford University Press, 1st Edition, 2013.

19EC35E	NANO ELECTRONICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1:Understand the basic concepts of nanoelectronics and various aspects of nanoelectronics. (K2)

CO2:Summarize the basic knowledge of Semiconductor materials and carbon nanotubes. (K2)

CO3: Understand the basic concepts of MOS scaling. (K2)

CO4: To understand the advanced nanoscale devices (K2)

CO5: Understand the Biosensor devices. (K2)

UNIT I INTRODUCTION TO NANOELECTRONICS 9

Introduction to nanoelectronics, Limitations of conventional microelectronics. Classical Particles, Classical Waves and Quantum Particles-Quantum Mechanics of Electronics - Schrödinger wave equation.

UNIT II MATERIALS FOR NANOELECTRONICS 9

Introduction- Semiconductors, Crystal lattices: Bonding in crystals- Electron energy bands-Semiconductor heterostructures-Lattice-matched and pseudomorphic heterostructures-Carbon nanomaterials: nanotubes and fullerenes.

UNIT III SHRINK-DOWN APPROACHES 9

Moore’s Law- Technology Scaling and Reliability Challenges.Basic MOS Transistor-Types, Modes of operation, n-MOS operation, Drain Current, Threshold Voltage, Energy band diagram of MOSFET, nanoscale MOSFET, SCEs- scaling limits, system integration limits.

UNIT IV ADVANCED NANOSCALE DEVICES 9

Double Gate MOSFETs, Tri-Gate MOSFETs, Tunnel FETs-Multi-Gate TFETs and Heterojunction TFETs- Graphene and Carbon Nanotube Transistors.

UNIT V NANO ELECTRONICS SENSORS AND APPLICATIONS 9

Principles- Components of biosensor-Classification of Biosensors based on transducers, FET based Biosensor- ion-sensitive field-effect transistor-operation and fabrication-Characteristics and Performance.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press 2011.

REFERENCES

1. Chandran Karunakaran, Kalpana Bhargava, Robson Benjamin, Biosensors and Bioelectronics, Elsevier Science, 2015.
2. Pierre R. Coulet, Loïc J. Blum, Biosensor Principles and Applications, CRC press-2019.
3. Donald A. Neamen, “Semiconductor Physics and Devices Basic Principles", Third Edition, McGraw-Hill Higher- Education, 2003.

19EC36E	ADVANCED MICROPROCESSORS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the architecture of ARM cortex M3. (K2)
CO2: Explain the data structures of Cortex-family. (K2)
CO3: Understand exceptionsofCORTEXM3 system (K2)
CO4: Write interrupt handling programs in CORTEXM3. (K3)
CO5: understand the concept behind Muticore processor (K2)

UNIT I ARM CORTEX–M3 PROCESSOR 9

Overview of ARM Cortex Profile Processor –CortexM3 Processor Architecture Registers-General Purpose Registers, Special purpose Registers-Operation Modes-Memory Map-Bus Interface-MPU-interrupts and Exceptions- Stack Memory Operations-Reset Sequence-Debugging Support.

UNIT II DATA STRUCTURES IN CORTEX M3 9

Concept of the directives -Different directives :Directives for simple memory reservation, directive for memory reservation with initialization, directives form memory management, directive for project management- Special directives-Operands for Common instruction,-Addressing modes-Bit banding concept –Alternative Structures-Compound condition:

Alternative with AND, Iterative with AND, Alternative with OR Cortex instruction set-Simple Assembly programming with CORTEXM3.

UNIT III MANAGING EXCEPTIONS 9

Process after reset-possible exceptions: NMI, TRAPS like hard fault, memory management fault, bus fault, usage fault, SVC all trap, monitor, PENDSV service, Internal SYSTICK timer-Interrupts- Priority management: Priority levels and sub levels, nested mechanism-Entry and return in exception processing–NVIC registers for exception handling-SimpleAssemblyprogrammingwithCORTEXM3.

UNIT IV INTERNALMODULARITYANDEXTERNALMODULARITY 9

Internal Modularity: Concepts of procedure-procedure arguments:Arguments by value and by reference, passing arguments by general registers, passing arguments by stack, passing arguments by system stack, local data & its reservation, chained list-Simple Assembly programming with CORTEXM3.

External Modularity: Different tools in ARM tool chain-Role of Assembler: Files produced by Assembler, placement counters, symboltable, translation, relocation table-Role of the linker: Functioning principle, product of the linker like mapfile and executable file image, scatter loading file-loader and debugging unit- Simple Assembly programming with CORTEXM3.

UNIT V MULTI-CORE PROCESSORS 9

Single core AND Multi-core architectures comparison – SIMD and MIMD systems – Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program challenges- concept of Open MP Execution Model-OpenMP and MPI comparison.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Vincent Mahout, “Assembly Language programming-ARM CortexM3”, John Wiley& Sons, 2012
2. JosephYiu,“TheDefinitiveGuidetotheARMCortex-M3”,Elsevier, 2nd Edition, 2010
3. Peter S. Pacheco, An Introduction to Parallel Programming-‖, Morgan-Kauffman Elsevier, 2011.

REFERENCES

1. Andrew N.Sloss, Dominic Symes, Chris Wright, “ARM System Developer‟s Guide Designing and Optimizing System Software”,Morgan Kaufmann,1st Edition, 2004
2. Steave Furber, “ARM System-On-Chip Architecture”, Addison Wesley, 2nd Edition, 2000
3. Daniel W.Lewis, “Fundamentals of Embedded Software with the ARMCortex-M3”, Prentice Hall, 1st Edition, 2012.
4. Michael J Quinn, Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill, 2003.
5. Shameem Akhter and Jason Roberts, Multi-core Programming, Intel Press, 2006.

19EC37E	FUNDAMENTALS OF SEMICONDUCTOR CHIP TESTING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Explain the need for IC testing. (K2)
CO2 : Describe the architecture of ATE. (K2)
CO3 : Explain various IC testing techniques.(K2)
CO4 : Explain the various features of CAD tools used for IC testing. (K2)
CO5 : Understand the concept of DFT. (K2)

UNIT I INTRODUCTION TO SEMICONDUCTOR IC TESTING 9

Design and manufacturing cycle of an IC –Logic Verification – Manufacturing defects in an IC – Manufacturing test – Need for CHIP testing – Types of CHIP testing – Engineering testing, production testing, QA testing, Customer inspection testing. Automated Test Equipment (ATE)– Types of ATE-ATE subsystems – Test head, Main frame, Test computer, Manipulator. Common accessories of an ATE – Load boards, Probe cards.

UNIT II AUTOMATIC TEST EQUIPMENT ARCHITECTURE9

Architecture of a mixed signal ATE – Digital subsystem, Pogo blocks, digitizers– Drivers, Comparators, PMU, Timing and formatting units,Sequence controller, Digital source memory, digital capture memory, ATE Pin Electronics. Analog source and Capture memory. Types of ATE- Digital ATE and Mixed Signal ATE.

UNIT III TESTING – CONCEPTS AND METHODS 9

Introduction to testing in digital domains – Data sheet of typical IC – DC Parametric test, continuity test, leakage test, IDD static test – VIL/VIH, VOL/VOH, IIL, IIH, IOL, IOH IDD dynamic test – AC Parameters Test – AC Timing Tests – Setup Time, Hold Time, Propagation Delay, ATE Time Measurement subsystem. Digital Functional Test – Pattern, Timing, Levels.Test plan and Test Programs

UNIT IV TEST DATA ANALYSIS USING CAD TOOLS AND ESD PROTECTION9

Introduction to data analysis– Data visualization tools – Data logs – Lot summaries – Wafer map – shmoo plots – Histograms – Statistical process control – Standard deviation – Mean – Process capability Index – Six sigma quality – Reproducibility – Introduction to ESD – Sources of ESD – ESD models – ESD protection circuits –
Latch up test.

UNIT V FAULT MODELS AND PRINCIPLES OF DESIGN FOR TESTABILITY9

Fault models – Simple examples with stuck at and bridging faults – Controllability and observability – Principles of DFT – Scan based Techniques – Boundary scan test – JTAG-Built in self test.

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark burns & Gordon W Roberts, “An Introduction to mixed signal IC testing and measurement”, Oxford University Press, 1st Edition, 2000.
2. Michael L. Bushnell &Vishwani D. Agrawal, “Essentials of electronic testing” Kluwer academic publishers, 2000.

REFERENCES

1. William J. Greig, “Integrated Circuit Packaging, Assembly and Interconnections”, Springer, 2007.
2. Artur Balasinki, “Semiconductors: Integrated Circuit Design for Manufacturability”, CRC Press, 1st Edition, 2011.

19EC38E	ARM PROCESSOR ARCHITECTURE AND PROGRAMMING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 : Describe the different ARM processor families.(K2)
CO 2 : Explain different types of instructions used in ARM. (K2)
CO 3 : Write ARM assembly programmes. (K3)
CO 4 : Explain exception and interrupts. (K2)
CO 5 : Describe interfacing circuit with ARM processor (K2)

UNITI ARMPROCESSORFUNDAMENTALS 9

Introduction to ARM Processors, ARM programmers model, ARM architecture Revisions, ARM Nomenclature, Functional block diagram of ARM Processor Families: ARM 9, ARM 11 and Cortex, Comparison of Cortex families.

UNITII ARM INSTRUCTION SET 9

Data Processing Instructions, MOVE Instructions, Barrel Shifter Operations, Arithmetic Instructions, Logical Instructions, Comparison and Test Instructions, Multiply Instructions, Branch Instructions, Load – Store Instructions, Single Register Transfer, Single Register Load Store Addressing Modes, Multiple Register Transfer, Addressing Modes for Stack Operations, Swap Instruction, Software Interrupt Instruction, PSR, MRS and MSR Instructions.

UNIT III ARM ASSEMBLY PROGRAMMING 9

Instruction Scheduling – Register Allocation – Conditional Execution – Looping Constructs– Bit manipulation – Efficient switches – Handling unaligned data-Simple ARM assembly program for calculating: Division, Square roots, Random Number Generation, Saturated and Rounded Arithmetic.

UNIT IV EXCEPTION AND INTERRUPT HANDLING 9

Definition: Exception, Interrupt, Interrupt handler, ARM Processor Exceptions and Modes-Exception Priorities - Link Register Offsets – Interrupts - Interrupt Latency - Vector table, Basic Interrupt Stack Design and Implementation - Nested Vector interrupt controller of Cortex M3 Processor.

UNIT V ARM INTERFACING APPLICATIONS 9

GSM Interfacing - ZigBee Interfacing - LCD Display Interfacing - Sensor Interfacing (Ultrasonic, Hall effect sensors) – Quadrature encoder interfacing.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Steve Furber, "ARM System-on-chip architecture", Pearson Education, 2nd Edition, 2005
2. Philip A. Laplante "Real time systems design and analysis", Wiley India Edition, 3rd Edition, 2006.

REFERENCES

1. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide
2. Designing and Optimizing System Software", Morgan Kaufmann, 2004.
3. www.arm.com
4. Cortex M3: Technical Reference Manual (TRM)

19EC39E	**EMBEDDED AND REAL TIME SYSTEMS**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 :Understand the fundamental concepts of embedded system. (K1)
CO2 :Explain the Interfacing schemes in embedded systems design.(K2)
CO3 :Describe real time system and its characteristics.(K2)
CO4 :Understand the basic properties of are altime operating systems.(K1)
CO5 :interpret the services of UCOS III operating system (K2)

UNIT I INTRODUCTION TO EMBEDDED COMPUTING 9

Definition: Embedded system, Intelligent system, Expert System – Embedded system-classification – Embedded system design process – ARM Processor–CPU: Programming input and output – Supervisor mode, exception and traps - concept of interrupts in ARM processor family. Embedded System design Example.

UNIT II COMPUTING PLATFORM AND DESIGN ANALYSIS 9

I/O devices – Component interfacing – Memory mapped I/O – I/O mapped I/O–DevelopmentandDebugging–Programdesign–Modelofprograms–Basiccompilation techniques–Assembly and Linking,simple program for I/O devices.

UNIT III REAL TIME SYSTEMS 9

Definition : Real time and real time systems – real time system Model – real time system characteristics–High reliability achievement ways in real time system-Hardware considerations for real time system – Examples for real time system.

UNIT IV PROCESS AND OPERATING SYSTEMS 9

Definition: Multi - tasking and multi - processing – Context Switching – Operating Systems Scheduling policies: Rate monotonic, EDF, Comparison example –Inter Process Communication mechanisms – Message Mail boxes – Message Queues –Evaluating operating system performance.

UNIT V TASK MANAGEMENT AND MEMORY MANAGEMENT WITH MICRO C IIIOS 9

Introduction to MICRO C OSIII: Features, Services and variants. Task Management: Task creation, task stacks, stack checking, task priority, task suspending, task deletion program example for Multitasking. Memory management: Creating partition in memory, memory control block, obtaining and returning memory control block functions program example for memory management implementation-Synchronization techniques

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Wayne Wolf, “Computers as Components – Principles of Embedded Computer System Design”, Morgan Kaufmann, 2nd Edition, 2008.
2. Philip A.Laplante, “Real time systems design and analysis”, Wiley India Edition, 3rd Edition, 2006.

REFERENCES

1. JeanJ.Labrosse, “Micro C/OS-III: The Real Time Kernal”, CMP Books, 2010.
2. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007.
3. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream tech Press, 2005.
4. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.

19EC40E	PLC AND SCADA	L	T	P	C
		2	0	2	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the PLC components and basic programming concept. (K2)
CO2: Explain the instructions used in PLC. (K2)
CO3: Develop the program using PLC for industrial applications. (K3)
CO4: Describe the functionality of SCADA. (K2)
CO5: Experiment to develop the program using PLC (K3)

UNIT I PROGRAMMABLE LOGIC CONTROLLER 10

Advantages of PLC over relay logic – Parts of PLC – Architecture - Principles of operation – PLC versus Computer – PLC Size and Application - PLC Hardware components - Different programming concept - Programming timers and counters.

UNIT II INSTRUCTIONS IN PLC 10

Instructions in PLC – Program control instructions - Data manipulation instructions - math instructions - sequencer and shift register instructions – Programming concept using Instructions.

UNIT III APPLICATIONS OF PLC 10

PLC Installation Practices - Editing and Troubleshooting – Data acquisition system - Application of PLC - Case study of bottle filling system, traffic light control system – Industrial Applications: Cement industry - Paint industry - Power plant.

UNIT IV SUPERVISORY CONTROL AND DATA ACQUISITION 10

Introduction to SCADA - SCADA Functional requirements and Components - General features, Functions and Applications, Benefits - Configurations of SCADA, RTU (Remote Terminal Units) Connections - SCADA Communication requirements - Structure of a SCADA Communications Protocol.

UNIT V PLC Application – Practical approach 20

Batch process control using Programmable Logic Controller - Level Process using Programmable Logic Controller - Reaction vessel control using Programmable Logic Controller - Automation of Traffic Light Control using Programmable Logic Controller - Automation of Bottle filling system using Programmable Logic Controller - Implementation of any control loop using SCADA system.

L: 40; P: 20 TOTAL: 60 PERIODS

TEXT BOOKS

1. Petruzella, Programmable Logic Controller, McGraw Hill, 5th Edition, 2016
2. M. Chidambaram, —Computer Control of Processes, Narosa Book Distributors Pvt. Ltd., 2009

REFERENCES

1. T. Hughes, Programmable Logic Controller, ISA press, 2007.
2. Krishna Kant, Computer based Industrial Control, Prentice Hall, New Delhi, 2011.

19EC41E	EMBEDDED SYSTEM ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the Hardware architecture of embedded product. (K2)
CO2: Understand the software layered architecture of embedded product. (K2)
CO3: Distinguish the internal components of FPGA specific design. (K2)
CO4: Describe the printed circuit board design principles.(K2)
CO5: Understand the concept of final product assembly sequence. (K2)

UNIT I HARDWARE ARCHITECTURE 9

Understanding embedded system Product specifications with Examples - Component selection - Component package types-embedded system design flow types- Preparation of Block diagram to Final Product Architecture arrival

UNIT II SOFTWARE ARCHITECTURE 9

System software**–**Embedded system software layered architecture**-**Understanding of different Operating System (Linux, Windows, VxWorks, RTOS etc) features and architectures - Basics of Boot loader functionalities–significance of Kerneland Device drivers - File system types.

UNIT III FPGA ARCHITECTURE 9

Basic concepts of CPLD architecture - Difference of CPLD & FPGA - Basic interface protocol study – I2C, GPIO, SPI & UART - Packaging options –concept of on chip logic blocks design-FPGA Design flow - Preparation of Block diagram to Final FPGA Architecture arrival

UNIT IV PCB ARCHITECTURE 9

Understanding of PCB design principles - Different PCB options - PCB component placement guidelines - PCB layout routing - Gerber generation

UNIT V DESIGN FOR MANUFACTURING 9

Understanding of basic Component assembly process - Different ways of assembly – machine assembly/manual assembly - Component storage options - Assembly flow
Understanding of basic mechanical ID design - Different mechanical enclosure options - Advantages & Disadvantages of different mechanical enclosure

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Vilas S bagad, "Electronics product design", Technical publications, Pune 2009
2. Rajkamal, "Embedded system- Architecture, programming and design", Mcgraw Hill, 2017.

REFERENCES

1. Shibu K.V, "Introduction to Embedded systems", Mcgraw Hill, 2017.
2. Kiyofumi Tanaka, "Embedded systems –Theory and Methodology", Intechpublication, Croatia, 2012.
3. Jack Ganssle, "The art of designing embedded system", 2nd Edition, Newness publication, 2008.

19EC42E EMBEDDED SYSTEM ANALYSIS AND RISK MANAGEMENT L T P C 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO1: Explain embedded product design specific feasibility analysis. (K2)
CO2: Explain embedded product component specific feasibility analysis. (K2)
CO3: Understand the concept of embedded product validation. (K2)
CO4: Distinguish different certification standards.(K2)
CO5: Understand the concept of risk management. (K2)

UNIT I FEASIBILITY ANALYSIS: DESIGN SPECIFIC 9

Conceptual design arrival to Final Product Architecture-Product Use Case Analysis-Product Feature Analysis-End application Analysis

UNIT II FEASIBILITY ANALYSIS: COMPONENT SPECIFIC 9

Power Analysis-DC Analysis types-AC Analysis types-Thermal Analysis need and concepts-Signal Integrity testing methods-MTBF Analysis-Reliability Analysis-BOM Compliance Analysis-EMI/EMC Analysis need and types

UNIT III VALIDATION 9

Independent Verification and Validation concepts and methods- Endurance- Validation through Environmental -concept of design for manufacturing (DFM) and concept of design for testability

UNIT IV CERTIFICATION OF STANDARDS 9

Different Certifications need –types of Certifications for embedded system product-features of FCC/CE and UL standards - DO254 standards and its components- DO178 Standards and its components

UNIT V MARKET RESEARCH & RISK MANAGEMENT 9

Methods of Market research for products under Consumer, Industrial, Defence & Automotive domains- different schemes for existing products analysis and gap analysis-Product feature enhancement analysis- Product competitor analysis for existing products-arrival of Product cost vs market demand and its analysis.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Vilas S bagad, “Electronics product design”, Technical publications, Pune 2009.
2. John P.Uyemura, “Introduction to VLSI circuits and Systems”, Wiley student Edition, 2006.

REFERENCES

1. Gunarschirner, “Embedded system: Design, Analysis and verification”, Springer, 2013.
2. Edward Ashford Lee, “Introduction to Embedded Systems – a cyber-physical system approach”, 2nd Edition, MIT press, 2017.
3. Shibu K.V, “Introduction to Embedded systems”, Mcgraw Hill, 2017.
4. Kiyofumi Tanaka, “Embedded systems –Theory and Methodology”, Intech publication,

Croatia, 2012.

5. Arnold Berger, “Embedded system Design –An Introduction to process, Tolls and Techniques”, CMP Books, 2002.
6. Jack Ganssle, “The art of designing embedded system”, 2nd Edition, Newness publication, 2008.
7. Kim H Pries, “Testing complex and embedded systems”, CRC Press, 2010.

19EC45E	**BIO-MEDICAL ELECTRONICS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 :Explain human psychology, bio-electric potential and bio-chemical measurements (K2)
CO 2 : Explain various diagnostic and Therapeutic equipment’s.(K2)
CO 3 : Describe different radiological and nuclear equipment’s for diagnosis. (K2)
CO 4 : Describe different medical imaging equipment and electrical safety.(K2)
CO 5 :Explore the wireless communication technology for bio-telemetry and telemedicine. (K2)

UNIT I BIO-POTENTIAL AND BIO-CHEMICAL MEASUREMENTS 9

Sources of Bio-electric potentials, Electrode Theory, Bio-potential Electrodes, Bio-chemical Transducers, Bio-electric amplifiers, Electrocardiograph – ECG waveform, standard lead systems and ECG Machine. Electro encephalograph. Blood Gas Analyzer - pH, pO2, pCO2 measurement, Colorimeter, Auto analyzer.

UNIT II CLINICAL DIAGNOSIS AND THERAPEUTIC EQUIPMENTS 9

Blood flow meter, Cardiac Output Measurement, Blood cell counters, Pacemakers,Defibrillators, Hemodialysis Machine, Heart-Lung machine.

UNIT III RADIOLOGY AND NUCLEAR EQUIPMENTS FOR DIAGNOSIS 9

Basis of Diagnostic Radiology, Nature of X-rays, Production of X-rays, X-ray Machine,Visualization of X-rays, X-ray Computed Tomography, Radio-isotopes in MedicalDiagnosis, Physics of Radioactivity, Radiation Detectors, Single Photon EmissionComputed Tomography, Positron Emission Tomography.

UNIT IV BIO MEDICAL EQUIPMENTS AND RISK MANAGEMENT 9

Magnetic Resonance Imaging, Ultrasonic Imaging, Thermal Imaging, Laser in Medicine, Physiological Effects of Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention.

UNIT V BIO-TELEMETRY AND TELEMEDICINE 9

Introduction to Bio-telemetry, Physiological Parameters Adaptable to Bio-telemetry, Components of a Bio-telemetry System, Single Channel and Multi-Channel Wireless Telemetry Systems, Multi-patient Telemetry, Implantable Telemetry systems, Telemedicine.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Lesile Cromwell, “Bio-medical instrumentation and measurement”, Prentice Hall of India, New Delhi, 2ndEdition Reprint, 2017.
2. Khandpur, R.S., “Handbook of Bio-medical Instrumentation”, Tata McGraw-Hill, New Delhi, 3rd Edition, 2014.

REFERENCES

1. A.P.F. Turner, I. Karube & G.S. Wilson, “Bio-sensors: Fundamentals & Applications”, Oxford University Press, Oxford, 1st Edition, Reprint 2015.
2. John G.Webster, “Medical Instrumentation Application and Design”, John Wiley and Sons,(Asia) Private Limited, 4th Edition, Reprint 2016.
3. B. H. Brown et. Al, “Medical Physics and Biomedical Engineering”, Overseas Press India Private Limited, 1st Edition, Reprint 2015.
4. Metin Akay, “Biomedical Signal Processing”, Academic Press Inc., 1st Edition, Reprint 2016.

19EC46E	POWER ELECTRONICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon successful completion of the course, the students will be able to

CO1: Illustrate various types of power semiconductor devices. (K2)
CO2: Explain the operation of phase controlled rectifiers. (K2)
CO3: Summarize the basic topologies of DC-DC and DC-AC converters. (K2)
CO4: Explain the operation of AC voltage controller and Cycloconverter. (K2)
CO5: Infer the applications of Power Electronics in Electric Drives and Power system. (K2)

UNIT I POWER SEMICONDUCTOR DEVICES 9

Basic Structure and Characteristics of BJT, SCR, TRIAC, DIAC - Structure and Characteristics of Power MOSFET and IGBT- Firing and commutation circuits for SCR - Gate/Base driver circuits - Protection and cooling.

UNIT II AC TO DC CONVERTERS 9

Operation and analysis of Single phase and three phase controlled rectifiers with R, RL and back EMF load - effect of source inductance, freewheeling effect, power factor control for phase controlled rectifiers- Dual converter

UNIT III CONVERTERS 9

Buck, Boost and Buck-Boost Converters – Time ratio control and current limit control - Single phase and three phase inverters (120ºmode and 180º mode) – PWM techniques: Single PWM - Multiple PWM - Sinusoidal PWM, modified sinusoidal PWM — Voltage and harmonic control – Series resonant inverter.

UNIT IV AC TO AC CONVERTERS 9

Single phase AC voltage controllers - Introduction to Integral cycle control – Single phase and three phase Cycloconverter – step up and step down converter

UNIT V APPLICATIONS9

Uninterrupted power supply topologies- Induction motor Drives– Stator voltage, Frequency and V/F control- HVDC Transmission principle and Links - Solar PV inverter and types - Energy storage - Heat sink design.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Rashid M.H., "Power Electronics: Circuits, Devices and Applications", Pearson Education, PHI, New Delhi, 3rd Edition, 2004.
2. Bimbra P.S., "Power Electronics", Khanna Publishers, 3rd Edition, 2003.

REFERENCES

1. Singh M. D. and Khanchandani K.B., "Power Electronics" Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2008.
2. Ashfaq Ahmed, "Power Electronics for Technology", Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 2004.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and sons, 3rd Edition, 2003.

19EC47E	HIGH SPEED ELECTRONICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 :Describe the concepts involved in RF design (K2)
CO 2 :Compare the structure and characteristics of different passive devices (K2)
CO 3 :Classify different power amplifiers (K2)
CO 4 :Explain the principle of mixers and oscillators for high speed applications (K2)
CO 5 :Choose appropriate tool for RF design (K2)

UNIT I TRANSMISSION LINES AND BASIC CONCEPTS IN RF DESIGN 9

Transmission line theory (basics) crosstalk and non-ideal effects; signal integrity, General Considerations in RF design, Effects of Non-linearity- Harmonic Distortion, Gain Compression, Cross Modulation, Inter- modulation -Sensitivity and Dynamic range, Scattering Parameters.

UNIT II PASSIVE DEVICES 9

General Considerations-Inductors, Basic Structure, Inductor Geometries, Inductance Equations, Parasitic Capacitances, Loss Mechanisms, Inductor Modelling, Alternative Inductor Structures – Transformers-Transformer Structures, Effect of Coupling Capacitance, Transformer Modelling -Transmission Lines-T-Line Structures – Varactors - Constant Capacitors, MOS Capacitors, Metal-Plate Capacitors.

UNIT III RF AMPLIFIER DESIGN 9

Low Noise Amplifiers-LNA Topologies, Gain Switching, Band Switching – Power Amplifiers –General Considerations-Effect of high currents, Efficiency, Linearity, Single ended and differential Power amplifiers, Classification of Power Amplifiers, Class A,B,C, High efficiency power amplifiers,

UNIT IV MIXERS AND OSCILLATORS 9

Mixers – Performance parameters, Mixer Noise Figures, Single balanced and double balanced mixers, Passive down conversion Mixers, Active Down Conversion Mixers, Oscillators – Basic Principles, Cross Coupled and Three point oscillators, VCOs, Phase Noise, PLL-Type I and Type II.

UNIT V PRODUCT DESIGN 9

PCB basics- Standard fabrication. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Stephen H. Hall, Garrett W. Hall, James A. McCall “High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices”, August 2016, Wiley-IEEE Press.
2. Behzad Razavi, “RF Microelectronics”, 2nd Edition, Prentice-Hall 2013,
3. Thomas H. Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”,2nd Edition, Cambridge University Press, 2012.

REFERENCES

1. R.G. Kaduskar and V.B.Baru, “Electronic Product design”, Wiley India, 2011
2. Peter J.W.Noble “Printed circuit board assembly the complete works” Open University Press Robotics Series, Springer 2013.
3. Kai Chang, “RF and Microwave Wireless systems”, Wiley, 2009.

19EC48E MEASUREMENTS AND INSTRUMENTATION

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss about the principles of various measurement techniques.(K2)
CO2: Analyze the transducers and its impact. (K2)
CO3 : Explain about the signal conditioning system and signal analyzers.(K2)
CO4 : Illustrate the digital measurement equipments(K2)
CO5 : Emphasize the need for data acquisition, recording and display systems(K2)

UNIT I SCIENCE OF MEASUREMENT 9

Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards

UNIT II TRANSDUCERS 9

Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fibre optic sensors – Smart/intelligent sensors

UNIT III SIGNAL CONDITIONING AND SIGNAL ANALYZERS 9

DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier – Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

UNIT IV DIGITAL INSTRUMENTS 9

Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

UNIT V DATA DISPLAY RECORDING AND SYSTEMS 9

Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.
2. Ernest o Doebelin, Dhanesh N Manik, "Measurement Systems", McGraw-Hill, 5th Edition, 2007.

REFERENCE

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2nd Edition, 2008.

19EC49E PCB DESIGN AND FABRICATION

L	**T**	**P**	**C**
2	**0**	**2**	**3**

COURSE OUTCOMES

CO1: To understand the basics, industry standards organizations related to the design and fabrication of PCBs.(K2)

CO2: To understand the signal integrity problems in PCB design. (K2)

CO3: To understand the transmission line issues in PCB design (K2)

CO4: To explore PCB software flow using ECAD tool. (K3)

CO5: To design and fabricate simple PCBs for the given application circuits.(K3)

UNIT I BASICS OF PCB DESIGN, TOOLS & INDUSTRY STANDARDS 10

Electronic components: Active components and Passive components-Integrated circuits-PCB fabrication process-Layer stack up-Function of the Layout in the PCB Design

Process. Design Files Created by Layout - Layout format files, Postprocess (Gerber) files, PCB assembly layers and files. Introduction to the Standards Organizations, Classes and Types of PCBs, Introduction to Standard Fabrication Allowances, PCB Dimensions and Tolerances, Copper Trace and Etching Tolerances, Standard Hole Dimensions, Solder mask Tolerance.

UNIT II PCB DESIGN FOR SIGNAL INTEGRITY 10

Signal propagation on transmission lines- Circuit Design Issues Not Related to PCB Layout, Issues Related to PCB Layout -PCB Routing -Making and editing capture parts, The Capture Part Libraries, Types of Packaging, Pins, Part Editing Tools, Constructing Capture Parts, making and editing layout footprints.

UNIT III TRANSMISSION LINES AND CROSSTALK 10

Transmission line characteristic impedance-Propagation velocity-Propagation delay-Time delay-Reflection coefficient-PCB Electrical Characteristics –Microstrip and strip lines-CPW layout-Significance of Transmission line in Board design, Types of Transmission lines. Crosstalk: The crosstalk in transmission lines-Crosstalk control in PCB design parts, planes, tracks, connectors, terminations-Minimization of crosstalk. Thermal issues: Thermal mapping of design

UNIT IV PCB DESIGN FLOW USING ECAD TOOL 10

Overview of Electronic Computer Aided Design tool-Package standards-Bill of materials (BOM) - Project structures and the layout toolset- Project Setup and Schematic Entry Details, the Layout Environment and Tool Set. Creating a Circuit Design with Capture-Starting a new project placing parts, Wiring (connecting) the parts, creating the Layout netlist in Capture. Designing the PCB with Layout- Starting Layout and importing the netlist, Performing a design rule check, Making a board outline, Placing the parts, Auto routing the board Manual routing, Cleanup Locking traces, Post processing the board design for manufacturing. Setting up a user account, Submitting Gerber files and requesting a quote, Annotating the layer types and stack-up, Receipt inspection and testing, Nonstandard Gerber files.

UNIT V PCB DESIGN PRACTICE MODULES 20

1. Generation of Schematic for the application circuits
2. Converting schematic into PCB layout
3. Selecting dimension of PCB layout
4. Placement of components in PCB layout
5. Routing of components in PCB layout based on required width
6. Generating Gerber file for the schematic

L: 40; P: 20 TOTAL: 60 PERIODS

REFERENCES

1. Kraig Mitzner, “Complete PCB Design Using OrCad Capture and Layout”, Newness, 1st Edition, 2009.
2. Simon Monk, “Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards”, McGraw-Hill Education TAB; 2nd Edition, 2017.

3. Douglas Brooks, "Signal Integrity Issues and Printed Circuit Board Design", Prentice Hall PTR, 2003.
4. Lee W. Ritchey, John Zasio, Kella J. Knack, "Right the First Time: a Practical Handbook on High Speed PCB and System Design", Speeding Edge, 2003.

19EC56E **WIRELESS SENSOR NETWORKS** **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the basic concepts and architecture of Wireless SensorNetworks. (K2)
CO2 : Describe the concept of physical layer in WSN. (K2)
CO3 : Describe the concept of MAC layer in WSN. (K2)
CO4 : Explain the concept of Network layer in WSN. (K2)
CO5 : Design of WSN nodes for real time applications (K3)

UNIT I BASICS OF WSN 9

Challenges for Wireless Sensor Networks, Enabling Technologies for WSN, Single node architecture – Energy consumption of sensor nodes - Network architecture – Sensor network scenarios - Optimization Goals and Figures of Merit - Design principles for WSN.

UNIT II PHYSICAL LAYER 9

Introduction, wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, wave propagation effects and noise, channels models, spread spectrum communication, packet transmission and synchronization, quality of wireless channels and measures for improvement, Physical layer and transceiver design consideration in wireless sensor networks: Energy usage profile, choice of modulation schemes, Antenna Considerations.

UNIT III MAC LAYER 9

MAC protocols – fundamentals of wireless MAC protocols, Low duty cycle protocols: STEM, S-MAC - wakeup concepts, contention-based protocols: CSMA, PAMAS - Schedule-based protocols: SMACS - IEEE 802.15.4 low rate WPAN.

UNIT IV NETWORK LAYER 9

Geographic routing, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques.

UNIT V INFRASTRUCTURE ESTABLISHMENT AND CASE STUDY 9

Topology Control - Localization and Positioning - Target detection tracking, Medicine and Health Care, Environmental disaster monitoring.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Holger Karl, Andreas willig, "Protocol and Architecture for Wireless SensorNetworks", John Wiley Publication, 2006.

2. K.Akkaya and M.Younis, “A Survey of routing protocols in wireless sensornetworks”, Elsevier Adhoc Network Journal, Vol.3, no.3, pp. 325-349,2005.

REFERENCES

1. KazemSohraby, Daniel Minoli and TaiebZnati, “Wireless SensorNetworks Technology- Protocols and Applications”, John Wiley & Sons, 2007.
2. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Elsevier Publication, 2004.
3. C.S.Raghavendra Krishna, M.Sivalingam and Taribznati, “Wireless Sensor Networks”, Springer Publication, 2004.
4. C. Siva Ram Murthy and B. S. Manoj, “Adhoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004
5. Philip Levis, “Tiny OS Programming”, 2006 – www.tinyos.net.
6. Jamal N. Al-karaki, Ahmed E. Kamal, “Routing Techniques in Wireless sensor networks: A survey”, IEEE wireless communication, December 2004, 6 – 28.

19EC57E	**MOBILE ADHOC NETWORKS**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Explain the challenges in the design of wireless Adhoc networks.(K2)
CO2 : Categorize and analyze the MAC layer protocols of Adhoc networks (K2)
CO3 : Analyze the challenges in routing layer protocol of Adhoc Networks.(K2)
CO4 : Analyze the attacks pertaining to transport layer protocol. (K2)
CO5 : Elaborate the QoS requirements and Energy Management schemes of Adhoc Networks.(K2)

UNIT I INTRODUCTION 9

Introduction to adhoc networks – Definition - Characteristics features, applications. Characteristics of Wireless channel, adhoc Mobility Models: - Indoor and outdoor models. IEEE standards: 802.11a, 802.11b, 802.11g, 802.11p, 802.11ac, 802.15. HIPERLAN.

UNIT II MEDIUM ACCESS PROTOCOLS 9

MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas.

UNIT III NETWORK LAYER PROTOCOLS 9

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Hybrid routing algorithm, Hierarchical Routing – Tree-Based and Mesh-Based Multicast routing algorithms.

UNIT IV TRANSPORT LAYER PROTOCOLS 9

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT V QUALITY OF SERVICE AND ENERGY MANAGEMENT SCHEMES9

Introduction - Issues and Challenges in providing QoS in Adhoc Wireless Networks- Classifications of QoS Solutions. MAC Layer Solutions-Network Layer Solutions-QoS Frameworks-Need for Energy Management-Classification of Energy Management Schemes-Battery, Transmission Power, System Power Management Schemes.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. C.Siva Ram Murthy and B.S.Manoj, "Adhoc Wireless NetworksArchitectures and protocols", Pearson Education, 2ndEdition, 2007 reprint2018.
2. Charles E. Perkins, "Adhoc Networking", Addison - Wesley, 1stEdition,2008.

REFERENCES

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic,"Mobile Adhoc Networking", Wiley India Edition, 2013.
2. Mohammad Ilyas, "The handbook of adhoc wireless networks", CRCpress, 2017.
3. Fekri M. Abduljalil and Shrikant K. Bodhe, "A survey of integrating IPmobility protocols and Mobile Adhoc networks", IEEE communicationSurvey and tutorials,v9.no.1, 2007.
4. Jonathan Loo, Jaime LloretMauri, "Mobile Adhoc Networks: Current status and Future Trends", CRC Press, 1stEdition, 2016.

19EC58E CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Describe the need for security and the various security techniques.(K2)
CO2 : Explain the various symmetric and asymmetric key algorithms. (K2)
CO3 : Apply suitable authentication functions to ensure authentication.(K2)
CO4 : Explain different types of security services used in variousapplications. (K2)
CO5 : Explain the solutions for security at the system level. (K2)

UNIT I INTRODUCTION 9

OSI Security Architecture - Security Goals - Types of Attacks - Passive attack, active attack - Security services – Overview of Cryptography - Classical Encryption techniques – Substitutional Ciphers, Transposition Ciphers – Steganography

UNIT II SYMMETRIC AND ASYMMETRIC KEY ALGORITHMS 9

Block Ciphers - Data Encryption Standard - Block Cipher Design Principles and Modes of Operation – Advanced Encryption Standard – Triple DES, Stream Cipher-RC4. Public Key Cryptography and RSA – Diffie-Hellman key Exchange.

UNIT III AUTHENTICATION AND HASH FUNCTION 9

Authentication requirements – Authentication functions – Message Authentication Codes - Hash functions- SHA-1-Digital signatures: Digital signature standards - Entity Authentication: Biometrics, Key management Techniques.

UNIT IV NETWORK SECURITY 9

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.

UNIT V SYSTEM LEVEL SECURITY 9

Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, 7thEdition, 2017.
2. Behrouz A. Foruzan, “Cryptography and Network Security”, Tata McGrawHill, 2007.

REFERENCES

1. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2nd Edition, 2001.
2. Charles B. PFleeger, Shari Lawrence P Fleeger, “Security in Computing”, Pearson Education, 3rd Edition, 2003.
3. Wade Trappe and Lawrence C. Washington, “Introduction to Cryptographywith coding theory”, Pearson Education, 2nd Edition, 2007.
4. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 3rd reprint, 2008.
5. Thomas Calabrese, “Information Security Intelligence: Cryptographic Principles and Applications”, Thomson Delmar Learning, 2006.
6. AtulKahate, “Cryptography and Network Security”, Tata McGraw-Hill, 8threprint, 2006.

19EC59E FUNDAMENTALS OF CYBER SECURITY L T P C QP
3 0 0 3 A

Prerequisites: Computer Networks

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Describe the challenges of securing information and identify the security threats (K2)
CO2 : Clarify the importance of Application, Host, and Data Security (K2)
CO3 : Enhance the security by applying network technologies and administration principles (K3)
CO4 : Express the solutions for securing Wireless network and Mobile Computing (K3)
CO5 : Explore the practical drive to secure cloud environments. (K3)

UNIT I SECURITY AND ATTACKS 9

Introduction to Security –Threats -Malware and Social Engineering Attacks – Application and Network Based Attacks - Basics of Cryptography.

UNIT II APPLICATION, DATA AND HOST SECURITY 9

Securing the Host - Securing the operating system (OS) software - Securing with Antimalware - Securing Static Environments - Application Security - Application Development Security - Securing Data

UNIT III ADMINISTERING A SECURE NETWORK 9

Security through Network Devices - Security through Network Technologies - Security through Network Design Elements - Network Protocols - Network Administration Principles - Securing Network Applications

UNIT IV WIRELESS AND MOBILE SECURITY 9

Wireless Attacks - Vulnerabilities of IEEE 802.11 Security - Wireless Security Solutions - Mobile Device Security - Mobile Device Risks, Securing Mobile Devices – IoT and Operational Technology (OT) Threats.

UNIT V CLOUD SECURITY 9

Cloud Computing Principles and Concepts - Overview of Cloud Native Security – Cloud Security - Cloud provider security, Infrastructure security - Cluster Security – Container Security – Code Security - Cloud security Solutions.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark Ciampa, “Security+ Guide to Network Security Fundamentals”, Course Technology, Cengage Learning, 4th Edition, 2012.
2. Chris Dotson, “Practical Cloud Security A Guide for Secure Design and Deployment”, O’Reilly Media, 1stEdition, 2019.

REFERENCES

1. Kimberly Graves, “CEH: Certified Ethical Hacker Study Guide”, Wiley Publishing Inc., 2010.
2. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press (Taylor & Francis Group), 2015.
3. Patrick Engebretson, “The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy”, Syngress, 2011.
4. https://kubernetes.io/docs/concepts/security/overview/

19EC60E	**PRINCIPLES OF OPERATING SYSTEM**	**L T P C QP**
		3 0 0 3 A
Pre-Requisites:	Fundamentals of Computers	

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Conceptualize the components involved in designing acontemporary OS and determine the various ways of structuring an operating system. (K2)
CO2: Discuss Handle processes, threads, and their communication and solve some of the common operating systems problems such as deadlock and synchronization. (K2)
CO3: Explore various techniques of allocating memory to processes and realize the role of virtual memory. (K2)
CO4: Evaluate disk scheduling algorithms and interpret the mechanisms adopted for file accessing in distributed applications. (K2)
CO5: Express the methods used to implement virtualization and general structure of distributed operating systems. (K3)

UNIT I OPERATION SYSTEM AND STRUCTURES 9

Introduction - Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Operating system, Protection and Security - Kernel Data Structures - Computing Environments - Open-Source Operating Systems, Operating-System Structures–Operating-System Services, System Calls, System Programs, Operating-System Design and Implementation.

UNIT II PROCESS MANAGEMENT 9

Processes– Process Scheduling, Operations on Processes, Inter-process Communication, Communication in Client– Server Systems, Threads - Multithreading Models, Process Synchronization - The Critical-Section Problem, Peterson’s Solution, Semaphores, and Classic Problems of Synchronization, CPU Scheduling - Scheduling Algorithms, Thread Scheduling, Deadlocks - Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock.

UNIT III MEMORY MANAGEMENT 9

Main Memory– Swapping, Contiguous Memory Allocation, Segmentation, Paging, Segmentation with paging, Structure of the Page Table, Virtual Memory - Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

UNIT IV STORAGE MANAGEMENT 9

Mass-Storage Structure - Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, File-System Interface - Access Methods, Directory and Disk Structure, File-System Implementation - File-System Structure and Implementation, Directory Implementation, Allocation Methods.

UNIT V ADVANCED OPERATING SYSTEM 9

Virtual Machines – Building Blocks, Types of Virtual Machines and Their Implementations, Virtualization and Operating-System Components, Distributed Systems - Types of Network-based Operating Systems, Network Structure, Communication Structure and Protocols.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. G. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne Operating System Concepts, 9th Edition, John Wiley & Sons Private Limited, 2013.
2. Operating Systems: Internals and Design Principles, 8th Edition, William Stallings, Pearson Education Limited, 2015.

REFERENCES

1. Andrew S. Tanenbaum, Modern Operating System, 4th Edition, Pearson Education Limited, 2014.
2. Operating System: A Design-oriented Approach, 2nd Edition, Charles Crowley, Irwin Publishing, 2011.
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India, 2006.
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates, 2008.

19EC61E	**SCIENTIFIC COMPUTING**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the sources of approximations (K2)
CO2 : Discuss the system of linear and non-linear equations (K2)
CO3: Discuss the characteristics of Linear and Non-linear squares and optimization(K2)
CO4 : Describe the methods for computation of eigen vectors (K2)
CO5 : Describe the methods for initial value problems for ODES (K2)

UNIT I INTRODUCTION 9

Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy, Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

UNIT II SYSTEM OF LINEAR AND NON-LINEAR EQUATIONS 9

Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems. Nonlinear equations: Fixed Point Iteration, Newton’s Method, Inverse Interpolation Method

UNIT III LINEAR LEAST SQUARES AND OPTIMIZATION 9

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank

Deficiency, and Column Pivoting Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

UNIT IV EIGEN VALUES AND EIGEN SPACES 9

Eigen values and singular values: Eigen values and Eigenvectors, Methods for Computing All Eigen values, Jacobi Method, Methods for Computing Selected Eigen values, Singular Values Decomposition, Application of SVD

UNIT V INITIAL VALUE PROBLEMS 9

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Edition, 2019.
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P.Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Edition, 2007.

REFERENCES

1. Xin-she Yang (Ed.), "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Edition, 2008.
2. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Edition, 2007
3. Bertil Gustafsson, "Fundamentals of Scientific Computing", Springer Verlag, 2011
4. Mark H. Holmes," Introduction to Scientific Computing and Data Analysis", Springer, 2016

19EC62E EDGE ANALYTICS AND INTERNET OF THINGS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, student will be able to

CO1 : Understand foundational concepts in Edge Analytics. (K2)
CO2 : Analysis of IOT protocols in cloud environment. (K2)
CO3 : Understand the principles of Machine Learning and Artificial Intelligence.(K2).
CO4 : Analysis of various unsupervised learning algorithm. (K3)
CO5 : Deployment of Edge devices and its challenges.(K3)

UNIT I INTRODUCTION TO EDGE ANALYTICS 9

Introduction to IOT - Importance and Need for IOT - Application and Use cases of IOT - Overview of Industrial IOT - Intersection of IOT and Edge Analytics.

UNIT II IOT PROTOCOLS AND SYSTEMS 9

IOT protocols and standards - Cloud IOT Infrastructure - Setup and program IOT device- Data Collection from IOT device.

UNIT III MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE 9

Introduction to Machine Learning and Artificial Intelligence - Overview of Deep Learning and Neural Networks- Introduction to Convolution Neural Networks.

UNIT IV AUTO ENCODERS AND ITS PROGRAMMING 9

Introduction to Recurrent Neural Networks- Introduction to Auto Encoders- Programming Practice: Build Image Classifier, Build Anomaly Detector

UNIT V EDGE ANALYTICS 9

Challenges with Edge Devices and Deployment - Need for Model Quantization Quantization Aware Training- Post Model Quantization- Programming Practice: Model quantization, deploying model on Edge Devices

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. P.Flach, Machine learning: The art and science of algorithms that make sense of data‖, Cambridge University Press, 2012.

REFERENCES

1. AnirudhKoul, Siddha Ganju, MeherKasam, “Practical Deep Learning for Cloud, Mobile, and Edge” O'Reilly Media, 2019.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things”, Springer, 2011.

19EC63E	MACHINE LEARNING TECHNIQUES	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon successful completion of the course, the students will be able to

CO1: Describe the basic concepts of machine learning. (K2)
CO2: Discuss supervised learning and classification techniques. (K2)
CO3: Apply the concept of unsupervised learning and Clustering for applications. (K3)
CO4: Describe the concept of Dimensionality Reduction. (K2)
CO5: Infer theoretical and practical aspects of reinforcement learning (K2)

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Introduction to Data Science and Artificial Intelligence, Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents. Machine Learning - Examples of machine learning applications- Types of machine learning –Model selection and generalization.

UNIT II SUPERVISED LEARNING 9

Classification - Decision Trees – Univariate Tree –Multivariate Tree - Pruning – Perceptron – Multilayer Perceptron - Back Propagation – Cross Validation and resampling Methods. Case Study: Implementation of Back propagation algorithm for problems in financial domain.

UNIT III UNSUPERVISED LEARNING 9

Clustering- Mixture densities -K-means - EM Algorithm – Supervised Learning After Clustering- Hierarchical Clustering. Case Study: Implementation of clustering algorithm for problems in health care domain.

UNIT IV DIMENSIONALITY REDUCTION 9

The Curse of Dimensionality –Subset Collection - Principal Component Analysis - Factor Analysis – Linear Discriminant Analysis. Case Study: Implementation of LDA for problems in financial/insurance/health care domain.

UNIT V REINFORCEMENT LEARNING 9

Single State Case – Elements of Reinforcement Learning - Model Based Learning – Temporal Difference Learning –Generalization in Reinforcement Learning - Policy Search. Case Study: Implementation of reinforcement learning for problems in automotive domain.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, 2014.
2. Christopher M. Bisho, “Pattern Recognition and Machine Learning”, Springer (India) Private Limited, 2013.

REFERENCES

1. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Richard S. Sutton and Andrew G. Barto: Reinforcement Learning: An Introduction. MIT Press, 2014.

19EC64E BLOCKCHAIN AND ITS APPLICATIONS

L	T	P	C	QP
2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: To learn the basics of Blockchain and components. (K2)
CO2: To comprehend hashing algorithms, wallets in blockchain. (K2)
CO3: To identify the consensus methods for an application. (K2)
CO4: To interpret blockchain solution, use case and blockchain instance. (K3)

CO5: To sketch various blockchain in industry application. (K3)

UNIT I HISTORY OF BLOCKCHAIN 10

Terminologies in Blockchain- Analogy of Block chain - Centralised vs Decentralised Systems - Types of Blockchain – working of blockchain - Ingredients of Blockchain – Blockchain Vs Cryptocurrency. Case study: Survey report on various block chain for real time use case.

UNIT II WORKING OF BLOCKCHAIN 10

Hashing algorithms-SHA-256 algorithm-Application of SHA algorithm.Wallets, Digital Signature and Protocols – Bit coin - Blockchain over traditional technologies and comparison.

UNIT III CONSENSUS METHODS 10

Introduction to Consensus Methods - Proof of Work (PoW) - Proof of Stake (PoS) - Proof of Burn (PoB) - Proof of Activity (PoA) - Proof of Elapsed Time (PoET) - Simplified Byzantine fault Tolerance - mining. Case study : Consensus methods for financial transaction.

UNIT IV BLOCKCHAIN TECHNOLOGY STACK 10

Blockchain Architecture – Forming own blockchain solution – use case identity – design integration – identify the platform – creating blockchain instance – application program interface.

UNIT V CASE STUDIES IN BLOCKCHAIN 20

Industry challenges in Blockchain – attacks over blockchain – blockchain in health care industry – blockchain in media and entertainment – blockchain in finance. Program to practice: Bit coin, crypto currency, blockchain in finance.

L: 40; P: 20; TOTAL: 60 PERIODS

TEXTBOOKS

1. Brojo Kishore Mishra, Sanjay Kumar Kuanar “Handbook of IoT and Blockchain: Methods, Solutions, and Recent Advancements (Internet of Everything (IoE)) “, CRC Press; 1st Edition, November 2020.
2. Jai Singh Arun , Jerry Cuomo , Nitin Gaur Blockchain for Business- For Understanding transformation, growth and new models of Business, 1st Edition Published by Pearson Paperback, 12 December 2019.

REFERENCES

1. https://iabtechlab.com/wp-content/uploads/2018/07/Blockchain-Technology-Primer.pdf
2. https://www.blockchain-council.org/blockchain/the-best-blockchain-business-models/

E – Book

1. https://www.researchgate.net/publication/337649428_Handbook_of_IoT_and_Blockchain_-_Methods_Solutions_and_Recent_Advancements

MOOC

1. https://www.coursera.org/learn/blockchain-business-models
2. https://www.udemy.com/course/the-complete-blockchain-professional-course/
3. https://www.udemy.com/course/build-your-own-proof-of-stake-blockchain/
4. https://www.udemy.com/course/build-your-own-cryptocurrency-in-48-hours/

19EC65E INTRODUCTION TO INTERNET OF THINGS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand basic building blocks of internet of things. (K2)
CO2: Choose suitable sensors and actuators used for specific IoT applications based on the performance. (K2)
CO3: Discuss web technologies suitable for IoT client device. (K2)
CO4: Understand fundamentals of technologies such as Node.JS, REST protocol and JSON which are used at IoT servers. (K2)
CO5: Understand the architecture of Raspberry pi and methodology to configure it as a IoT device. (K2)

UNIT I FUNDAMENTALS OF IOT 9

IoT& Web Technology: The Internet of Things Today, Time for Convergence, Towards the loT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT II SENSORS AND ACTUATORS 9

Classification of Sensors and Actuators - General Requirements for Interfacing - Units and Measures - Transfer function - Impedance and Impedance matching - Range, Span, Resolution, Accuracy, Errors, Repeatability, Sensitivity and Sensitivity analysis, frequency response & bandwidth, temperature sensor, pressure sensor,optical sensors and actuators, DC motor, STEP motor.

UNIT III FRONT END WEBTECHNOLOGIES FOR IOT 9

Client Server Communication, World wide web, URL, HTTP request & response, Web Clients, Web Servers, HTML - Elements, Forms with post and get methods, Cascade Style sheet, JavaScript - functions and objects.

UNIT IV BACK END WEB TECHNOLOGIES FOR IOT 9

Introduction to Node.JS, Node package manager, callback concept, event loop, buffers, streams, file system, global object, utility module, web modules, Express framework, RESTful API, JSON

UNIT V SINGLEBOARD COMPUTER & WEB PROGRAMMING 9

Introduction to Raspberry Pi, Architecture, Compatible Peripherals, Add-Ons, and Accessories, Operating System for Raspberry Pi, Setting up Raspberry Pi, Node.JS as webserver, returning sensor data as JSON.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1) Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, "Internet of Things", Wiley, 2016.
2) Nathan Ida, “Sensors, Actuators and their Interfaces”, Scitech publishing, 2013.
3) Dominique D. Guinard, Vlad M. Trifa, "Building the Web of Things with Examples in Node.JS AND RASPBERRY PI", Manning Publications Co., 2016

REFERENCES

1) Arshdeep Bahga, Vijay Madisetti, “Internet of Things, A Hands-on-Approach”, 1st Edition, Universities press Pvt. Ltd., India, 2015.
2) Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things: Principles and Paradigms”, 1st Edition, Elsevier, USA, 2016
3) Charles Bell, “Beginning Sensor Networks with Arduino and Raspberry Pi”, 1st Edition, Apress Publishers, USA, 2013.
4) Patranabis D, “Sensor and Actuators”, Prentice Hall of India (Pvt) Ltd. 2005.

WEB REFERENCES

1) https://www.raspberrypi.org/
2) https://www.w3schools.com/nodejs/

19EC66E DATABASE MANAGEMENT SYSTEM FOR IOT

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: Understand basic concepts of database management system, relational model and E-R model. (K2)
- CO2: Describe the importance of good database design and optimize database design using normalization rules. (K2)
- CO3: Simulate various MySQL command for schema creation and data manipulation. (K3)
- CO4: Comprehend query evaluation plan and optimization to reduce complexity. (K2)
- CO5: Write program to access MySQL database using Node.JS environments. (K3)

UNIT I FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEM 9

Purpose of Database System, Views of data, Database Languages, Database System Architecture, Database users and Administrator, Structure of relational databases, database schema, schema diagrams, relational algebra, Entity-Relationship Model, Developing ER diagram

UNIT II DATABASE DESIGN CONCEPTS 9

Good database design, functional dependency, closure of functional dependency set, closure of attributes, dependency preservation, decomposition using functional dependency, Need for Normalization, I Normal form, II Normal form, III Normal form, Higher level Normal forms, Design improvement

UNIT III MY SQL COMMANDS 9

Introduction to MySQL, Literal values, schema object name, keywords and reserved words, Datatypes, Function and operators, Data definition commands, data manipulation commands, select queries with conditional restrictions, arithmetic operators, logical operators, special operators, ordering, grouping, joining tables, sub queries, Insert, Update and Delete queries, Introduction to Advanced SQL - Functions and Procedures, Triggers.

UNIT IV QUERY PROCESSING AND OPTIMIZATION 9

Query Processing - Measures of Query Cost - Selection– Sorting - Join Operation – Other Operations - Evaluation of Expressions – Query Tuning - Query Optimization - Transformation of Relational Expressions - Estimating Statistics of Expression Results - Choice of Evaluation Plans – Materialized Views.

UNIT V NODE.JS & MYSQL FOR IOT APPLICATIONS 9

Three Tier Architecture, MySQL driver for Node.JS, Connection establishment, Programming with data definition and manipulation commands, Time series database, SQLite, JSON data parsing, calling stored procedure and views, case study: Temperature and humidity monitoring system, live GPS location tracking system.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1) Abraham Silberschatz, Henry F.Korth, S.Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2013.
2) Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition, 2016.
3) C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Pearson Education, 8th Edition, 2012.

REFERENCES

1) Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Pearson Education, 5th Edition, 2009.
2) S.K.Singh, —Database Systems Concepts, Design and Applications‖, 1st Edition, Pearson Education, 2006.
3) Peter Membrey, “Mongo DB Basics”, Apress; 1st Edition, 2014.
4) Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition, 2004

WEB REFERENCES

1) https://www.w3schools.com/nodejs/nodejs_mysql.asp
2) https://www.mysqltutorial.org/

19EC67E	IOT: ARCHITECTURE, STANDARDS AND PROTOCOLS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Comprehend evolution of internet technology, need for IoT and architecture of IoT systems. (K2)
CO2: Analyze suitable components required to design IoT application. (K3)
CO3: Discuss security issues in IoT and resolving techniques. (K2)
CO4: Describe hardware and software specifications for IoT. (K2)
CO5: Understand industrial 4.0 and industrial IoT evolution. (K2)

UNIT I IOT ARCHITECTURE AND EVOLUTION 9

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards, M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT II TRANSPORT & SESSION LAYER PROTOCOLS 9

Transport Layer: TCP, UDP, DCCP, SCTP- TLS, DTLS - Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

UNIT III IOT SECURITY 9

Need for encryption, standard encryption protocol, light weight cryptography, Quadruple Trust Model for IoT-A – Threat Analysis and model for IoT-A, Cloud security

UNIT IV IOT HARDWARE & SOFTWARE 9

Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, Hardware for the IoT - Classes of Constrained Devices, Arduino, Intel Galileo, Software for the IoT – Open WSN, Tiny OS, Free RTOS, TI-RTOS, RIOT, Contiki OS. Cloud services – AWS. Case study: IoT for smart cities, health care, agriculture, smart meters

UNIT V INDUSTRIAL IOT 9

Industry 4.0 - Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Industrial IoT-Introduction, Business Models & Reference Architecture, Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1) Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine to Machine to Internet of Things”, Elsevier Publications, 2014.

2) Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri, "Internet of Things Architectures, Protocols and Standards", John Wiley & Sons Ltd., 2019.
3) Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2017.

REFERENCES

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016.
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642- 19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications, 2016.
4. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, "Industrial Internet of Things: Cyber manufacturing Systems", Springer, 2017.

		L	T	P	C
19EC68E	**WIRELESS TECHNOLOGIES FOR IOT**	**3**	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the fundamentals of wireless communication system. (K2)
CO2: Discuss various wireless standards and protocols used in IoT. (K2)
CO3: Explain concepts and applications of Narrow Band (NB) IoT with MQTT protocol (K2)
CO4: Understand green communication in IoT. (K2)
CO5: Understand wireless IoT applications such as RFID and wireless sensor node. (K2)

UNIT I FUNDAMENTALS OF WIRELESS NETWORKS 9

Network Topologies, Types of networks, Role of Wireless Standards in IoT, OSI reference model, TCP/IP reference model, IEEE 802 Reference model, Layered model for IoT, Spectrum planning, Multiple Access, Narrow band, Wide band and Ultra Wide Band technologies for IoT.

UNIT II WIRELESS STANDARDS AND PROTOCOLS 9

Bluetooth, Z-Wave, Zigbee, Wi-Fi, LORA - Qualitative analysis: Protocol stack, transceiver model, channel and spectrum, network topology, access and spread spectrum, data rate, error correction strategy.

UNIT III LTE CELLULAR NARROW BAND INTERNET OF THINGS (NB-IOT) 9

3GPP standardization, 4G and 5G system, LTE cellular NB IoT, NB-IoT sensors and actuators, NB-IoT core network, MQTT implementation in NB-IoT - publish/subscribe model, topic and subscription, retained message, Quality of Service levels, AT commands

UNIT IV GREEN IOT 9

Focus of Green IoT, Green communication components - RFID Tags, wireless sensor network, cloud computing, data centers, Green M2M, Key technologies, applications, challenges & problems

UNIT V WIRELESS IOT APPLICATIONS 9

Radio Frequency Identification - RFID in IoT, operation and components, Electronic Product Code - Architecture and Framework, RFID Middleware, Benefits, opportunities & Risk.

Wireless Sensor Networks - Characteristics and design challenges, WSN Layers, WSN Middle ware, use of Zigbee and IEEE 802.15.4 in WSN, Future Trends

L:45; TOTAL: 45 PERIODS

TEXT BOOKS

1) Daniel Chew, "The Wireless Internet of Things - A Guide to the Lower Layers", IEEE Press, Wiley, 2019.
2) Hossam Fattah, "5G LTE Narrowband Internet of Things (NB-IoT)", CRC Press, Taylor & Francis Group, 2019.

REFERENCES

1) OlofLiberg, Marten Sundberg, Y.P. Eric Wang, Johan Bergman and Joachim Sachs, "Cellular Internet of Things Technologies, Standards, and Performance", Academic Press, Elsevier Ltd., 2018.
2) William Stallings, “Wireless Communication Network and Systems”, Pearson Education Asia, 2016.
3) Simon Haykin, Michael Moher and David Koilpillai, “Modern Wireless Communication”, 1stEdition, Pearson Education, 2015.
4) Christopher Siu, "IoT and Low Power Wireless Circuits, Architectures and Techniques", CRC Press, Taylor & Francis Group, 2018

WEB REFERENCES

1) https://www.3gpp.org/
2) https://lora-alliance.org/

		L	T	P	C
19EC69E	**IOT BIG DATA ANALYTICS**	**3**	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand integration of IoT and big data for analytics. (K2)
CO2: Discuss processing methodologies for IoT real time data and linked stream data. (K2)
CO3: Comprehend processing of IoT big data using Apache Hadoop. (K2)
CO4: Understand the multimedia big data computing for IoT. (K2)
CO5: Understand the implementation of big data analytics in Smart IoT systems through several case studies. (K2)

UNIT I INTRODUCTION TO IOT BIG DATA ANALYTICS 9

Introduction to IoT data and Big data – Challenges of IoT analytics applications – IoT analytics life cycle and techniques –Searching the Internet of Things: Introduction - Search Architecture for Social and Physical Sensors - Local Event Retrieval - Using Sensor Metadata Streams to Identify Topics of Local Events in the City – Venue Recommendation

UNIT II IOT SEMANTICS AND DATA STREAMING ANALYTICS 9

Introduction – Linking data - Real-time & Linked Stream Processing - Semantic-based Distributed Reasoning – Cross Domain Recommender Systems - Semantic Analytics - Semantic Modelling and Validation Tools - Data Reasoning - Ethical IoT

UNIT III IOT BIG DATA ANALYTICS USING HADOOP 9

Apache Hadoop, Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce jobs - Distributing data processing across server farms –Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows

UNIT IV MULTIMEDIA BIGDATA COMPUTING FOR IOT 9

Introduction - Definition and Characteristics – Relationship between IoT and Multimedia Big Data(MMBD) – Multimedia Big Data LifeCycle - MMBD for IoT Applications - Data Collection – Technologies used - Analysis of Various Techniques - Opportunities, Issues, and Challenges

UNIT V CASE STUDIES OF IOT DATA ANALYTICS 9

Precision Agriculture and its Cyber-Physical Management, IoT implementation for smart cities and future Challenges, IoT based Intelligent Transportation System for Global Perspective, IoT based implementations for smart buildings

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1) John Soldatos, "Building Blocks for IoT Analytics", River Publishers Series In Signal, Image and Speech Processing, 2017.
2) Sudeep Tanwar, Sudhanshu Tyagi, Neeraj Kumar, "Multimedia Big Data Computing for IoT Applications: Concepts, Paradigms and Solutions", Springer, 2020

REFERENCES

1) Andrew Minteer, "Analytics for the Internet of Things (IoT)", Packt publishing Ltd., 2017.
2) Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.
3) NilanjanDey, Aboul Ella Hassanien, Chintan Bhatt, Amira S. Ashour, Suresh Chandra Satapathy, "Internet of Things and Big Data Analytics Toward Next-Generation Intelligence", Springer International Publishing, 2018.

WEB REFERENCES

1) https://www.edureka.co/blog/iot-tutorial/
2) https://data-flair.training/blogs/data-analytics-tutorial/

19EC70E PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

L	T	P	C
0	0	6	3

COURSE OBJECTIVES

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Upskill in emerging technologies and apply to real industry-level use cases
CO2: Understand agile development process
CO3: Develop career readiness competencies, Team Skills / Leadership qualities
CO4: Develop Time management, Project management skills and Communication Skills
CO5: Use Critical Thinking for Innovative Problem Solving
CO6: Develop entrepreneurship skills to independently work on products

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be	3

	uploaded to cloud based repository such as GitHub.	
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

TECHNICAL SKILLS		**SOFT SKILLS**	
Criteria	***Weightage***	***Criteria***	***Weightage***
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
Total	**70**	**Total**	**30**
Total Weightage		**100**	
Passing Requirement		**50**	
Continuous Assessment Only			

P: 90; TOTAL: 90 PERIODS

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

ONE CREDIT ELECTIVE COURSES

19EC01L	BASIC DEVICE DRIVER PROGRAMMING PRACTICE	L	T	P	C
		0	0	2	1

COURSE OUTCOME

Upon completion of this course, the student will be able to

CO1:Write character type Device Driver programs for the given on chipperipherals (K3)

EXPERIMENTS

1. Theoretical introduction about the significance and different types of Device driver
2. Device driver program to perform on-board LEDS glow using GPIO logic block
3. Device driver program to perform on-board LEDS glow using Timer0 logic block
4. Device driver program to perform LCD interface using SPI logic block
5. Device driver program to perform SPI communication using SPI logic blocks of two different LPC 2148 Boards
6. Device driver program to perform serial data communication using UART logic block
7. Device driver program to perform GSM interface using UART logic block
8. Device driver program to perform DC Motor interface using UART and SPI logic blocks.
9. Device driver program to perform ToF interface using I2C logic blocks of different processor families

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier Inc, 2005
2. SreekrishnanVenkateswaran, “Essential Device Driver”, Prentice Hall, 2008
3. www.arm.com
4. www.embeddedrelated.com
5. www.embeddedarm.com

19EC02L	IMAGE PROCESSING PRACTICE USING OPENCV	L	T	P	C
		0	0	2	1

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO1: Perform the Image Processing operations using OPENCV (K3).

LIST OF EXPERIMENTS

1. Program to Read, Load and Display the given images.
2. Program to perform Negative, Logarithmic transformation of different images.
3. Develop Histogram equalization algorithm and display the Histogram equalized image.
4. Program to perform filtering operation in spatial domain on noisy image corrupted by both Gaussian noise and Salt Pepper noise.
5. Program to perform Translation and rotation operations.
6. Program to perform Sharpening of two different images using Filters.
7. Program to perform segmentation on bi-level images using histogram method.

8. Program to perform Morphological operations Erosion and Dilation.
9. Program to perform Geometric transformations scaling and shearing.
10. Program to perform Face detection in images using Raspberry Pi.

P:30 TOTAL: 30 PERIODS

19EC03L	INTRODUCTION TO OFDM	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Understand modulation and demodulation process of OFDM. (K2)
CO 2: Comprehend the effect of offset errors and compensation techniques (K2)
CO 3: Describe the channel estimation for time varying channels (K2)
CO 4: Understand various PAPR reduction techniques. (K2)

UNIT I FUNDAMENTALS OF OFDM 4

Single-Carrier vs. Multi-Carrier Transmission, OFDM Modulation and Demodulation, OFDM Guard Interval, OFDM Guard Band, BER of OFDM Scheme

UNIT II SYNCHRONIZATION FOR OFDM 4

Effect of STO, CFO, and Sampling Clock Offset, Estimation Techniques for STO and CFO.

UNIT III CHANNEL ESTIMATION 4

Pilot Structure, Training Symbol-Based Channel Estimation, DFT-Based Channel Estimation, Decision-Directed Channel Estimation, Channel Estimation in Fast Time-Varying Channels

UNIT IV PAPR REDUCTION 3

Introduction to PAPR, PAPR Reduction Techniques **-** Clipping and Filtering, PAPR Reduction Code, Selective Mapping, Partial Transmit Sequence, DFT Spreading

L: 15; TOTAL:15 PERIODS

REFERENCES

1. Aditya K. Jagannatham, “Principles of Modern Wireless Communication - Theory and Practice”, McGraw Hill Education (India) Private Limited, 2016.
2. Yong Soo Cho, Jaekwon Kim, Won Young Yang and Chung G. Kang, “MIMO-OFDM Wireless Communications with MATLAB”, IEEE Press, John Wiley & Sons Pvt. Ltd., 2010.
3. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
4. Richard van Nee, Ramjee Prasad, “OFDM for Wireless multimedia communications”, Artech House, 2000.
5. R. E. Blahut, Algebraic Codes for Data Transmission, Cambridge University Press, 2002.

19EC04L WIRELESS COMMUNICATION SYSTEM DESIGN USING SDR

L	T	P	C
0	0	2	1

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO 1: Design and implement a wireless transceiver using PSK/QAM Modem with channel estimation (K3)

PRE-REQUISITES:

Before starting this course the students should have the knowledge on

- Fundamentals of Digital Communication and Wireless communication
- Programming using virtual instrumentation simulation toolbox
- Architecture of Universal Software Radio Peripheral (USRP)

LIST OF EXPERIMENTS

1. Study of virtual instrumentation engineering workbench for communication system design.
2. Device Driver for Universal Software Radio Peripheral (USRP).
3. PSK/QAM transceiver using pulse shaping filters and shaping and matched filtering, synchronization.
4. Frame synchronization, frame detection and frequency offset correction in QAM transceiver.
5. Channel estimation and equalization for QAM transceiver.

REFERENCES

1. Robert W. Heath Jr., Digital Wireless Communication, Physical Layer Exploration Lab Using the NI USRP, National Technology and Science Press, 2012.
2. Bruce A. Black, Introduction to Communication Systems - Lab Based Learning with NI USRP and LabVIEW Communications, National Instruments, 2014.
3. Rapid Prototyping of Real-Time Wireless Systems, National Instruments, 2013
4. An Introduction to Software Defined Radio with LabVIEW Communications System Design Software and NI USRP, Version 2.0, National Instruments, 2015.

WEB REFERENCES

1. http://www.ni.com/en-in/innovations/white-papers/14/overview-of-the-ni-usrp-rio-software-defined-radio.html
2. http://www.ni.com/en-in/innovations/white-papers/11/what-is-ni-usrp-hardware-.html

19EC05L OFDM SYSTEM DESIGN USING SDR

L	T	P	C
0	0	2	1

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO 1: Design and implement a wireless transceiver using OFDM. (K3)

PRE-REQUISITES

Before starting this course the students should have the knowledge on

- Fundamentals of Digital Signal Processing and Wireless communication
- Concepts of Orthogonal Frequency Division Multiplexing (OFDM)
- Programming using virtual instrumentation simulation toolbox
- Architecture of Universal Software Radio Peripheral (USRP)

EXPERIMENTS

1) Baseband OFDM modulation& demodulation with PSK/QAM mapping and cyclic prefix
2) Lattice type pilot insertion in OFDM symbol, channel estimation and equalization
3) ML Estimation of Time and Frequency Offset (Van De Beek Algorithm)

REFERENCES

1. Robert W. Heath Jr., Digital Wireless Communication, Physical Layer Exploration Lab Using the NI USRP, National Technology and Science Press, 2012.
2. Bruce A. Black, Introduction to Communication Systems -Lab Based Learning with NI USRP and LabVIEW Communications, National Instruments, 2014.
3. Rapid Prototyping of Real-Time Wireless Systems, National Instruments, 2013.
4. An Introduction to Software Defined Radio with LabVIEW Communications System Design Software and NI USRP, Version 2.0, National Instruments, 2015.

WEB REFERENCES

1. http://www.ni.com/en-in/innovations/white-papers/14/overview-of-the-ni-usrp-rio-software-defined-radio.html
2. http://www.ni.com/en-in/innovations/white-papers/11/what-is-ni-usrp-hardware-html
3. http://www.ni.com/tutorial/13878/en/
4. http://www.ni.com/en-in/innovations/white-papers/06/ofdm-and-multi-channel-communication-systems.html

19EC06L	SPREADING CODES IN SPREAD SPECTRUM MODULATION	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Identify the popular spreading codes in communication.(K2)
CO2: Explain the various code generation methods.(K2)
CO3: Analyze and select code for spreading. (K2)
CO4: Explain the applications of spreading codes. (K2)

UNIT I DESCRIPTION OF POPULAR CODES 3

Maximal length sequences code, Gold code, and Kasami code

UNIT II CODES GENERATION 4

Binary Shift Register concept for generation of PN sequence: balance property, run length property, and Correlation Property, generation of Gold code set, generation of Kasami code set.

UNIT III CODE SELECTION FOR SPREADING 4

Comparison of auto correlation and cross correlation of various codes such as PN sequence code, M-Sequence code, Gold code, Kasami code.

UNIT IV APPLICATIONS OF THE SPREADING CODES 4

Applications of spreading code to cellular communication systems, Second and third generation CDMA systems/ standards, Design examples of IS-95, GPRS, Bluetooth, W-CDMA, Wi-Fi.

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. John Proakis and MasoudSalehi, Digital Communications, McGraw-Hill, 5th Edition, 2007.
2. T. S.Rappaport, Wireless Communications: Principles and Practice (2nd Edition), Prentice Hall, 2001.
3. R.L. Peterson, R. L Ziemer, D. E Borth, “Introduction to Spread Spectrum Communications”, Upper Saddle River: NJ, Prentice Hall, 1995.
4. E. H. Dinanve B. Jabbari, "Spreading codes for direct sequence CDMA and wideband CDMA cellular networks", IEEE Communications Magazine, vol. 36, pp.48-54, September 1998.

19EC07L MEMORY BUILT IN SELF TEST (MBIST)

L	T	P	C	QP
1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to,

CO1: Understand the different types of Memory and the faults associated with the memory (K2)
CO2: Understand MBIST Architecture (K2)
CO3: Analyse the various algorithms involved in MBIST (K3)

UNIT I INTRODUCTION TO MEMORY 3

Basic memory Architecture- Different Types of Memory (RAM, ROM, Serial Access memory, Content addressable memory)-MOSFET RAM structures(6T-cell SRAM & DRAM)

UNIT II FAULTS IN MEMORY 4

Fault models: Basic state diagrams, Stuck at faults, Transition faults, coupling faults, neighbourhood pattern sensitive fault, Address decoder faults.

UNIT III MEMORY BUILT IN SELF TEST ARCHITECTURE 4

Basic Mbist architecture-Types of collars (parallel, dedicated, sequential)-MbistControllers(hardwired based, Microcode based, Processor based)

UNIT IV ALGORITHMS FOR MBIST 4

Types of algorithms for MBIST patterns (classical, March based)- Walking, GALPAL, Checkerboard, Sliding diagonal, Butterfly, MARCH algorithm

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Adams. R. Dean, “High performance memory testing - Design principles, Fault modeling and self-test”, Adams Kluwer Academic Publishers, 2003.
2. Charles. E.Stroud, “A Designer’s guide to Built-in Self-test”, Kluwer Academic Publishers, 2002.
3. A.J.Van De GOOR and C.A.Verruijt, “An overview of Deterministic Functional RAM chip testing”, ACM Publishers, 2007.
4. Sachdev**,** Manoj, “Defect oriented testing for CMOS analog and digital circuits” Springer Science publications, 1999.
5. Tegze.P.Haraszti, “CMOS memory Circuits”, Kluwer Academic Publications, 2000

19EC08L	**JOINT TEST ACTION GROUP (JTAG)**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the basic concept of JTAG and its Architecture (K2)

UNIT I INTRODUCTION TO JTAG 1

Basics of Testing, Why testing, why JTAG

UNIT II JTAG STRUCTURE 4

TAP - TAP controller - TAP logic control - TMP controller - Instruction register.

UNIT III JTAG TEST DATA REGISTER STRUCTURE 4

Basic design - Boundary scan register - Device ID – ECID – TMP status ID - Bypass register

UNIT IV JTAG INSTRUCTIONS 4

Public instruction - private instruction – INTEST – EXTEST – BYPASS – SAMPLE – PRELOAD - HIGHZ-RUNBIST- CLAMP – IDCODE – USERCODE - Timing diagrams.

UNIT V JTAG SPECIAL INSTRUCTIONS 2

Special instructions (from 2013 standard)-Timing diagrams

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. IEEE-1149.1-2013 standard-IEEE Standard for Test Access Port and Boundary-Scan Architecture, IEEE Computer Society.
2. IEEE-1149.1-2001 standard-IEEE Standard for Test Access Port and Boundary-Scan Architecture, IEEE Computer Society.

19EC09L	NETWORK TRAFFIC ANALYSIS USING WIRESHARK LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO1 :Analyze the performance of TCP/IP protocol suite and detect security breaches on the network (K3)

PRE-REQUISITES

- OSI Layers and formation and deformations of TCP / IP Packets
- Sound knowledge of TCP/IP protocols
- Prior hands-on experience in Linux operating system
- Exposure to networking protocols and technologies such as DNS, DHCP, ICMP, FTP, HTTP, SMTP, and ARP.

EXPERIMENTS

1. Study the installation, packet capturing and protocol analysis functions of Wireshark.
2. Generate ping command and analyse several aspects of ICMP Protocol.
3. Analyze the trace of Transmission Control Protocol (TCP) segments.
4. Investigate the Address Resolution Protocol (ARP).
5. Examine the Dynamic Host Configuration Protocol (DHCP) packets captured by a host.
6. Explore the HTTP Protocol: The Basic Get/Response Interaction.
7. Customize Wireshark for investigating malicious network traffic.
8. Discover the malicious traffic and analyzing security problems.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Yoram Orzach - Network Analysis Using Wireshark Cookbook, Packt Publishing, 2013.
2. Chris Sanders, PRACTICAL PACKET ANALYSIS - Using Wireshark to Solve Real-World Network Problems, No Starch Press, Inc. 2007.
3. Laura Chappell - Troubleshooting with Wireshark - Locate the Source of Performance Protocol Analysis Institute, Inc, 2004.

19EC10L	**INTRUSION DETECTION SYSTEM USING SNORTLABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOME

Upon Completion of this course, the students will be able to

CO1: Implement Intrusion Detection / Prevention system and rules using Snort (K3)

PRE-REQUISITES

- OSI Layers and formation and deformations of TCP / IP Packets
- Sound knowledge of TCP/IP protocols
- Prior hands-on experience in Linux operating system

EXPERIMENTS

1. Basic Commands in Linux - Study Experiment.
2. Installation and Configuration of Linux OS and Virtual Box.
3. Creation of Virtual Machine - IDS/IPS machine.
4. Creation of Virtual Machine - Attacker machine.
5. Understanding the snort architecture and Snort configuration.
6. Working with Snort Rules.
7. Ping and its Detection.
8. Alert for Browsing on Facebook.
9. Hacking attempt with Metasploit and its Detection using Snort.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Security Configuration Guide: Unified Threat Defense, Cisco, 2018
2. Rafeeq Ur Rehman - Intrusion Detection Systems with Snort, Pearson Education, Inc, 2003.
3. Charlie Scott, Bert Hayes, Paul Wolfe - Snort for Dummies, Wiley Publishing, Inc, 2004.

19EC11L VULNERABILITY ASSESSMENT AND PENETRATION TESTING LABORATORY

L T P C
0 0 2 1

Prerequisites: Computer Networks

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Assess the security posture of an organization with the same approach as malicious hackers use and identify the weaknesses (K3)

1. Study Experiment on Ethical Hacking and understanding ethical hacking terminology.
2. Study Experiment on Gathering Target Information: Reconnaissance, Foot printing, and Social Engineering

3. Study Experiment on Gathering Network and Host Information: Scanning and Enumeration
4. System Hacking: Password Cracking, Escalating Privileges, and Hiding Files
5. Gathering Data from Networks: Sniffers
6. Performing Social Engineering attacks
7. Denial of Service and Session Hijacking
8. Bypassing Network Security: Evading IDS, Firewalls, and Honeypots
9. Web Hacking: Google, Web Servers, Web Application Vulnerabilities - OWASP, and Web-Based Password Cracking Techniques
10. Attacking Applications: SQL Injection and Buffer Overflows
11. CSRF – Cross-site request forgery
12. XSS – Cross-site scripting
13. Study of Cloud computing concepts
14. Cloud−Based Threats and attacks
15. IoT Threats and Operational Technology (OT) Attacks
16. Cloud Security techniques and tools

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Kimberly Graves, “CEH: Certified Ethical Hacker Study Guide”, Wiley Publishing Inc., 2010.
2. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press (Taylor & Francis Group), 2015.
3. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy”, Syngress, 2011.
4. EC-Council Press, “Investigating Network Intrusions and Cybercrime”, Course Technology, Cengage Learning, 11th Edition, 2010.

		L	T	P	C
19EC12L	**MALWARE ANALYSIS AND REVERSE ENGINEERING LABORATORY**	**0**	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Infer the behavior of malware using dynamic and static analysis and to detect the malware using signatures. (K3)

PRE-REQUISITE : Computer Networks

LIST OF EXPERIMENTS

1. Configure a virtual machine for malware analysis.
2. Virtual Machines as Malware Sandboxes.
3. Dynamic Analysis: Monitoring Malware Behavior.
4. File Identification and Hashing.

5. Study of PE Structure.
6. Static Analysis: Analyzing Embedded Strings.
7. Static Analysis: Understanding the PE Header.
8. PE Header Analysis Tools.
9. Reverse engineering using Olly Debug / Ghidra.
10. Malware detection using Yara signature writing tool.

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. Michael Sikorski, Andrew Honig, “Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software”, No Starch Press, 2012.
2. Monnappa K A, “Learning Malware Analysis_ Explore the concepts, tools, and techniques to analyze and investigate Windows malware”, Packt Publishing, 2018.
3. Digit Oktavianto, Iqbal Muhardianto,“Cuckoo Malware Analysis”, Packt Publishing, 2013.
4. http://fumalwareanalysis.blogspot.com/2011/08/malware-analysis-tutorial-reverse.html.

19EC13L	**CYBER SECURITY: GOVERNANCE, RISK AND COMPLIANCE**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Realize the accountability for designing and maintaining securityinfrastructure within an organization. (K2)

UNITI INFORMATION SECURITY GOVERNANCE AND RISK MANAGEMENT

Introduction to Cyber Security, Introduction to Governance, Risk and Compliance, Regulations, standards and best practices, Risk assessment and risk management

UNIT II INFORMATION SECURITY - AUDITS AND ASSESSMENTS

ISO 27001 Overview, Security Architecture and Design, Business continuity management, Legal, Regulations, Compliance, and Investigations

L: 15 TOTAL: 15 PERIODS

REFERENCES

1. Shon Harris, "ALL IN ONE CISSP EXAM GUIDE", Sixth Edition, McGraw Hill, 2013.
2. James Michael Stewart, "CISSP Certified Information Systems Security Professional Study Guide", Seventh Edition, John Wiley & Sons, 2015

19EC14L	**PROGRAMMING IN JAVA**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1 : Understand JAVA language features (K2)
CO2 :Develop a program in object-oriented way. (K3)

UNIT I FUNDAMENTALS OF JAVA 5

Introduction to JAVA - BYTE code, JDK, JVM, JRE, JVM. Modules and packagesintroduction. Variables, Data types, Operators, Basics of Input/Output, Condition and Looping structures.

UNIT II OOPS IN JAVA 5

OOPs introduction – Advantage of OOP, Method overloading, Constructors, Inheritance, Interface and Abstract classes.

UNIT III 5

JAVA Data structures – Introduction to Generics and collection classes framework. Sorting and Searching, Strings, Recursive functions, Exception handling, File Handling.

P: 30 TOTAL: 30 PERIODS

TEXT BOOKS

1. Balagurusamy.E., “Programming with Java”, Fourth Edition, TMH,2009
2. Paul Deitel, Harvey Deitel, “Java How to program”, Eighth Edition, PHI, 2010

REFERENCES

1. Java – The complete reference By Herbert Schildt, McGraw Hill
2. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, Ninth Edition, Sun Microsystems Press, 2012.
3. Hortsmann and Cornell, “Core Java 2 Advanced Features”, Vol-II, Pearson Education, 2002

JAVA LABORATORY

1. Simple Applications (Using data types –including arrays and strings, control structures and loops)
2. Applications using classes and interfaces
3. Threading/Exception handling/Filehandling

19EC15L	PROGRAMMING IN PYTHON	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, student will be able to

CO1 :Understand programming language features. (K2)
CO2 : Develop a program in python in object-oriented way. (K3)

UNIT I PYTHON FUNDAMENTALS 5

Introduction to Python, Software development environment Interactive shell, Interactive/script mode, Python character set, Tokens, Literals, Operators, operator precedence, Delimiters, Variables and assignments, Data types, Decision Making Constructs

UNIT II OOPS IN PYTHON 5

Loops, Functions, Strings, File operations, Object oriented programming-Classes, Inheritance and Polymorphism

UNIT III PYTHON DATA STRUCTURES AND ALGORITHMS 5

Collection classes - Lists, Tuples, Sets, Dictionaries, searching and sorting.

P: 30 TOTAL: 30 PERIODS

TEXT BOOKS

1. "Think Python: How to Think Like a Computer Scientist", by Allen B. Downey, O'Reilly Media, Inc., 2016
2. "A Practical Introduction to Python Programming", Brian Heinold, Mount St.Mary"s University, 2012.
3. "Learning to Program with Python", Richard L. Halterman, 2019, E-book
4. Dive into Python, Mark Pilgrim, Apress, 2012.

REFERENCES

1. "Exploring Python", Timothy A.Budd, Mc-Graw Hill Education (India) Private Limited, 2015.
2. "Introduction to Computer Science using python: A Computational Problem-solving Focus, Charles Dierbach, Wiley India Edition, 2015. NATIONAL ENGINEERING COLLEGE, KOVILPATTI (An Autonomous Institution, Affiliated to Anna University, Chennai) 15
3. "Practical Programming: An Introduction to Computer Science using Python 3.6", Paul Gries, Jennifer Campbell and Jason Montojo, Second edition, Pragmatic Programmers, LLC, 2018.
4. "Introduction to Programming in Python: An Inter-disciplinary Approach", Robert Sedgewick, Kevin Wayne, Robert Dondero, Pearson India Education Services Pvt. Ltd, 2016.

19EC16L	CONSUMER ELECTRONICS	L	T	P	C
		1	0	0	1

COURSE OUTCOMES

Upon completion of this course, student will be able to

CO1:Understand the working of audio system (K2)
CO2:Describe the principles involved in communication gadgets (K2)
CO3:Identify the developments in domestic appliances (K2)

UNIT I AUDIO SYSTEM COMPONENTS 5

Introduction to wave motion – Interference and superposition of waves – Beats, Resonance, Echos –characteristics of microphones – types of microphone – wireless microphones – types of headphones –Types of loudspeakers – Multi speaker systems – Acoustic Insulation and acoustic design. Stereo systems and multiway systems.

UNIT II COMMUNICATION AND CONSUMER GADGETS 5

Radio system – VHF and UHF – Types of mobile phones – Facsimile machine – electronic calculators – digital clocks – Automobile computers – Antilock Braking Systems, Safety Belt System, Navigation System – Microwave Ovens and TV Remote.

UNIT III CONSUMER APPLICATIONS 5

Washing Machines – electronic controller, fuzzy logic, Hardware and Software development – Air Conditioners – Components, Remote Controls, Unitary and central air conditioner systems – Bar Coders – Bar codes, scanner and decoder – Set Top Box – Types, firmware development, Interactive program guides. Video on demand.

L: 15TOTAL: 15 PERIODS

TEXTBOOKS

1. S.P.Bali, Consumer Electronics, Pearson Education, 2005.
2. B.R.Gupta, V.singhal, Consumer Electronics, S.K.Kataria& Sons, 2013

REFERENCES

1. C.A.Schuler and W.L.McNamee, Modern Industrial Electronics, McGrawHill, 2002.
2. D.J.Shanefield, Industrial Electronics for Engineers, Chemists andTechnicians, Jaico Publishing House, 2007.

19EC17L	COMPUTATIONAL ELECTROMAGNETICS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, student will be able to

- CO1:Design and simulate planar antennas for the given specifications usingelectromagnetic (EM) tool (K2)
- CO2:Simulate microwave transmission lines using EM tool (K2)
- CO3: Simulate Microwave passive components and demonstrate using microwave bench set up (K2)

LIST OF EXPERIMENTS

1. Study of High Frequency Structural Simulator (HFSS)
2. Study of Microwave transmission lines and its equivalent circuit analysis
3. Simulation of Microwave components: Isolator, Circulator, Couplers
4. Simulation of Microwave tees

5. Design and simulation of wire antennas
6. Design and simulation of Microstrip patch antenna using various types of substrate
7. Demonstration of basic bench set up using microwave oscillators and passive components and to study about mode characteristics of reflex klystron oscillator

P: 30 TOTAL: 30 PERIODS

19EC18L ADVANCED COMMUNICATION SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Calculate the S parameters of various microwave components.(K2)
CO 2: Measure the parameters of different microwave antennas.(K3)
CO 3: Measure various parameters of optical fibers (K3)
CO 4: Understand the fundamentals of Software defined radio (SDR). (K3)

LIST OF EXPERIMENTS

1. Study of various parameters of Optical Fibers.
2. Setting up a fiber optic analog and digital communication links.
3. Study of Microwave components and determining its S-Matrix.
4. Study the characteristics of Reflex Klystron Oscillator.
5. Radiation Pattern of Microwave antennas.
6. Performance measure of microwave components such as directional coupler, circulator and waveguide tees.
7. Study of Labview Communication Design Suite for SDR
8. Transmission of a single tone signal and spectrum sensing using SDR
9. Wireless AM transmitter and receiver using SDR.

P: 30 TOTAL: 30 PERIODS

19EC19L MACHINE LEARNING TECHNIQUES LABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Analyze the preprocessing the data, prediction tasks and performance for machine Learning. (K3)
CO2: Demonstrate suitable machine learning algorithms for clustering tasks and Reduce the dimensionality of the training data (K3)

LIST OF EXPERIMENTS

1. Basics of python and Introduction to Anaconda-Spyder / Google colab Interface
2. Prepare data for machine learning

3. Demonstrate linear Regression for a prediction task
4. Apply Multiple Linear Regression and evaluate its performance
5. Build a Binary Classifier using Decision Tree Algorithm
6. Use the Tensor Flow library to build and train neural nets
7. Apply k-means algorithm for clustering task
8. Perform feature selection using Backward Elimination Algorithm
9. Demonstrate Dimensionality Reduction using PCA Algorithm
10. Apply Factor Analysis technique for feature extraction

P: 30 TOTAL: 30 PERIODS

REFERENCES

1. EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, 2014.
2. Christopher M. Bisho, “Pattern Recognition and Machine Learning”, Springer (India) Private Limited, 2013.

19EC20L	WEB OF THINGS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOME

Upon completion of this course, the student will be able to

CO1: Develop web server application using single board computer for real time IoT implementation. (K3)

List of Experiments

1. Installation Node.JS in single board computer.
2. Study of Node Package Manager
3. Creating web page with CSS and Java script.
4. Creating web forms and request through post & get method.
5. Creating modules using Node.js
6. Creating, reading and writing JSON file using Node.js
7. Development of dashboard
8. Study of RESTFul API

P: 30 TOTAL: 30 PERIODS

19EC21L	IOT DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOME

Upon completion of this course, the student will be able to

CO1: Design database and access it remotely using single board computer for real time IoT implementation. (K3)

LIST OF EXPERIMENTS

1. Installation of MySQL in single board computer.
2. Creation of database schema using DDL.
3. Perform various data manipulation commands, aggregate functions and sorting concept on all created tables.

4. Solving queries using the concept of sub query.
5. Joining data from multiple tables.
6. Implementation of procedures, functions and views
7. Deployment of Asset Management System using single board computer.
8. Study of cloud database with timeseries using NoSQL.

P: 30 TOTAL: 30 PERIODS

19EC22L	INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OUTCOME

Upon completion of this course, the student will be able to
CO1: Design and develop IoT applications using wireless standards. (K4)

List of Experiments

1. Interconnection of sensors, actuators and display units with embedded processor
2. Integration of Bluetooth with embedded processor
3. Integration of Wi-Fi with embedded processor
4. Integration of LORA with embedded processor
5. Implementation of MQTT protocol with publish and subscribe using Mosquito Broker.
6. Design MQTT dashboard and DB storage
7. Cloud based temperature monitoring system using Wi-Fi & MQTT
8. Implementation of live GPS tracking and cloud storage using LORA

P: 30 TOTAL: 30 PERIODS

B. E. – ELECTRONICS AND COMMUNICATION ENGINEERING

OPEN ELECTIVE COURSES

19EC01N	**BASICS OF COMMUNICATION SYSTEMS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

PRE-REQUISITE: Basic Knowledge on Signals and Systems

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: Describe various analog modulation schemes (K2)
- CO2: Describe Digital Communication methods for high bit rate transmission (K2)
- CO3: Understand the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission. (K2)
- CO4: Understand the MAC used in communication systems for enhancing the number of users. (K2)
- CO5: Describe the various media for digital communication (K2)

UNIT I ANALOG COMMUNICATION (Qualitative only) 9

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency

UNIT II DIGITAL COMMUNICATION (Qualitative only) 9

Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding: DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only) 9

Primary communication – entropy, properties, BSC, BEC, source coding: Shaum, Fao, Huffman coding : noiseless coding theorum, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnBcodes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

SS&MA techniques: FDMA, TDMA, CDMA, SDMA application in wire and wireless communication: Advantages of Multiple Access Techniques

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA 9

Orbits: Types of satellites: frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Education, 2013.
2. S. Haykin “Digital Communications” 1st Edition, John Wiley, 2013.

REFERENCES

1. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd Edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications”, 2nd Edition, Pearson Education, 2007.

19EC02N OVERVIEW OF COMMUNICATION SYSTEMS

L	T	P	C	QP
3	0	0	3	A

PRE-REQUISITE: Basic Knowledge on Signals and Systems

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe various analog modulation schemes (K2)
CO2: Describe various Pulse modulation and Digital Modulation schemes (K2)
CO3: Explain the basics of Microwave and satellite communication (K2)
CO4: Illustrate the need for optical communication and classify different optical fiber cables (K2)
CO5: Describe the basic concept of mobile communication (K2)

UNIT I ANALOG MODULATION SYSTEMS 9

Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation –Frequency modulation – Frequency spectrum of FM wave – AM transmitter – FM transmitter – Super heterodyne AM receiver –FM receivers.

UNIT II PULSE AND DIGITAL MODULATION SYSTEMS 9

Principles of pulse modulation – sampling theorem, PAM – PWM – PPM–Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems – PCM, ASK, FSK and PSK

UNIT III MICROWAVE AND SATELLITE COMMUNICATION SYSTEMS 9

Microwave communication systems: advantage, block diagram of a microwave radio system, microwave radio stations- Terminal station and repeater station. Satellite Communication system: Satellite Orbits, launch vehicles, look angles, satellite parameters, satellite link model, personal communication systems- GPS services.

UNIT IV FIBER OPTICAL COMMUNICATION SYSTEMS 9

Need for fiber optics, introduction to optical fiber, principle of light transmission through a fiber, fiber characteristics and classification, various fiber losses- Light sources and photo detectors, Block diagram of a fiber optic system- Power budget analysis for a optical link- Recent applications of fiber optics.

UNIT V CELLULAR MOBILE COMMUNICATION 9

Cellular concept, basic cellular concept and its operation, uniqueness of mobile radio environment- Performance metrics in cellular system-Elements of cellular mobile radio-Handoff- Frequency management and channel assignment- Introduction to various cellular standards like AMPS, GSM, GPRS, IS-95A, IS-95B, CDMA-2000 and WCDMA.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Kennedy Davis, “Electronic Communication Systems”, Tata McGraw Hill Publishing Company Limited, New Delhi, 4th Edition, 2008.
2. Wayne Tomasi, “Electronic Communication Systems”, Pearson education Private Limited, Delhi, 5th Edition, 2008.

REFERENCES

1. Roddy D and Coolen J, “Electronic Communications”, Prentice Hall of India Private Limited, Fourth Edition, 2008.
2. William C.Y.Lee, “Mobile Cellular Telecommunication Systems”, McGraw Hill International Edition, Second Edition, 2006.
3. Gerd Keiser, “Optical fiber Communications”, McGraw Hill International Edition, Fourth Edition, 2006.

19EC03N CMOS TECHNOLOGY AND CHIP TESTING

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Explain MOS transistor theory and CMOS process technology. (K2)
CO2 : Explain the different types of CMOS families (K2)
CO3 : Describe the various IC Testing Techniques.(K2)
CO4 : Explain the various features of CAD tools used for IC testing. (K2)
CO5 : Understand the concept of DFT. (K2)

UNIT I IC MANUFACTURING PROCESS AND CMOS TECHNOLOGY 9

Introduction to IC manufacturing process – wafer formation, epitaxial growth, oxidation, photolithography, Ion implantation, Isolation techniques - MOS Transistor Theory – Ideal I-V Characteristics of MOS Transistor.DC Transfer Characteristics of CMOS Inverter, n well, p well, twin tub and SOI CMOS processes- Lambda based design Rules. Manufacturing Issues.

UNIT II CMOS FAMILIES AND CIRCUIT CHARACTERIZATION 9

CMOS circuit Families- Static CMOS, Ratioed circuits ,Pseudo NMOS , Dynamic CMOS and Pass Transistor Logic. Comparision of CMOS families. Delay Estimation and Logic Effort of CMOS circuits. Static and Dynamic Power dissipation of CMOS. Interconnect Impact .

UNIT III INTRODUCTION TO SEMICONDUCTOR IC TESTING 9

Design and manufacturing cycle of an IC –Logic Verification – Manufacturing defects in an IC – Manufacturing test – Need for CHIP testing – Types of CHIP testing – Engineering testing, production testing, QA testing, Customer inspection testing. – Automated Test Equipment– ATE subsystems – Common accessories of an ATE-Architecture of a mixed signal ATE-.DC parametric Tests of IC- AC Parametric Test.

UNIT IV TEST DATA ANALYSIS USING CAD TOOLS AND ESD PROTECTION 9

Introduction to data analysis– Data visualization tools – Data logs – Lot summaries – Wafer map – shmoo plots – Histograms – Statistical process control – Standard deviation – Mean – Process capability Index – Six sigma quality – Reproducibility – Introduction to ESD – Sources of ESD – ESD models

UNIT V FAULT MODELS AND PRINCIPLES OF DESIGN FOR TESTABILITY 9

Fault models – Simple examples with stuck at and bridging faults – Controllability and observability – Principles of DFT – Scan based Techniques – Boundary scan test – Built in self test – Memory BIST.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark burns & Gordon W Roberts, “An Introduction to mixed signal IC testing and measurement”, Oxford University Press, 1st Edition, 2000.
2. Weste and Harris, “CMOS VLSI DESIGN: A Circuit and Systems Perspective”, 4th Edition, Pearson Education, 2009.

REFERENCES

1. Michael L. Bushnell & Vishwani D. Agrawal, “Essentials of electronic testing” Kluwer academic publishers, 2000.
2. A Text book on semiconductor IC testing using Automatic Test Equipment, Tessolve Services Private circulation manual.
3. William J.Greig, “Integrated Circuit Packaging, Assembly and Interconnections”, Springer, 2007.
4. Artur Balasinki, “Semiconductors: Integrated Circuit Design foe Manufacturability”, CRC Press, 1st Edition, 2011.

19EC04N	AUTOMOTIVE ELECTRONICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Know the importance of emission standards in automobiles.(K2)

CO2:Understand the electronic fuel injection/ignition components and their function. (K2)

CO3: Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.(K2)

CO4 : Diagnose electronic engine control systems problems with appropriate diagnostic tools.(K2)
CO5: Analyses the chassis and vehicle safety system.(K2)

UNIT I INTRODUCTION 8

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards.Automotive standards for EMI/EMC – CISPR12, CISPR25. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II IGNITION AND INJECTION. SYSTEMS 10

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III SENSOR AND ACTUATORS 7

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 10

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

L: 45; TOTAL: 45 PERIODS

The students will be able to use advanced sensors and actuators in the upgradation of automobiles.

TEXT BOOKS

1. William Ribbens, "Understanding Automotive Electronics An Engineering perspective", 8th Edition, Elsevier, Indian Reprint, 2017
2. Tom Denton, "Automobile Electrical and Electronics Systems", 5th Edition, Edward Arnold Publishers, 2017.

REFERENCES

1. Barry Hollembeak, “Automotive Electricity, Electronics & Computer Controls”, 6th Edition, Cengage Learning, 2015.
2. Richard K. Dupuy, “Fuel System and Emission controls Classroom Manual”, Check Chart Publication, 2000.
3. Ronald. K. Jurgon, “Automotive Electronics Handbook”, McGraw-Hill, 1999.

19EC05N ELECTRONICS AND MICROPROCESSORS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the behavior of semiconductor devices and various rectifier circuits and voltage regulators. (K2)
CO2 : Discuss the different biasing techniques to operate the transistor and FET. (K2)
CO3 : Examine the structure of various number systems and the combinational building blocks. (K2)
CO4: Describe the architecture and different modes of operations of a typical Microprocessor (K2)
CO5 : Discuss the interfacing concepts and programming of microprocessor. (K3)

UNIT I SEMICONDUCTORS AND RECTIFIERS 9

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation

UNIT II TRANSISTORS AND AMPLIFIERS 9

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS 9

Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR 9

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 9

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor: Temperature control, Stepper motor control, traffic light control.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers, 2nd Edition (New), 2011.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 6th Edition, 2013.

REFERENCES

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill, 8th Edition, 2015
2. Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 3rd Edition, 2012

19EC06N	ARM PROCESSOR ANDPROGRAMMING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1 : Describe the different ARM processor families.(K2)
CO 2 : Explain LPC2148 Microcontroller details. (K2)
CO 3 : Explain LPC2148 system control details (K2)
CO 4 : Write simple Embedded C programs using GPIO. (K3)
CO 5 : Write Embedded C code for Timer, ADC, DAC and UART. (K3)

UNITI INTRODUCTION TO ARM PROCESSOR 9

Introduction to embedded system and ARM Processor, ARM related Companies and its opportunities, ARM processor family, Application of ARM Processor, Compiler, Emulation and Debugging, Difference between RISC & CISC.

UNITII LPC2148 ARCHITECTURE 9

LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148, Pin diagram of LPC2148, Architectural overview, On-chip flash program memory, On-chip static RAM.

UNITIII SYSTEM CONTROL 9

Crystal Oscillator, PLL, Reset and Wake-up Timer, Brownout detector, Code Security, External Interrupt input, Memory Mapping Control, Power Control.

UNITIV GENERAL PURPOSE INTERFACING 9

Pin Connect Block, General Purpose Parallel I/O: Features, 8 Bit LED's and Switches, Relay and Buzzer, Seven Segment LEDs, Keypad, LCD – Interfacing

UNITV SPECIAL PURPOSE INTERFACING 9

General purpose timer / External event counters: Features, Interfacing Timer and CounterOperation, 10-bit ADC: Features, Interfacing Temperature Sensor LM35, 10-bit

DAC: Features, Interfacing DAC, UARTs: Features, Serial Communication, Interrupt Controller, Interrupt Sources, External Interrupt.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Steve Furber, "ARM System-on-chip architecture", Pearson Education, 2ndEdition, 2005
2. ARM System-on-Chip Architecture, Second Edition, bySteve Furber, PEARSON, 2013

REFERENCES

1. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer‘s Guide
2. Designing and Optimizing System Software", Morgan Kaufmann, 2004.
3. www.arm.com
4. ARM System Developers Guide, Designing andOptimizing System Software, by Andrew N. SLOSS,Dominic SYMES and Chris WRIGHT, ELSEVIER, 3004
5. Operating Systems, 5th Edition, By William Stallings

19EC07N	FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Classify and analyze the types of signals, their responses and properties. (K2)
CO2 : Perform frequency transformation for the signals. (K2)
CO3 : Design analog and digital IIR filters and realize them. (K3)
CO4 : Design digital FIR filters and realize them. (K3)
CO5 : Explain the concepts of Multi rate signal processing. (K2)

UNIT I SIGNALS AND SYSTEMS 9

Introduction to Continuous-Time and Discrete-time signals Elementary signals: Step, ramp, impulse, pulse and step, Basic operations on signals – scaling, shifting, System classification – Linearity, causality, Time-invariance, dynamic system

UNIT II FREQUENCY TRANSFORMATIONS 9

Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithms – Decimation – in – time Algorithms, Decimation – in – frequency Algorithms – Use of FFT in Linear Filtering.

UNIT III IIR FILTER DESIGN 9

Review of design of analog Butterworth Filters, Frequency transformation in analog domain - Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform – pre warping.

UNIT IV FIR FILTER DESIGN 9

Structures of FIR – Linear phase FIR filter – Fourier Series – Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

UNIT V MULTIRATE SIGNAL PROCESSING 9

Introduction to Multirate signal processing – Decimation-Interpolation Polyphase implementation of FIR filters for interpolator and decimator - Multistage implementation of sampling rate conversion- Applications: Sub band coding, Quadrature Mirror filter.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. John G Proakis and Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson Education, 4th Edition, 2014.
2. Alan. V. Oppenheim, R. Schafer, “Digital Signal Processing”, Pearson Education, 1st Edition, 2015.

REFERENCES

1. E.C. Ifeachor and B.W. Jervis, “Digital signal processing - A practical approach”, Pearson, 2nd Edition, 2002.
2. S.K. Mitra, “Digital Signal Processing- A Computer Based approach”, Tata McGraw-Hill, 4th Edition, 2013.
3. S.Salivahanan, “Digital Signal Processing”, Tata McGraw Hill, 4th Edition, 2019.
4. Johny R. Johnson, “Introduction to Digital Signal Processing”, PHI, 2006.
5. Lonnie C.Ludeman, “Fundamentals of Digital Signal Processing”, Wiley, 1st Edition, 2009.

19EC08N EMBEDDED AND REALTIME SYSTEMS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Understand the fundamental concepts of embedded system. (K2)
CO2 : Explain the Interfacing schemes K2)
CO3 : Describe realtime system and its characteristics.(K2)
CO4 : Understand the basic properties of arealtime operating system. (K2)
CO5 : interpret the services of UCOS III operating system (K2)

UNIT I INTRODUCTIONTO EMBEDDED SYSTEM 9

Definition: Embedded system, Intelligent system, Expert System–Embedded system-classification –Embedded system design process–ARM Processor–CPU: Programming input and output–Supervisor mode, exception and traps-concept of interrupts in ARM processor family-.Embedded System design Example.

UNIT II PERIPHERAL INTERFACING 9

I/O devices – Component interfacing – Memory mapped I/O – I/O mapped I/O – Development and Debugging – Program design–Model of programs–Basic compilation techniques – Assembly and Linking,--simple program for I/O devices.

UNIT III REALTIME SYSTEM 9

Definition: Real-time and real time systems–real time system Model-real time system characteristics–High reliability achievement ways in real time system-Hardware considerations for real time system–Examples for real time system.

UNIT IV PROCESS AND OPERATING SYSTEMS 9

Definition: Multi-tasking and multi-processing –Context Switching–Operating Systems Scheduling policies: Rate monotonic, EDF, Comparison example –Inter Process Communication mechanisms – Message Mailboxes – Message Queues – Evaluating operating system performance.

UNIT V TASK MANAGEMENT AND MEMORY MANAGEMENT OF UCOS III 9

Introduction to UCOS III Features, Services and variants. Task Management: Task creation, task stacks, stack checking, task priority, task suspending, task deletion program example for Multitasking. Memory management: Creating partition in memory, memory control block, obtaining and returning memory control block functions program example for memory management implementation-Synchronization techniques

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Wayne Wolf, "Computers as Components Principles of Embedded Computer System Design", Morgan Kaufmann, 2ndEdition, 2008.
2. Philip A.Laplante, "Real time systems design and analysis", Wiley India Edition, 3rdEdition, 2006.

REFERENCES

1. Jean J.Labrosse, "Micro C/OS-III: The Real Time Kernal", CMP Books, 2010.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design&Programming", Dream tech Press, 2005.
4. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.

NATIONAL ENGINEERING COLLEGE

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REGULATIONS – 2019

CURRICULUM & SYLLABUS

B. E. – COMPUTER SCIENCE AND ENGINEERING

Accredited by NBA

B. E. – COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To produce globally competent, innovative and socially responsible computing professionals

MISSION

- To provide world-class teaching - learning and research facilities.
- To stimulate students' logical thinking, creativity, and communication skills effectively.
- To cultivate awareness about emerging trends through self-initiative.
- To instill a sense of societal and ethical responsibilities.
- To collaborate with industries and government organizations.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

After 3-4 years of Graduation, our graduates will:

1. Accomplish their professional career and/or pursue higher education by applying knowledge of computer science and engineering.
2. Participate in life-long learning through the successful completion of advanced degrees, continuing education, certifications and/or other professional developments.
3. Perseverance of successful startups through the entrepreneurial initiatives and design thinking capabilities.

PROGRAMME OUTCOMES (POs)

By the time of graduation, graduates will attain the following programme outcomes:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **CSE programme** is designed with total number of credits ***165 (123)*** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table-1.

TABLE – 1 CATEGORY OF COURSES

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	13
2.	Basic Science courses	23
3.	Engineering Science courses	29.5
4.	Programme Core courses	59.5
5.	Programme Elective courses relevant to chosen specialization / branch	18
6.	Open Elective courses from other technical and /or emerging subject areas	8
7.	Skill Development Courses	14
8.	Mandatory courses	(non – credit)
	TOTAL	**165**

i. **Humanities and Social Sciences (HSMC)** include English, Communication Skill laboratory and Management courses

ii. **Basic Science Courses (BSC)** include Chemistry, Physics, Biology and Mathematics

iii. **Engineering Science Courses (ESC)** include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering

iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.

vii. **Skill Development Courses (SDC)** include the courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.

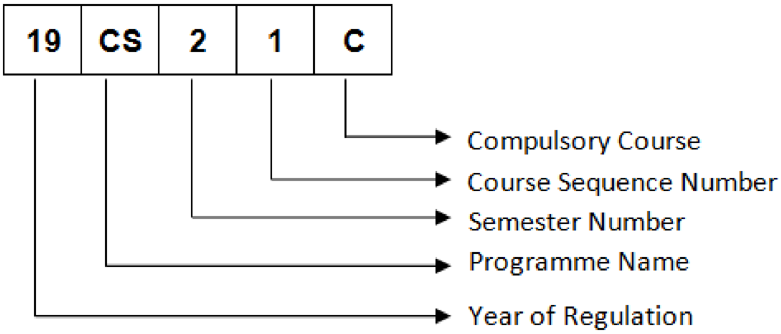
viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

TABLE – 2 QP - QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE


19
CS
2
1
C
Compulsory Course
Course Sequence Number
Semester Number
Programme Name
Year of Regulation

REGULATIONS – 2019 CURRICULUM AND SYLLABUS

SEMESTER – I

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19CS11C	Python Programming	3	0	0	3	A
6.	ESC	19CS12C	Basic Electrical and Electronics Engineering	3	0	0	3	A
PRACTICAL COURSES								
7.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	-
8.	ESC	19CS13C	Python Programming Laboratory	0	0	4	2	-
			TOTAL	**15**	**1**	**7**	**19.5**	

SEMESTER – II

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1	HSMC	19CS21C	Professional English	2	0	0	2	B
2	BSC	19CS22C	Probability and Queueing theory	3	1	0	4	A
3	BSC	19CS23C	Semiconductor Physics	2	0	0	2	B
4	BSC	19CS24C	Biology for Engineers	2	0	0	2	B
5	ESC	19CS25C	Problem Solving Techniques	3	0	0	3	A
6	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
PRACTICAL COURSES								
7.	BSC	19CS26C	Semiconductor Physics and Biology Laboratory Part A – Semiconductor Physics Laboratory Part B – Biology Laboratory	0	0	3	1.5	-
8.	ESC	19CS27C	Problem Solving Techniques Laboratory	0	0	4	2	-
9.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
			TOTAL	**15**	**1**	**13**	**22.5**	

SEMESTER – III

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19CS31C	Discrete Mathematics	3	1	0	4	A
2.	PCC	19CS32C	Data Structures	3	0	0	3	A
3.	PCC	19CS33C	Computer Organization and Architecture	3	0	0	3	A
4.	PCC	19CS34C	Object Oriented Programming	3	0	0	3	A
5.	ESC	19CS35C	Digital Principles and System Design	3	0	2	4	A
6.	PCC	19CS36C	Software Engineering Methodologies	3	0	0	3	A
7.	MAC	19MC01C	Environmental Science and Engineering	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19CS37C	Data Structures Laboratory	0	0	4	2	-
9.	PCC	19CS38C	Object Oriented Programming Laboratory	0	0	4	2	-
10.	HSMC	19CS39C	Communication Skills Laboratory	0	0	2	1	-
			TOTAL	**21**	**1**	**12**	**25**	-

SEMESTER – IV

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	ESC	19CS41C	Statistics and Numerical methods	3	1	0	4	A
2.	PCC	19CS42C	Design and Analysis of Algorithms	3	1	0	4	A
3.	PCC	19CS43C	Operating Systems	3	0	0	3	A
4.	PCC	19CS44C	Database Management Systems	3	0	0	3	A
5.	PCC	19CS45C	Computer Networks	3	0	0	3	A
6.	HSMC	19CS46C	Finance and Accounting	3	0	0	3	A
PRACTICAL COURSES								
7.	PCC	19CS47C	Operating Systems Laboratory	0	0	3	1.5	-
8.	PCC	19CS48C	Database Management Systems Laboratory	0	0	3	1.5	-
9.	PCC	19CS49C	Networks Laboratory	0	0	3	1.5	-
			TOTAL	**18**	**2**	**9**	**24.5**	

SEMESTER – V

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19CS51C	Java Programming	3	1	0	4	A
2.	PCC	19CS52C	Theory of Computation	3	1	0	4	A
3.	HSMC	19CS53C	Professional Ethics and Human Values	3	0	0	3	A
4.	ESC	19CS54C	Embedded Systems	3	0	0	3	A
5.	PCC	19CS55C	Cryptography and Network Security	3	0	0	3	A
6.	PEC		Elective – I	3	0	0	3	A
7.	MAC	19MC02C	Constitution of India	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19CS56C	Java Programming Laboratory	0	0	3	1.5	-
9.	ESC	19CS57C	Embedded Systems Laboratory	0	0	3	1.5	-
10.	PCC	19CS58C	Cryptography and Network Security Laboratory	0	0	2	1	-
			TOTAL	**21**	**2**	**8**	**24**	

SEMESTER – VI

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	19CS61C	Object Oriented Analysis and Design	3	0	0	3	A
2.	PCC	19CS62C	Principles of Compiler Design	3	0	2	4	A
3.	PCC	19CS63C	Internet and Web Technology	3	0	0	3	A
4.	HSMC	19CS64C	Business Process Management	2	0	0	2	B
5.	PEC		Elective – II	3	0	0	3	A
6.	PEC		Elective – III	3	0	0	3	A
7.	OEC		Elective – IV	3	0	0	3	A
PRACTICAL COURSES								
8.	PCC	19CS65C	Internet and Web Technology Laboratory	0	0	3	1.5	-
9.	PCC	19CS66C	Comprehension	0	0	2	1	-
10.	SDC	19CS67C	Product Development Laboratory	1	0	2	2	-
			TOTAL	**21**	**0**	**9**	**25.5**	

SEMESTER – VII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PEC	-	Elective-V	3	0	0	3	A
2.	PEC	-	Elective-VI	3	0	0	3	A
3.	PEC	-	Elective-VII	3	0	0	3	A
PRACTICAL COURSES								
4.	SDC	19CS71C	Research Paper and Patent Review - Seminar	0	0	2	1	-
5.	SDC	19CS72C	Project work - I	0	0	6	3	-
			TOTAL	**9**	**0**	**8**	**13**	

SEMESTER – VIII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	OEC	-	Elective - VIII	3	0	0	3	A
PRACTICAL COURSES								
2.	SDC	19CS81C	Project work – II	0	0	12	6	-
3.	SDC	19CS82C	Internship / Inplant Training	0	0	4	2	-
			TOTAL	**3**	**0**	**16**	**11**	

Total Credits: 165

PROGRAMME ELECTIVE COURSES

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern⊕
DATA SCIENCE								
1.	PEC	19CS01E	Data Virtualization	3	0	0	3	A
2.	PEC	19CS02E	Big Data Analytics	3	0	0	3	A
3.	PEC	19CS03E	Data Science	3	0	0	3	A
4.	PEC	19CS04E	Data Mining	3	0	0	3	A
5.	PEC	19CS05E	Business Analytics	3	0	0	3	A
6.	PEC	19CS06E	Social Media Analytics	3	0	0	3	A
7.	PEC	19CS07E	Analytic Computing	3	0	0	3	A
THEORY & ALGORITHMS								
8.	PEC	19CS08E	Algorithmic Game Theory	3	0	0	3	A
9.	PEC	19CS09E	Blockchain Architecture and Design	3	0	0	3	A

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern$^{\oplus}$
10.	PEC	19CS10E	Computational Graph Theory	3	0	0	3	A
11.	PEC	19CS11E	Quantum Computing	3	0	0	3	A
12.	PEC	19CS12E	Multicore Programming	3	0	0	3	A
13.	PEC	19CS13E	Micro service architecture	3	0	0	3	A
AI & DEEP LEARNING								
14.	PEC	19CS14E	Computational Methods of Optimization	3	0	0	3	A
15.	PEC	19CS15E	Artificial Intelligence	3	0	0	3	A
16.	PEC	19CS16E	Machine Learning in healthcare	3	0	0	3	A
17.	PEC	19CS17E	Machine Learning	3	0	0	3	A
18.	PEC	19CS18E	Nature and Bio-inspired Computing	3	0	0	3	A
19.	PEC	19CS19E	Natural Language Processing	3	0	0	3	A
20.	PEC	19CS20E	Computer Vision and Image Processing	3	0	0	3	A
NETWORKING								
21.	PEC	19CS21E	Storage Area Networks	3	0	0	3	A
22.	PEC	19CS22E	Wireless Adhoc Networks	3	0	0	3	A
23.	PEC	19CS23E	TCP / IP	3	0	0	3	A
24.	PEC	19CS24E	Cyber Forensics and Ethical hacking	3	0	0	3	A
25.	PEC	19CS25E	Software Defined Networks	3	0	0	3	A
26.	PEC	19CS26E	Cloud Computing	3	0	0	3	A
27.	PEC	19CS27E	Robotics Process Automation in Cloud	3	0	0	3	A
28.	PEC	19CS28E	Cloud Security	3	0	0	3	A
29.	PEC	19CS29E	Internet of Things	3	0	0	3	A
APPLICATION DEVELOPMENT								
30.	PEC	19CS30E	Advanced Java Programming	3	0	0	3	A
31.	PEC	19CS31E	Mobile Application Development	3	0	0	3	A
32.	PEC	19CS32E	UI/UX Design	3	0	0	3	A
33.	PEC	19CS33E	Software Design Architecture	3	0	0	3	A
34.	PEC	19CS34E	Augmented Reality and Virtual Reality	3	0	0	3	A
35.	PEC	19CS35E	Web Analytics	3	0	0	3	A
36.	PEC	19CS36E	Social Computing	3	0	0	3	A
37.	PEC	19CS37E	Software Testing Techniques	3	0	0	3	A
38.	PEC	19CS38E	Advanced Database Technology	3	0	0	3	A
39.	PEC	19CS39E	SQL Programming	3	0	0	3	A
BLOCKCHAIN TECHNOLOGY								
40.	PEC	19CS40E	Blockchain Fundamentals	3	0	0	3	A
41.	PEC	19CS41E	Digital Currencies And Crypto Assets	3	0	0	3	A
42.	PEC	19CS42E	Smart Contract and Solidity	2	0	2	3	A
43.	PEC	19CS43E	Blockchain Frameworks Laboratory	0	0	4	2	-
SKILL DEVELOPMENT COURSE								
44.	SDC	19CS44E	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3	-

ONE CREDIT ELECTIVE COURSES

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question Pattern⊕
DATA SCIENCE								
1.	PEC	19CS01L	Statistical foundations for data science	1	0	0	1	C
2.	PEC	19CS02L	Data visualization using Tableau	0	0	2	1	-
3.	PEC	19CS03L	Data visualization using Power BI	0	0	2	1	-
4.	PEC	19CS04L	Python for Data Science	0	0	2	1	-
5.	PEC	19CS05L	R programming	0	0	2	1	-
THEORY & ALGORITHMS								
6.	PEC	19CS06L	Proof systems in Cryptography	1	0	0	1	C
7.	PEC	19CS07L	Theoretical Foundations of Cryptography	1	0	0	1	C
8.	PEC	19CS08L	Randomness in Cryptography	1	0	0	1	C
AI & DEEP LEARNING								
9.	PEC	19CS09L	Deep Learning Algorithms	0	0	2	1	-
10.	PEC	19CS10L	Machine learning with Tensorflow	0	0	2	1	-
11.	PEC	19CS11L	Data Exploration using Python	0	0	2	1	-
12.	PEC	19CS12L	Mathematics for Machine Learning	1	0	0	1	C
NETWORKING								
13.	PEC	19CS13L	Cyber security tools and techniques	0	0	2	1	-
14.	PEC	19CS14L	Vehicular Cloud Networking	1	0	0	1	C
15.	PEC	19CS15L	Speckled computing	1	0	0	1	C
16.	PEC	19CS16L	Introduction to Networks	1	0	0	1	C
17.	PEC	19CS17L	Routing and Switching Essential	1	0	0	1	C
18.	PEC	19CS18L	Scaling Networks	1	0	0	1	C
19.	PEC	19CS19L	Connecting Networks	1	0	0	1	C
APPLICATION DEVELOPMENT								
20.	PEC	19CS20L	Server-side Development using Node.js	0	0	2	1	-
21.	PEC	19CS21L	Web Application Development using AngularJS	0	0	2	1	-
22.	PEC	19CS22L	NoSQL on MongoDB	0	0	2	1	-
23.	PEC	19CS23L	Application development using Flutter	0	0	2	1	-
24.	PEC	19CS24L	Application development using Firebase	0	0	2	1	-
25.	PEC	19CS25L	Linux Administration	0	0	2	1	-
26.	PEC	19CS26L	Software testing using Selenium	0	0	2	1	-
27.	PEC	19CS27L	Predictive analytics using Machine Learning	0	0	2	1	-
28.	PEC	19CS28L	Python for Machine Learning	0	0	2	1	-
29.	PEC	19CS29L	Full stack development	0	0	2	1	-
30.	PEC	19CS30L	Microprocessor and Microcontroller	1	0	0	1	C
BLOCKCHAIN TECHNOLOGY								
31.	PEC	19CS31L	Golang Programming	0	0	2	1	-

32.	PEC	19CS32L	Kotlin Programming	0	0	2	1	-
33.	PEC	19CS33L	Ethical Hacking	0	0	2	1	-
34.	PEC	19CS34L	Augmented Reality for Developers	0	0	2	1	-

OPEN ELECTIVE COURSES (OEC)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question Pattern$^{\oplus}$
1.	OEC	19CS01N	Computer graphics and virtual reality	2	0	2	3	A
2.	OEC	19CS02N	Mobile application development	2	0	2	3	A
3.	OEC	19CS03N	Object oriented programming	2	0	2	3	A
4.	OEC	19CS04N	Programming in python	2	0	2	3	A
5.	OEC	19CS05N	Fundamentals of Java programming	2	0	2	3	A
6.	OEC	19CS06N	Programming for robotics	2	0	2	3	A
7.	OEC	19CS07N	Fundamentals of Artificial intelligence	2	0	2	3	A
8.	OEC	19CS08N	Simulation and Modeling	2	0	2	3	A
9.	OEC	19CS09N	Computer Architecture	3	0	0	3	A
10.	OEC	19CS10N	Deep Learning	3	0	0	3	A
11.	OEC	19CS11N	Fundamentals of Machine Learning	3	0	0	3	A
12.	OEC	19CS12N	Blockchain Technology	3	0	0	3	A
13.	OEC	19CS13N	Database Management Systems	3	0	0	3	A
14.	OEC	19CS14N	Structured Query Language	3	0	0	3	A

19SH11C TECHNICAL ENGLISH L T P C
(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply the basic language skills to understand various aspects of communication skills (K3)
CO2: express their thoughts with correct usage of language in formal writings (K3)
CO3: understand various language components and develop the pronunciation skill. (K2)
CO4: make effective technical writings and interpret any pictorial representation. (K3)
CO5: frame sentences and write effective reports. (K3)

UNIT I 6

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, Letter to Friend / Parent / Siblings - Greetings and Self Introduction – Situational Phrases - Tense (Present)

UNIT II 6

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) –Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

UNIT III 6

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

UNIT IV 6

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

UNIT V 6

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

Suggested Activity: Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Anderson, Paul V. “Technical Communication: A Reader - Centered Approach”, 9th Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. “A Comprehensive Grammar of the English Language”, Longman Inc., Newyork, 2014.

REFERENCES

1. Murphy Raymond, "Basic Grammar Practice on Tense", Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., "Engineering English", Orient Blackswan: Hyderabad, 2015.

19SH12C MATHEMATICAL FOUNDATIONS FOR ENGINEERS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make use of orthogonal transformation. (K3)
CO2: find the evolutes of various curves.(K2)
CO3: maxima and minima of real valued functions.(K3)
CO4: solve ordinary differential equations.(K2)
CO5: solve partial differential equations.(K2)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivative – Total derivative – Euler's theorem on homogeneous functions – Taylor's Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange's multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order ordinary differential equations - Equations solvable for 'p', equations solvable for 'y', equations solvable for 'x' - Solutions of higher order linear differential equations with constant coefficients – Cauchy's and Legendre's linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange's linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Bali.N.P. and Manish Goyal, “A Text book of Engineering Mathematics”, 9th Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, “Calculus and Analytic Geometry”, 9th Edition, Dorling Kindersley Private Limited, 2010.

19SH13C **ENGINEERING PHYSICS** **L T P C**

(Common to all B.E. / B.Tech. Degree Programmes) **2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)
CO2: understand the principle and propagation of different types of waves (K2)
CO3: choose the appropriate Laser technique for industrial and medical applications (K2)
CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)
CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

UNIT I CRYSTALLOGRAPHY 6

Lattice, Unit cell, Bravais lattice, Lattice planes - Crystal system - Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

UNIT II WAVES 6

Simple harmonic oscillators - Damped harmonic oscillator - Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

UNIT III LASER 6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein’s A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

UNIT IV FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

UNIT V QUANTUM PHYSICS 6

Black Body Radiation - Matter Waves - Heisenberg’s uncertainty principle - Schrodinger’s wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, “Fundamentals of Physics”, 11th Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, “Concepts of Modern Physics”, 7th Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D. J. Griffiths, “Quantum mechanics”, 2nd Edition, Cambridge University Press, 2014.

REFERENCES

1. Renk, Karl.F “Basics of laser physics”, 2nd Edition, Springer international publishing, 2017.
2. H. J. Pain,Patricia Rankin “Introduction to vibration and waves”, 1st Edition, Wiley, 2015
3. K.S.Mathur, “Fundamentals of Fiber Optics”, 1st Edition, Zorba books, 2018.

19SH14C ENGINEERING CHEMISTRY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)

CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)

CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)

CO4: familiar with the various novel organic material used in electronics industry. (K2)

CO5: understand the principle, components and working of various analytical instruments. (K2)

UNIT I WATER TREATMENT 6

Hardness - Estimation of hardness of water – Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

UNIT II SURFACE CHEMISTRY AND CATALYSIS 6

Adsorption – Types - Freundlich’s adsorption isotherm – Langmuir’s adsorption isotherm – contact theory – Kinetics of surface reactions - Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications - Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

UNIT III ELECTROCHEMISTRY AND CORROSION 6

Electrode potential-Nernst Equation-reference electrode - glass electrode - measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)

Corrosion: Types of corrosion - Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

UNIT IV ELECTRONIC MATERIALS 6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidene fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, biosensor - chemical sensors

UNIT V ANALYTICAL TECHNIQUES 6

Spectroscopy:Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20th Edition, 2018.

REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6th Edition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, "Organic Electronics: Materials, manufacturing and applications", Wiley - VCH, 2016

19CS11C PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: develop simple Python programs. (K3)
- CO2: structure simple Python programs for solving problems and decompose a Python program into functions. (K3)
- CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)
- CO4: understand file management concepts and develop packages in Python Programs. (K3)
- CO5: design and Develop GUI Programming. (K5)

UNIT I DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode - values and data types: Variables - expressions - statements – Operators - precedence of operators – Input and Output - comments – Errors: Syntax Errors - Runtime errors - Logical Errors.

UNIT II CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) – chained conditional (if-elif-else) - Iteration: state – while – for – break – continue - pass - Fruitful functions: Function argument and its types - return values – parameters - local and global scope - function composition – recursion - Documenting Function – Classes and Inheritance - Object Oriented Programming - Class Instances – Class Methods.

UNIT III LISTS, TUPLES, DICTIONARIES 9

Strings: string slices – immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists – list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods - advanced list processing - list comprehension

UNIT IV FILES, MODULES, PACKAGES 9

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Name space

UNIT V GRAPHICAL USER INTERFACE PROGRAMMING 9

Event driven programming - TkInter introduction - Introducing callbacks - User input - Mini-case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. “Think Python: How to Think Like a Computer Scientist”, by Allen B. Downey, O'Reilly Media, Inc. , 2016
2. “A Practical Introduction to Python Programming”, Brian Heinold, Mount St. Mary’s University, 2012.
3. “Learning to Program with Python”, Richard L. Halterman, 2019, E-book
4. Dive into Python, Mark Pilgrim, Apress, 2012.

REFERENCES

1. “Exploring Python”, Timothy A.Budd, Mc-Graw Hill Education (India) Private Limited, 2015.
2. “Introduction to Computer Science using python: A Computational Problem-solving Focus, Charles Dierbach, Wiley India Edition, 2015.
3. “Practical Programming: An Introduction to Computer Science using Python 3.6”, Paul Gries, Jennifer Campbell and Jason Montojo, second edition, Pragmatic Programmers, LLC, 2018.
4. “Introduction to Programming in Python: An Inter-disciplinary Approach”, Robert Sedgewick, Kevin Wayne, Robert Dondero, Pearson India Education Services Pvt. Ltd, 2016.

19CS12C BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the concepts of basic electrical circuits (K2)
CO2: describe the working principles of electrical machines and instruments (K2)

CO3: outline the functions of the component of low voltage electrical installations (K2)
CO4: explain the characteristics and applications of semiconductor devices (K2)
CO5: recall the different logic principles used in digital circuits (K2)

UNIT I CONCEPTS OF DC AND AC ELECTRICAL CIRCUITS 9

Electrical Circuit Elements – Ideal and Practical Sources – Electrical Quantities: Voltage, Current, Power and Energy – Ohms Law – Kirchoffs Laws – analysis of simple circuit with DC excitation- AC Circuits Fundamentals – Single Phase Circuits and Three Phase Circuits – Power and Power Factor.

UNIT II ELECTRICAL MACHINES 9

DC Machines: Types – Construction – Working Principles – Need for Starters - Speed control of DC motors.
AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Starting and Speed Control of Induction Motors.
AC Synchronous Generators: Construction – Working Principle.
Transformers: Single Phase and Three Phase Transformers – Auto Transformers- Construction – Working Principle.

UNIT III INSTRUMENTS AND ELECTRICAL INSTALLATION 9

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.
Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Operation, Characteristics and Applications: PN Junction Diode - Rectifiers - Zener Diode – Regulators - Bipolar Junction Transistor –CE Amplifier - FET – Opto-Electronic Devices – LEDs – Photo Diodes.

UNIT V DIGITAL ELECTRONICS 9

Binary Number System – Logic Gates – Boolean Algebra – Adders - Flip Flops – Shift Registers – Counters – ADC and DAC.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. D.P. Kothari and I.J. Kothari, “Basic Electrical and Electronics Engineering”, Tata McGraw Hill, 1st Edition, 2014.
2. P.S. Bimbhra, “Electrical Machinery”, Khanna Publishes, 7th Edition, 2011.
3. Thomas L. Floyd, “Digital Fundamentals”, 10thEdition, Pearson Education Inc, New Delhi, 2009.
4. A.K.Sawhney, “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai and Co, 2004.

REFERENCES

1. D.C. Kulshreshtha, “Basic Electrical Engineering”, Tata McGraw Hill, Revised 1st Edition, 2011.
2. L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
3. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
4. V.D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
5. E.O. Doebelin, “Measurement Systems – Application and Design”, Tata McGraw Hill, 2003.
6. David Bell, “Electronic Devices and Circuits”, Prentice Hall Private Limited, 2007.
7. M. Morris Mano, “Digital Design”, Pearson Education, 4th Edition, 2007.

19SH16C	**ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**0 0 3 1.5**

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K2)
CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium.(K2)
CO3: illustrate the electrical properties of materials. (K2)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster’s bridge.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. David Loyal, “ Physics laboratory” 4th Edition, Cengage learning, 2013
2. Sesha Sai Kumar Vemula, “Engineering Physics lab manual” 1st Edition, LAP LAMBERT Academic Publishing, 2017

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: determine various water quality parameters. (K2)
CO 2: quantify different ions by different analytical techniques. (K2)
CO3: determine the rate of corrosion of mild steel plate. (K2)
CO4: verify the freundlich adsorption isotherm. (K2)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron (Fe^{2+}) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.
6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron (Fe^{2+}) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris “Quantitative Chemical Analysis: International Edition”, W.H.Freeman, 9th Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford , P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19CS13C PYTHON PROGRAMMING LABORATORY

	L	T	P	C
	0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: solve Simple problems using conditional and control statement in Python.(K3)
CO2: develop user defined function for solving problems in modular approach. (K3)
CO3: enhance the program skills with lists and dictionaries. (K3)
CO4: design and develop packages and GUI application. (K5)

LIST OF EXPERIMENTS

1. **Simple Programs**
    a. To calculate the average of numbers
    b. To read two numbers and print their quotient and remainder

2. **Programs using control flow**
   a. To compute prime factors of an integer
   b. To form an integer that has the number of digits at ten's place and the least significant digit of the entered integer at one's place
   c. To get the marks of students for 5 subjects and display their grade as per the 2019 regulation.
   d. To print all numbers in a range divisible by a given number
   e. To accept three digits and print all possible combinations from the digits
3. **Programs using functions**
   a. To determine all Pythagorean triplets in the range
   b. Given a square matrix with n rows and n columns, you have to write a program to rotate this matrix such that each element is shifted by one place in a clockwise manner.
   c. To check whether a string is a palindrome or not using recursion

4. **Programs using strings**
   a. To detect if two strings are anagrams
   b. To accept a hyphen separated sequence of words as input and print the words in a hyphen-separated sequence after sorting them alphabetically

5. **Programs using lists**
   a. To find the second largest number in a list
   b. To merge two lists and sort it

6. **Programs using dictionaries**
   a. There is a robot which wants to go the charging point to charge itself.
   The robot moves in a 2-d plane from the original point (0,0). The robot can move toward up, down, left and right with given steps.
   The trace of robot movement is shown as the following:
      i. Up 5
      ii. Down 3
      iii. Left 3
      iv. Right 2

   Write a program to compute the distance between the current position after a sequence of movement and original point. If the distance is a float, then just print the nearest integer (use round() function for that and then convert it into an integer).
   b. Consider a cricket series containing five matches between india and australia read the scores of individual players of both teams and finally identity the man of the series.

7. **Programs using files**
   a. To count the number of words and number of lines in a text file

  b. That reads a text file and counts the number of times a certain letter appears in the text file

8. **Programs using modules and packages.**

9. **Case study:** GUI programming

P: 60; TOTAL: 60 PERIODS

SOFTWARE REQUIREMENTS

1. Python 3.x
2. Anaconda Navigator

19CS21C	**PROFESSIONAL ENGLISH**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: integrate and apply the acquired skills in real life situation. (K3)
CO 2: write effectively in any professional contexts. (K3)
CO 3: enhance the vital sub-functions of communication in any formal situation. (K3)
CO 4: participate actively in any informal and formal discussion. (K3)
CO 5: recall the acquired skills and apply them in their work place. (K2)

UNIT I **6**

Standard Abbreviations - If Conditionals - Presenting articles based on newspaper reading - Listening for specific information - Argumentative essay.

UNIT II **6**

One word substitution - Rearranging the jumbled phrases of sentences – Chart Description - Business Letters for Quotations and Clarification.

UNIT III **6**

Idioms and Phrases - Direct & Indirect Speech - Business Letters for Placing orders and Making Complaints - Process Description.

UNIT IV **6**

Synonyms **-** Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples - Demo) - Proposal Writing.

UNIT V **6**

Error Spotting (Based on Concord, Pronouns, Articles & Adverb Placement) - Job Application Letter & Resume Preparation - Circular and Minutes of the meeting - Reading Comprehension.

Suggested Activity: Career Analysis – Herein the students will be required to submit a report about their dream career / company of their choice. This will be followed by a presentation of the same in the class.

L: 30 TOTAL: 30 PERIODS

TEXT BOOKS

1. Board of editors. "Fluency in English A Course book for Engineering and Technology", Orient Blackswan, Hyderabad, 2016.
2. Bovee, Courtland, L., John V.Thill. "Business Communication Today", 13th Edition, Pearson Education, New Delhi, 2018.

REFERENCES

1. Lester Mark and Larry Beason, "Hand book of English Grammar and Usage", McGraw Hill Education, 1st Edition, 2017.
2. Raman, Meenakshi and Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2014.

19CS22C PROBABILITY AND QUEUEING THEORY L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: grasp the basic concepts of probability and random variables.(K2)
CO2: find the correlation and regression of two dimensional random variables.(K2)
CO3:characterize the phenomena which evolve with respect to time in a probabilistic manner. (K3)
CO4: interpret the basic characteristic features of Markovian queues. .(K3)
CO5: utilize the concepts of Non Markovian queues and Networks.(K3)

UNIT I RANDOM VARIABLES 12

Random Variable – Discrete and continuous random variables - Moments - Moment generating functions and their properties; Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions .

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

UNIT III CLASSIFICATION OF RANDOM PROCESSES 12

Random process **-** Classification - Stationary process – WSS and SSS - Markov process - Markov chains – Transition probabilities - Limiting distributions - Poisson process

UNIT IV QUEUEING THEORY 12

Markovian models – Birth and Death Queueing models- Steady state results: Single and multiple server queueing models- Queues with finite waiting rooms- Finite source models- Little's Formula

UNIT V NON-MARKOVIAN QUEUES AND QUEUE NETWORKS 12

M/G/1 queue- Pollaczek- Khintchine formula, series queues - Open and closed networks.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. O.C. Ibe, “Fundamentals of Applied Probability and Random Processes”, Elsevier, 1st Indian Reprint, 2007.
2. D. Gross and C.M. Harris, “Fundamentals of Queueing Theory”, Wiley and Sons Publication Limited, 4th Edition, 2008.

REFERENCES

1. A.O. Allen, “Probability, Statistics and Queueing Theory with Computer Applications”, Elsevier, 2nd Edition, 2005.
2. H.A. Taha, “Operations Research”, Pearson Education, Asia, 10th Edition, 2017.
3. K.S. Trivedi, “Probability and Statistics with Reliability, Queueing and Computer Science Applications”, John Wiley and Sons, 2nd Edition, 2016.

19CS23C SEMICONDUCTOR PHYSICS

L T P C
2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: infer the principles of quantum physics to understand the properties of electronic materials. (K2)
CO2: explain the basics of semiconductors. (K2)
CO3: gain the knowledge of the quantum-mechanical interaction between light and semiconductor. (K2)
CO4: understand the working of various instruments used for the measurement of various electrical engineering parameters. (K2)
CO5: express the characteristics and working principles of semiconductor devices (K2)

UNIT I ELECTRONIC MATERIALS 6

Free electron theory- Density of states and energy band diagrams- Kronig-Penny Model- Energy bands in solids-Direct and indirect bandgaps- Types of electronic materials: metals, semiconductors and insulators- Density of states-Occupation, probability, Fermi level.

UNIT II SEMICONDUCTORS 6

Intrinsic and extrinsic semiconductors- Dependence of Fermi level on carrier-concentration and temperature-Carrier generation and recombination-Carrier transport.

UNIT III LIGHT-SEMICONDUCTOR INTERACTION 6

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission- Joint density of states- Density of states for photons- Transition rates -Fermi's golden rule- Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

UNIT IV MEASUREMENTS 6

Four-point probe and Van der Pauw measurements for carrier density- resistivity and hall mobility- Hot-point probe measurement- capacitance-voltage measurements- parameter extraction from diode –V-I characteristics.

UNIT V ENGINEERED SEMICONDUCTOR MATERIALS AND DEVICES 6

PN junction diode- Transistors- Types of semiconductor Photodetectors – PIN and Avalanche, their structure, materials, working principle and characteristics- LED, LCD, OLED- device structure, materials, characteristics.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Charles Kittel, “ Introduction to Solid State Physics”, John Wiley and Sons, 8th Edition, Singapore, 2013.
2. Jasprit Singh, “Electronic and optoelectronic properties of semiconductor structures”, McGraw-Hill Inc., 1st Edition, 2003

REFERENCES

1. B.E.A. Saleh and M.C.Teich, “Fundamentals of Photonics”, John Wiley & Sons, Inc., 2nd Edition, 2013.
2. S.M.Sze, “Semiconductor Devices: Physics and Technology”, Wiley, 2nd Edition, 2008.
3. Online course: “Semiconductor Optoelectronics”, M R Shenoy on NPTEL.
4. Online course: "Optoelectronic Materials and Devices", Monica Katiyar and Deepak Gupta on NPTEL.

19CS24C BIOLOGY FOR ENGINEERS

	L T P C
	2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe and comprehend the fundamental concepts of cell biology. (K2)
CO2: understand the various bimolecular interactions in living organisms. (K2)
CO3: familiar with biological database. (K2)
CO4: understand the thermodynamic concepts in living organisms. (K2)
CO5: apply the molecular modeling methods in the drug design. (K2)

UNIT I CELL BIOLOGY 6

Cell as a basic unit of life-Cell organization of prokaryotic and eukaryotic cells-Structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus - Cell cycle - cell division: mitosis and meiosis.

UNIT II BIO MOLECULAR INTERACTIONS 6

DNA and RNA-hydrophobicity and hydrophilicity-Molecular interactions: covalent and non covalent interactions – Spectroscopic methods to measure the interactions.

UNIT III BIOLOGICAL DATABASES 6

Primary and secondary sequence databases – Composite protein sequence databases - General concepts of sequence analysis - Identification of functional sequences PDB (Protein Data Bank) and NDB (Nucleic Acid Data Bank).

UNIT IV BIOCHEMICAL THERMODYNAMICS 6

First and Second laws of thermodynamics, Details of thermodynamic variables and functions. Application of thermodynamic laws in Life Science with examples.

Bioenergetics: Energy rich bonds - Coupled reactions-Group transfer - Autotrophic and Heterotrophic principle of energy transductions - Gibbs free-energy calculation for Bio-redox reactions – Thermodynamics of ligand binding – Association and dissociation constant.

UNIT V DRUG DESIGN AND MOLECULAR MODELING 6

Principles of drug development – partition coefficient (Log p): octanol - Water system - Lipinski's rule of five - structure based drug designing approaches - target identification and validation - semi-empirical calculations - single point calculations - full-geometry optimization methods - Molecular docking programs: AutoDock.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Y. Nelson, L. David, Lehninger Principles of Biochemistry, International Edition, W.H.Freeman, Macmillan Learning, New York, 7th Edition, 2017.
2. Nagata, Kazuhiro, Real-Time Analysis of Biological Interactions, Springer, Japan, 3rd Edition, 2015.
3. I. Bertini, H. B Gray, Bioinorganic Chemistry, Viva Books Private Limited, New Delhi, 4th Edition, 2014.

REFERENCES

1. B.A. Bunin, B. Siesel, G. Morales, J. Bajorath, Chemoinformatics: Theory, Practice, & Products, Springer, 2nd Edition, 2014.
2. A. Nag and B. Dey , Computer aided drug design and delivery system, McGraw-Hill, ISBN: 978-0-07-170125-9, 2011.
3. B. Wang, E.V. Anslyn, Chemosensor: Principles, Strategies, and Applications, a John Wiley & Sons, inc., Publication, 2011.

19CS25C	**PROBLEM SOLVING TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: develop algorithmic solutions to simple computational problems. (K3)
CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
CO 3: solve problems using array and functions. (K3)
CO 4: implement various sorting techniques. (K3)
CO 5: implement various searching techniques. (K3)

UNIT I BASICS OF PROBLEM SOLVING 9

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with

Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

UNIT II BASIC TECHNIQUES 9

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

UNIT III ARRAYS AND FUNCTIONS 9

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV SORTING TECHNIQUES 9

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

UNIT V SEARCHING TECHNIQUES 9

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Maureen Sprankle and Jim Hubbard, "Problem Solving and Programming Concepts", Prentice Hall, 9th Edition, 2012.
2. Harsha Priya, R. Ranjeet, — "Programming and Problem Solving Through C Language", Firewall/Laxmi Publications (P) Ltd., New Delhi, 2015.

REFERENCES

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, Oxford University Press, 2nd Edition, 2013.
2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner‘s Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

19SH15C ENGINEERING GRAPHICS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
2	0	4	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)

CO2: construct the orthographic projections of points, straight lines and lamina (K2)

CO3: draw the projections of simple solids in different positions. (K3)

CO4: visualize the sectional views and surface areas of various solids. (K3)

CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P: 60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, "Engineering Drawing", 53rd Edition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2nd Edition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, "Engineering Drawing", Subhas Publications, 32nd Edition, 2017.

19CS26C	SEMICONDUCTOR PHYSICS AND BIOLOGY LABORATORY	L T P C 0 0 3 1.5

PART A SEMICONDUCTOR PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: demonstrate the properties of optical materials. (K2)
CO 2: illustrate the characteristics of semiconducting materials (K2)
CO 3: analyze the characteristics of semiconductor devices (K2)

LIST OF EXPERIMENTS

1. (a) Determination of wave length of Laser source.
   (b) Particle size determination using Laser source.
2. Determination of Band Gap of a semiconducting material.
3. Determination of Hall coefficient
4. V - I Characteristics of PN junction diode.
5. V - I Characteristics of Zener diode.
6. V - I Characteristics of LED/Photo diode
7. Characteristics of NPN Transistor – CE configuration

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. P.R.Sasikumar, “Practical Physics” PHI Learning Pvt Ltd,2011
2. David Loyal, “ Physics laboratory” 4th Edition, Cengage learning, 2013
3. Sesha Sai Kumar Vemula, “Engineering Physics lab manual” 1st Edition, LAP LAMBERT Academic Publishing, 2017

PART B BIOLOGY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: identify the various biomolecules by suitable chemical analysis. (K3)
CO 2: quantify the amount of acid by pH metric method. (K3)
CO3: estimate the retention factor and log P value of paracetamol and aspirin. (K2)
CO4: draw the structure of different types of drugs using Gaussian and Chem Draw software. (K3)
CO5: identify the molecular interactions of drug with biomolecules.(K3)

LIST OF EXPERIMENTS

1. Qualitative analysis of biomolecules.
2. Estimation of acid by pH metric method.
3. Calculation of retention factor of amino acids.
4. Determination of (log P) value for paracetamol and aspirin.
5. Low energy conformation of medicinally important compounds using Gaussian soft ware.

6. Draw the chemical structure of important drugs using Chem Draw software.
7. Identification of interactions between drug and biomolecules using Auto Dock software.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Biology.

REFERENCES

1. P.Worsfold, A.Townshend, C.Poole, M.Miro, Encylopedia of Analytical science Elsevier, 3rd Edition, 2018.
2. A.I. Vogel, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education Limited, England, 8th Edition, 2015.

19CS27C PROBLEM SOLVING TECHNIQUES LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: solve simple and Complex problems. (K3)
CO 2: solve sorting and searching problems. (K3)

LIST OF EXERCISES

Programs using simple logics and switch cases

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

Programs using Control Structures

5. Perform the following operations:
   a. Generate Pascal‘s triangle.
   b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.
7. Compute Sine series and Cosine series.
8. Find the 2‘s complement of a binary number.

Programs using Arrays

9. Perform the following operations:
   a. Matrix addition.
   b. Transpose of a matrix.
   c. Matrix multiplication by checking compatibility

Programs to manipulate Strings

10. Perform the following operations on a string:
    a. Insert a sub-string into main string at a given position.

b. Delete n characters from a given position in a string.
c. Check whether the given string is palindrome or not.
d. Replace a character of string either from beginning or ending or at a specified location.

Programs using Functions

11. Perform the following operations: (Use recursive functions)
    a. Find the factorial of a given integer.
    b. Find the GCD (Greatest Common Divisor) of two given integers.
    c. Solve the Towers of Hanoi problem.

Programs using sorting and searching techniques

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

P: 60; TOTAL: 60 PERIODS

Software Requirement: Turbo C / Python

19GN01C INNOVATION THROUGH DESIGN THINKING

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to
CO1: To discuss the design thinking process and innovation. (K2)
CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS 15

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS 30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, “Design Thinking: The Handbook”, WS Professional, 2020
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving”, Penguin Random House, 2020
3. D.M. Arvind Mallik, “Design Thinking for Educators”, Notion Press, 2019
4. Michael Lewrick, “The Design Thinking Playbook”, Wiley, 2019
5. Kathryn Christopher, “Design Thinking in Engineering”, Kendall Hunt Publishing Company, 2019
6. Robert Curedale, “Design Thinking Process & Methods” 5th Edition, Design Community College Inc, 2019
7. David Lee, “Design Thinking in the Classroom”, Ulysses Press, 2018
8. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, “The Little Booklet on Design Thinking: An Introduction”, 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, “Design Thinking: New Product

Development Essentials", Wiley-Blackwell, 2016
11. Thomas Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies - presentation	10 Hours
Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions	20 Hours
Evaluating the students' activities through their presentations	

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19CS31C DISCRETE MATHEMATICS

L	T	P	C	QP
3	1	0	4	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: check the validity of the arguments.(K2)
CO2: understand the concepts of Sets, Relations and Functions.(K2)
CO3: perform the principles of counting and solve recurrence relations. (K3)
CO4: interpret the basic concepts of graphs.(K2)
CO5: find all Spanning Trees of a graph and understand the concepts of colouring of graphs (K3)

UNIT I MATHEMATICAL LOGIC 12

Propositional Logic – Equivalences and Implications – Normal forms –Predicate Calculus and Quantifiers - Rules of inference – Proof methods and Strategies - Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT II SETS, RELATIONS AND FUNCTIONS 12

Basic Definitions - Set operations – Laws of set theory – Relations – Properties of relations - Partial Ordering Relation - Equivalence Relation - Matrices of relations - Closure of relations – Functions - Bijective functions - Inverse and Compositions of functions.

UNIT III COMBINATORICS 12

Mathematical induction - Strong induction and well ordering -The basics of counting –The pigeonhole principle - Permutations and combinations – Recurrence relations - Solving linear recurrence relations – Generating functions - Inclusion and exclusion principle.

UNIT IV GRAPH THRORY 12

Graphs and their properties - Special types of graphs – Matrix representation of graphs and graph isomorphism- connectivity, Cut vertex and cut edge - Euler and Hamiltonian graphs.

UNITV GRAPH COLOURING AND TREES 12

Graph Colouring - Colouring Vertices, Colouring Edges - Perfect Graph, properties - Trees – Some properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree – Rooted and Binary Trees - Spanning Trees.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Kenneth H.Rosen, “Discrete Mathematics and its Applications (with Combinatory and Graph Theory)”, Special Indian Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 7th Edition, 2017.
2. Trembly J.P and Manohar.R. “Discrete Mathematical Structures with Applications to Computer Science”, 1st Edition, Tata McGraw-Hill Pub. Company Limited, New Delhi, 2017.
3. Narsingh Deo, “Graph Theory with Applications to Engineering and Computer Science”, 1st Edition, Dover Publications Inc., 2016.

REFERENCES

1. Ralph .P. Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, 5th Edition, Pearson Education Asia, Delhi, 2003.
2. J.A.Bondy U.S.R.Murty, “Graph Theory”, Springer, 2008.

19CS32C	DATA STRUCTURES	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: impart the basic concepts of data structures and implementation of stacks and different types of queues using arrays. (K3)

CO2: implement different types of list, stack and queue using pointers. (K3)

CO3: Construct different types of trees. (K3)

CO4: recognize the various indexing techniques and distinguish various hashing and collision resolution techniques. (K2)

CO5: realize the basic concepts and applications of graphs to solve different real time problems. (K4)

UNIT I LINEAR DATA STRUCTURES 9

Data Structures: Definition – Types – Applications of Data Structures – Basic Terminologies: Elementary data organizations – Data structures operations - Abstract Data Types. Stacks and Queues: Stack and its operations - Applications of Stacks - Expression Conversion and evaluation. Queue and its types: Simple Queue -Circular Queue - Priority Queue - Operations on each types of Queues – Complexity Analysis.

UNIT II LINKED LISTS 9

Singly linked lists: Representation in memory - Algorithms of various operations: Traversing - Searching - Insertion into linked list - Deletion from linked list; Linked list representation of Stack and Queue - Header nodes. Doubly linked list: Representation and its operations. Circular Linked Lists: Representation. Applications of linked list – Complexity Analysis

UNIT III TREES 9

Basic Tree Terminologies - Different types of Trees: Binary Tree - Binary Search Tree - Threaded Binary Tree- Expression tree –Tree traversal - Operations on each of the trees and their Algorithms. AVL Tree: Single and double rotations. Applications of Trees – Complexity Analysis – Tries-Ternary search tree.

UNIT IV INDEXING AND HASHING 9

Indexing: B Tree and B+ Tree: Definitions- algorithms. Splay tree – Rotations. Hashing: Hash Function – Separate chaining – Open Addressing – Rehashing – Extendible hashing – Complexity Analysis. Dictionary: Dictionary ADT – Implementation – Applications. Case study on data structures in social media.

UNIT V GRAPHS 9

Graphs: Basic Terminologies and Representations, Graph traversal algorithms - Topological sort –- Shortest Path Algorithms – Network Flow Problems - Minimum Spanning Tree – Prim's and Kruskal's Algorithms – Bi-connectivity.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. M. A. Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson, 2002.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.

REFERENCES

1. A.V. Aho, J. E. Hopcroft, and J. D. Ullman,”Data Structures and Algorithms”, 1st Edition, Pearson Education, Reprint 2003.
2. R. F. Gilberg, B. A. Forouzan, “Data Structures – A Pseudo code approach with C, 2nd Edition, Thomson India Edition, 2005.
3. M. A. Weiss, —Data Structures and Algorithm Analysis in C In C++, 3rd Edition, Pearson, 2014.
4. http://web.engr.oregonstate.edu/~sinisa/courses/OSU/CS261/CS261_Textbook/Chapter12.pdf
5. http://cse01-iith.vlabs.ac.in/List%20of%20experiments.html?domain=Computer%20Science

19CS33C COMPUTER ORGANIZATION AND ARCHTECTURE L T P C QP

3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: realize the role of functional units and various architectural features (K2)
CO2: examine data representation and execution procedure of an ALU (K2)
CO3: categorize the pipelining techniques and recognize the I/O mechanism for high speed devices. (K3)
CO4: know the different I/O Interfaces and categorize the different memory systems. (K2)
CO5: distinguish the operational functions of symmetric and distributed architectures. (K2)

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional Units – Basic Operational Concepts – Bus Structures – Performance– Processor Clock- Performance Equation- Clock Rate- Instruction Set –CISC And RISC – Performance Measurement – Multiprocessors and Multicomputers- Memory Locations and Addresses- Memory Operations - Instructions and Instruction Sequencing – Addressing Modes - Basic Input / Output Operations.

UNIT II ARITHMETIC AND PROCESSING UNIT 9

Addition and Subtraction of Signed Numbers –Multiplication of Positive Numbers- Signed Operand Multiplication - Fast Multiplication –Restoring and Non Restoring Division Algorithm - Floating Point Numbers and Operations. Processing Unit- Fundamental Concepts – Execution of a Complete Instruction – Multiple Bus Organization – Hardwired Control – Micro Programmed Control.

UNIT III PIPELINING AND I/O ORGANIZATION 9

Basic Concepts – Data Hazards – Instruction Hazards – Influence on Instruction Sets – Data Path and Control Considerations – Superscalar Operations –Accessing I/O Devices – Interrupts –Direct Memory Access- Buses

UNIT IV I/O INTERFACES AND MEMORY SYSTEM 9

Interface Circuits - Standard I/O Interfaces – Memory System Basic Concepts – Semiconductor RAM – ROM – Speed, Size and Cost – Cache Memories –Performance Considerations – Virtual Memory – Memory Management Requirements – Secondary Storage.

UNIT V MULTI-CORE PROCESSORS 9

Single Core to Multi-Core Architectures – SIMD And MIMD Systems – Interconnection Networks – Symmetric and Distributed Shared Memory Architectures – Cache Coherence – Performance Issues – Parallel Program Design.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5th Edition, Tata McGraw Hill, 2011. (UNIT I to IV)
2. Peter S. Pacheco, —An Introduction to Parallel Programming, Morgan-Kauffman / Elsevier, 2011.(UNIT- V)

REFERENCES

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, 3rd Edition, Elsevier, 2005.

2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition, Pearson Education, 2003.
3. John P. Hayes, "Computer Architecture and Organization", 3rd Edition, Tata Mc-Graw Hill, 2002.
4. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", 2nd Edition, Pearson Education, 2004.
5. Kai Hwang, ZhiWeiXu, "Scalable Parallel Computing", 3rd Edition, Tata Mc-Graw Hill, 2003.
6. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

19CS34C	OBJECT ORIENTED PROGRAMMING	L T P C QP
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: recognize and use object oriented programming constructs to write object oriented programs. (K3)
CO2: adopt appropriate constructor and overloading mechanisms to develop the application. (K3)
CO3: understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code. (K3)
CO4: demonstrate exception handling mechanisms to handle runtime errors and generic programming design. (K3)
CO5: implement rich data handling through files and streaming. (K2)

UNIT I BASIC CONCEPTS 9

Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism. Introduction to C++ - Classes and objects: classes - structures and classes - unions and classes - friend functions – friend classes - inline functions - parameterized constructors - static class members - scope resolution operator - nested classes - local classes - passing objects to functions - returning objects – object assignment. Arrays, Pointers, References and Dynamic Allocation Operators: Arrays of Objects – Pointers to Objects – Type Checking – This Pointer – Pointers to Derived Types – Pointers to Class Members – References – Dynamic Allocation Operators.

UNIT II FUNCTION OVERLOADING AND CONSTRUCTORS 9

Function Overloading – Overloading Constructors – Copy Constructors – Finding the Address of Overloaded Functions – Overload Anachronism – Default Function Arguments – Function Overloading and Ambiguity. Operator overloading: Creating a member Operator Function – Operator Overloading Using Friend Function – Overloading New and Delete – Overloading Special Operators – Overloading Comma Operator.

UNIT III INHERITANCE AND POLYMORPHISM 9

Inheritance: Base-Class Access Control – Inheritance and Protected Members – Inheriting Multiple Base Classes – Constructors, Destructors and Inheritance – Granting Access – Virtual Base Classes. Polymorphism: Virtual Functions – Virtual Attribute and Inheritance – Virtual Functions and Hierarchy – Pure Virtual Functions – Using Virtual Functions – Early vs. Late Binding. Run-Time Type ID and Casting Operators: RTTI – Casting Operators – Dynamic Cast.

UNIT IV TEMPLATES AND EXCEPTION HANDLING 9

Templates: Generic Functions – Applying Generic Functions – Generic Classes – Type name and Export Keywords – Power of Templates. Exception Handling: Fundamentals – Handling Derived Class Exceptions – Exception Handling Options – Understanding terminate() and unexpected() – uncaught exception() Function – Exception and bad exception Classes – Applying Exception Handling.

UNIT V I/O STREAMS 9

File I/O-<fstream> and the File Classes-Opening and Closing a File-Reading and Writing Text Files-Unformatted and Binary I/O. Namespaces: Namespaces – std namespace. Standard Template Library: Overview – Container Classes – General Theory of Operation –Vectors- Lists-Maps – String Class

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Herbert Schildt, "C++: The Complete Reference", 5th Edition, Tata Mc-Graw Hill Publishers, 2014.
2. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall Publisher, 2016.
3. Trivedi, Bhushan "Programming with ANSI C++", 2nd Edition, Oxford University Press NASW Press, 2013.

REFERENCES

1. Ira Pohl, "Object Oriented Programming using C++", 2nd Edition, Pearson Education, Reprint, 2004.
2. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Primer", 4th Edition, Pearson Education, 2012.
3. Bjarne Stroustrup, "The C++ Programming language", 4th Edition, Pearson Education, 2013.

19CS35C DIGITAL PRINCIPLES AND SYSTEM DESIGN

L	T	P	C	QP
3	0	2	4	A

COURSE OUTCOMES

Upon completion of this course, the students are able to:

CO1: simplify Boolean functions and realize the importance of logic circuits. (K3)

CO2: design combinational logic circuits for various applications and implement using logic gates and simulate them using Hardware Description Language(HDL) (K3)

CO3: design sequential logic circuits like counters and sequence detectors and implement them using different flip flops. (K3)

CO4: design asynchronous sequential circuits. (K3)
CO5: understand the memory and programmable logic circuits. (K2)

UNIT I BOOLEAN ALGEBRA AND LOGIC GATES (Practical) 15

Review of Number Systems –Number representation: Signed, Unsigned, Fixed point, Floating point. Computer codes –BCD, Gray code, Excess 3 code, Error detection and correction codes, Parity, Hamming codes. Boolean algebra – Basic Postulates and theorems, Switching functions, Canonical forms, Logic gates. Simplifications of Boolean functions using Karnaugh map and tabulation methods. Introduction to Hardware Description Language (HDL).

UNIT II COMBINATIONAL LOGIC (Practical) 17

Analysis and design procedures of Combinational circuits -Arithmetic Circuits: Binary / BCD adders and subtractors, Carry look ahead adder, Magnitude comparator, Code conversion Decoders, Encoders, Multiplexers and Demultiplexers - HDL for combinational circuits.

UNIT III SYNCHRONOUS SEQUENTIAL LOGIC (Practical) 17

Sequential Devices: General model of sequential circuits –Latch, Design of Flip Flops, Master slave configuration. Mealy/Moore models -Sequence detector –Concept of state, State diagram, State table, State reduction procedures using Implication chart. Design of synchronous sequential circuits – Updown / Modulus counters, Serial adder, Binary counters - HDL for Sequential Circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC (Practrical) 17

Introduction to Asynchronous Sequential Circuits – Fundamental mode and Pulse mode circuits, Analysis and design of asynchronous sequential circuits -Reduction of state and flow tables – Race Free State assignment -Hazards.

UNIT V MEMORY AND PROGRAMMABLE LOGIC 9

Introduction to PLDs – ROM, PAL, PLA - Implementation of digital functions using PLDs. Introduction to Hardware Description Language – Behavioral, Dataflow and gate level modeling

L: 45; P: 30; TOTAL: 75 PERIODS

TEXT BOOKS

1. M.Morris Mano, “Digital Design”, 5th Edition, Pearson Education, 2013.
2. D.A.Godse, A.P.Godse, “Digital Electronics”, 3rd Revised Edition, Technical Publications, 2008.

REFERENCES

1. Thomas L.Floyd, “Digital Fundamentals”, 11th Edition, Global Edition, Pearson Education, 2015.
2. Charles H.Roth, Jr. “Fundamentals of Logic Design”, 7th Edition, Jaico Publishing House, 2015.
3. Donald D.Givone, “Digital Principles and Design”, Tata McGraw-Hill, 2003.

19CS36C	SOFTWARE ENGINEERING METHODOLOGIES	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the importance of software engineering practices. (K2)
CO2: effectively participate in software requirement analysis and design. (K2)
CO3: realize the value and challenges in software testing. (K3)
CO4: identify the necessitate for configuration and Maintenance concepts (K2)
CO5: realize the importance of Agile process and DevOPS models (K2)

UNIT I INTRODUCTION 9

Definition of terms - The evolving role of Software – Software characteristics - Software applications. Software process models – Waterfall model-RAD model-The prototyping model.

UNIT II SOFTWARE MODELING 9

Requirement elicitation - Requirement analysis and negotiation - Requirement validation - Requirement management. Elements of the analysis model - Data modeling - Data objects, attributes and relationships - Cardinality and modality - Entity/Relationship diagram - Data flow diagrams. Software design –Design process and concepts, case study.

UNIT III TESTING 9

Software testing fundamentals - Test case design: White box testing - Basis path testing - Control structure testing. Black box testing - Testing strategies - Unit testing - Integration testing - System testing – Acceptance Testing – case study.

UNIT IV SOFTWARE CONFIGURATION MANAGEMENT AND MAINTENANCE 9

Baselines - Software configuration items -The SCM process - Version control - Change control - Configuration audit - SCM standards. Software Maintenance - Software Supportability – Reengineering - Software Reengineering - Reverse Engineering – Restructuring - Forward Engineering - Economics of Reengineering.

UNIT V AGILE AND DEVOPS MODEL 9

Agility - Agile process models: extreme programming –adaptive software development-scrum – DevOps, case study.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Roger S.Pressman, “Software Engineering: A Practitioner's Approach”, 8th Edition, Tata McGraw Hill Edition, 2015.

REFERENCES

1. Ian Somerville, "Software Engineering", 10th Edition, Pearson, 2016.
2. Shari Lawrence Pfleeger, “Software Engineering: Theory and Practice”, 4th Edition, Pearson Education, New Delhi, 2014.

3. Pankaj Jalote, “Integrated Approach to Software Engineering”, 3rd Edition, Springer, New York, 2010.
4. Len Bass, Ingo Weber and Liming Zhu,"DevOps: A Software Architect‘s Perspective", 1st Edition, Pearson Education, 2016.

19MC01C ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C	QP
3	0	0	0	D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: explain the structure and function of ecosystem. (K2)
CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)
CO 3: explain the causes and effects of pollution. (K2)
CO 4: describe social issues related to the environment and the environment act. (K2)
CO 5: identify the nutrients in food and impact of metals on human health. (K2)

UNIT I ENVIRONMENT AND ECOSYSTEMS 9

Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

UNIT II BIODIVERSITY AND NATURAL RESOURCES 9

Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over - exploitation – deforestation – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

UNIT III ENVIRONMENTAL POLLUTION 9

Causes, effects and control measures of air pollution, water pollution, noise pollution and nuclear hazards – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9

Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; Environment laws: environmental (protection) act 1986-the wild life (protection) act 1972.

UNIT V FOOD AND HUMAN HEALTH 9

Carbohydrates, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, cadmium, mercury and chromium on human health.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Miller G. and Spoolman S, "Environmental Science", 14th Edition, Brooks/Cole Publishing Co., 2014.
2. Maczulak A.E., "Environmental Engineering", Facts on file Inc., 2009.
3. Han D, "Concise Environmental Engineering", Ph.D & Ventus Publishing ApS, 2012.

REFERENCES

1. Weller K. "Environmental Science and Biological Engineering", 1st Edition, WIT Press, 2015
2. Strange C., "Environmental Science and production", NasonTrest Publisher, 2014.

19CS37C DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: implement linear data structures to solve simple problems. (K3)
CO 2: solve real world problems using non linear data structures and hashing. (K4)

LIST OF EXPERIMENTS

1. Array Implementation of stack and queue ADT.
2. Linked list Implementation of stack and queue ADT
3. Applications of stack, queue and linked list,
4. Implementation of Heap using priority queue.
5. Implementation of Binary(expression) Trees and operations of Binary Trees
6. Implementation of binary search tree ADT
7. Implementation of AVL tree.
8. Implementation of hash table ADT.
9. Applications of hash table.
10. Applications of Graphs

SOFTWARE REQUIREMENTS

- Codeblocks
- OS – LINUX/ Windows 8.1

P: 60; TOTAL: 60 PERIODS

Sample Question Bank (Exercises not limited to this)

1. Using Stack ADT, write a program to convert infix expression into postfix expression which includes '(',')','+','-','*' and '/' .

2. Create a deque with 3 elements. Insert two elements at the rear end (Inject) and insert two elements at the front end (Push). Delete an element from the front end (Pop) and rear end (Eject). Display the queue after each operation and number of elements in the queue.

3. Write a program to implement the priority queue using binary heap. Compare the running time for sorted, reverse-ordered and random inputs.

4. a. Create two lists L1 and L2. While creating, the new nodes should be added in the front of the list by default.
i. Find the intersection of the two lists L1 and L2 and display the resultant list.
ii. Find the union of two lists L1 and L2 eliminates the duplicates and display the resultant list.
b. i. Create a list with n nodes
ii. Display the list in the reverse order and number of nodes in the list.
iii. Delete the specified node from the list and display the resultant list.

5. Represent a polynomial as a linked list and write functions to add the following polynomial and display the resultant polynomial $4X^4+3X^3+X+5, 3X^3-2X^2+X+3$.

6. Write a program to implement an expression tree. Produce its pre-order, in-order, and post-order traversals.

7. a .i. Implement basic binary search tree operations.
ii.While deleting the node with two children, replace it with either in-order successor or in-order predecessor based on choice.

b. Create a tree with nodes containing hit count information of various engineering college sites. Display the count in ascending order. The tree's height should be optimum. ie. It should not exceed $1.44*\log_2 n$. Find the height of the tree after each insertion.

8. Implement basic operations of Dictionary ADT using hash table assuming that the user does not attempt to insert entries with the same key.

9. The ABC Company has its branches in several cities in India. The company wants to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. They want to connect all the branches with a minimum total cost. Help them to fix their problem.

10. The XYZ Logistics wants to deliver goods from Madurai to Tirumangalam, Virudhunagar, Sivakasi, Sathur, Rajapalayam and Kovilpatti through Lorry. The transport charges between each pair of cities vary. The XYZ Logistics wants to cut down on the total distance travelled to save transport charge and it wants to know the route with minimum distance from Madurai to all other cities. Help them to find the route.

19CS38C OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: demonstrate the use of various OOPs concepts (Class and Objects, Abstraction, Encapsulation, Inheritance and Polymorphism) with the help of C++ program (K3)

CO2: demonstrate the usage of exception handling mechanisms to handle runtime errors and to demonstrate the design of generic programming. (K3)

CO3: implement rich data handling through files and streaming. (K3)

LIST OF EXPERIMENTS

1. Implement C++ Program for passing arguments to a function(by value and by reference) and returning value from a function
2. Implement C++ Program for function overloading, constructor overloading, default arguments and use of non-inline functions
3. Build a C++ Program for Overloading unary operators and Overloading binary operators
4. C++ Program for passing arrays and objects as arguments to function and returning arrays and objects from functions
5. Demonstrate the dynamic memory allocation for the working of the new and the delete operator.
6. Execute C++ program for inheritance and Virtual function.
7. Implement C++ program for abstract base classes and pure virtual functions.
8. Construct a program for RTTI
9. Construct a program for class and function templates
10. Implement C++ program for Exception handling and File handling.

The course instructor may specify a problem statement for a team or individual. It must be focus towards above topics. The course instructor may assign a mini project for the team (contains 4 or 5 members) concentrating on each of the above topics as modules integrated into the project.

SOFTWARE REQUIREMENTS

- Code base/ Code blocks/Visual studio / GCC Compiler
- OS - LINUX/ Windows 7/ 8

P: 60; TOTAL: 60 PERIODS

Sample Question Bank (Exercises not limited to this)

1. Design C++ classes with static members, methods with default arguments, friend functions. (For example, design matrix and vector classes with static allocation, and a friend function to do matrix–vector multiplication).

2. Write a class Time which represents time. The class should have three fields for hours, minutes and seconds. It should have constructor to initialize the hours, minutes and seconds.

- A method printTime() to print the current time.
- Overload the following operators:
  plus operator (+) (add two time objects based on 24 hour clock) and < (compare two time objects)

3. Implement complex number class with necessary operator overloading and type conversions such as integer to complex, double to complex, complex to double etc.

4. Consider an example of a banking system. Design a class called 'Bank' that has data members such as those representing account number, name, account type, branch, and balance amount. Derive a 'Deposit' class from Bank for depositing the amount into that account and to maintain the balance. Also derive a 'Withdrawal' class from Bank for withdrawing the amount from that account and to maintain the balance. Now, derive a 'Statement' class from both Deposit and Withdrawal to print the complete bank statement of the specific account holder with all transactions. Write an interactive C++ program for N customers using appropriate inheritance mechanism.

5. Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instance variable, named department, of type string. Supply a method to string that prints the manager s name, department and salary. Make a class Executive inherit from Manager. Supply a method to String that prints the string Executive followed by the information stored in the Manager superclass object. Supply a test program that tests these classes and methods.

6. Write a discount system for a beauty saloon, which provides services and sells beauty products. It offers 3 types of memberships: Premium, Gold and Silver. Premium, gold and silver members receive a discount of 20%, 15%, and 10%, respectively, for all services provided. Customers without membership receive no discount. All members receives a flat 10% discount on products purchased (this might change in future). Your system shall consist of three classes: Customer, Discount and Visit,. It shall compute the total bill if a customer purchases Rs.x of products and Rs.y of services, for a visit. Also write a test program to exercise all the class behaviors.

7. Consider a class called MyTime, which models a time instance which contains the following private instance variables:
    - hour: between 0 to 23.
    - minute: between 0 to 59.
    - Second: between 0 to 59.

You are required to perform *input validation*.
It contains the following public methods:

- ✓ setTime(int hour, int minute, int second): It shall check if the given hour, minute and second are valid before setting the instance variables. (Advanced: Otherwise, it shall throw an IllegalArgumentException with the message "Invalid hour, minute, or second!".)
- ✓ Setters setHour(int hour), setMinute(int minute), setSecond(int second): It shall check if the parameters are valid, similar to the above.
- ✓ Getters getHour(), getMinute(), getSecond().
- ✓ toString(): returns "HH:MM:SS".
- ✓ nextSecond(): Update this instance to the next second and return this instance. Take note that the nextSecond() of 23:59:59 is 00:00:00.
- ✓ nextMinute(), nextHour(), previousSecond(), previousMinute(), previousHour(): similar to the above.
- ✓ Write the code for the MyTime class. Also write a test driver (called TestMyTime) to test all the public methods defined in the MyTime class.

8. Demonstrate the dynamic memory allocation or the working of the new and the delete operator.

9. Create a simple “shape” hierarchy: a base class called Shape and derived classes called Circle, Square, and Triangle. In the base class, make a virtual function called draw( ), and override this in the derived classes. Make an array of pointers to Shape objects that you create on the heap (and thus perform upcasting of the pointers), and call draw( ) through the base-class pointers, to verify the behavior of the virtual function.

10. Design a Book class. Assume that a book is written by one (and exactly one) author. The Book class contains the following members:

- Four private member variables: name (String), author (an *instance* of the Author class assuming that each book has exactly one author), price (double), and qty (int).
- The public getters and setters: getName(), getAuthor(), getPrice(), setPrice(), getQty(), setQty().
- A toString() that returns "'book-name' by author-name (gender) at email". You could reuse the Author's toString() method, which returns "author-name (gender) at email".

11. Define a sort() that takes its comparison criterion as a template argument. Define a class Record with two data members count and price. Sort a vector<Record> on each data member.

12. Write a singly-linked list class template that accepts elements of any type derived from a class Link that holds the information necessary to link elements. This is called an intrusive list. Using this list, write a singly-linked list that accepts elements of any type (a non-intrusive list). Compare the performance of the two list classes and discuss the tradeoffs between them

13. Add an exception handler (try/catch/throw) to the class that throws an error message (e.g. “value out of range”) in the getValue function that is caught and handled in the main program. Implement two version of the program. In version 1, throw the error in getValue, catch the error in the main, display an error message in the main, and then allow the program to terminate. In the second version, perform the same basic actions (throw and catch) but keep re-invoking the getValue function from the main program until the user enters a valid value

14. Write a C++ program to keep records and perform statistical analysis for a class of 20 students. The information of each student contains ID, Name, DOB, quizzes Scores (2 quizzes per semester), mid-term score, final score, and total score.

15. Given two text files “f1.txt” and “f2.txt”, in which each line is a series of numbers separated by “:”, and assuming that the lines are in ascending order by the first number, make a function to read both files line by line writing in the file “f3.txt” the common lines, like in the following example:

F1.txt	F2.txt	F3.txt
10:4543:23	10:334:110	10:4543:23:334:110
15:1:234:67	12:222:222	15:1:234:67: 12:222:222

17:188:22	15:881:44	17:188:22: 15:881:44
20:111:22	20:454:313	20:111:22:454:313

16. Write a C++ program to create a class called ‘PhoneBook’ which consists of name, std_code and phone_number as data members. Perform the following functions.

- Get input for the PhoneBook object by overloading the operator >>
- Display the PhoneBook object by overloading the operator <<

Mini Project:

Design and build the following applications using C++

- Bike Race Game (using SDL)
- Banking Record System
- Bookshop Management System
- Bus Reservation System
- Hotel Management System
- Payroll Management System
- Phonebook Management System
- Fortune Teller (Predict Future)
- Helicopter Game (using SDL)
- Airlines Reservation System

19CS39C COMMUNICATION SKILLS LABORATORY
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: listen and respond effectively to interact at different situations fluently (K2)
CO2: excel appropriately in professional contexts.(K3)
CO3: acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3)

UNIT I

Lab session: Listening and responding to audio files

Practice session: Mini Presentation related to Business English & Picture description.

UNIT II

Lab session: Role Play – News Reader

Practice session: Resume Preparation

UNIT III

Lab session: Listening to audio files related to soft skills.

Practice session: Practicing Power point presentation, Group discussion.

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Dutt P. Kiranmai and Rajeevan Geeta, “Basic Communication Skills”, Foundation Books, 2013.
2. Comfort, Jeremy, et al. “Speaking Effectively, Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge: Reprint, 2011.
3. Rizvi.M.Ashraf, “Effective Technical Communication”, The MC Graw Hill Education Private Limited, 2010.

19CS41C STATISTICS AND NUMERICAL METHODS

L	T	P	C	QP
3	1	0	4	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Calculate the various measures of dispersion.(K3)
CO2: Apply the concept of testing of hypothesis for small and large samples (K3)
CO3: Apply the basic concepts of classifications of design of experiments (K3)
CO4: Use numerical techniques to interpolate, solve algebraic equation, differentiation and integration. (K3)
CO5: Solve differential equations using numerical methods. (K3)

UNIT I STATISTICS 12

Central tendencies - Mean, median, mode - Measures of Dispersion –Mean deviation, and Quartile deviation–Moments– Skewness –Kurtosis - Correlation and Regression.

UNIT II TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table for independent of attributes – Goodness of fit.

UNIT III DESIGN OF EXPERIMENTS 12

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT IV NUMERICAL SOLUTION OF EQUATIONS, NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Solution of Algebraic and transcendental linear equations - Newton - Raphson Method- Solution of simultaneous equations – Gauss Elimination method – Gauss Seidel method – Interpolation – Newton’s forward and backward formulae - Numerical Differentiation – Newton’s forward difference and backward difference formula – Numerical integration - Single and double integration using Trapezoidal and Simpson’s rules.

UNIT V NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS 12

Taylor’s Series Method - Euler’s Method – Runge Kutta fourth order Method – Predictor - corrector Methods - Milne’s Method - Solution of one dimensional heat equation by explicit and implicit methods - Two dimensional Laplace and Poisson equations – Liebman’s Iteration Process

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Richard A. Johnson, Irwin Miller, John Freund, “Miller & Freund's Probability and Statistics for Engineers,” 9th Edition, Pearson Education Limited, Global Edition, 2017. (unit 1& 2).
2. Grewal, B.S., “Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB”, 10th Edition, Khanna Publishers, New Delhi, 2014.(unit 3,4,5)

REFERENCES

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, “Probability and Statistics for Engineers and Scientists”, Pearson Education, Asia, 9th Edition, 2016.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, “Schaum’s Outlines Probability and Statistics”, Tata McGraw Hill Edition, 2017.
3. Chapra, S. C and Canale, R. P. “Numerical Methods for Engineers”, 7th Edition, Tata McGraw - Hill, New Delhi, 2016.
4. Gerald, C. F. and Wheatley, P. O., “Applied Numerical Analysis”, 7th Edition, Pearson Education Asia, New Delhi, 2007.

19CS42C DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C	QP
3	1	0	4	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand and apply algorithm analysis techniques to solve real time problems. (K4)
CO2: Understand and apply divide-and-conquer and greedy technique to solve a given problem. (K4)
CO3: Solve the combinatorial problem using dynamic programming techniques. (K3)
CO4: Demonstrate backtracking and branch & bound algorithms. (K4)
CO5: Understand and solve problems using approximation and randomization algorithmic techniques. (K3)

UNIT I INTRODUCTION 12

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Recurrence equations –Solving recurrence equations: Substitution method, Recursion tree method and Masters’ theorem.

UNIT II DIVIDE-AND-CONQUER AND GREEDY TECHNIQUE 12

Divide and conquer methodology – Merge sort – Binary search – Multiplication of Large Integers – Stassen’s Matrix Multiplication - Greedy Technique – Container loading problem – Prim’s algorithm and Kruskal’s Algorithm – Knapsack problem – Huffman Trees.

UNIT III DYNAMIC PROGRAMMING 12

Dynamic Programming: Principle of optimality – Coin changing problem - Computing a Binomial Coefficient – Warshall and Floyd’s algorithm - Multistage Graphs – Knapsack Problem and Memory functions.

UNIT IV BACKTRACKING AND BRANCH AND BOUND 12

Backtracking: n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem - Graph coloring – Branch and Bound: Knapsack Problem – Traveling Salesman Problem.

UNIT V APPROXIMATION ALGORITHMS 12

Approximation Algorithms - Travelling Salesman problem – Knapsack problem – Set cover, Vertex cover - Bin packing - Introduction to NP-Hard and NP-Completeness

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2017. (UNIT I to UNIT IV)
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms / C++", 2nd Edition, Universities Press, 2008. (UNIT I to UNIT V)
3. Vijay V. Vazirani, "Approximation Algorithms", Springer, 1st Edition, 2003. (UNIT-V)

REFERENCES

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2010.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D.Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.

19CS43C OPERATING SYSTEMS

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: acquire knowledge on basic working principles of operating systems. (K2)
CO2: realize the mechanisms of OS involved in process scheduling and synchronization. (K2)
CO3: detect deadlock and apply the solutions for handling deadlocks. (K3)
CO4: acquire knowledge on mechanisms of memory management. (K2)
CO5: apply file management and I/O management techniques. (K3)

UNIT I INTRODUCTION 9

Concept of operating systems - Types of operating system - structure of OS – operations of OS - system calls and its types – system programs – Processes : Concept – Process scheduling – operations on processes – Threads : concept – multithreading models - Inter process communication – Processes and threads in Linux os

UNIT II PROCESS SCHEDULING 9

CPU Scheduling – basic concepts – scheduling criteria – Preemptive and non preemptive scheduling algorithms: FCFS, SJF, Priority, Round Robin – scheduling in Real Time Operating System (RTOS) – Rate Monotonic (RM) scheduling algorithm – Least Laxity First (LLF) scheduling algorithm - case study of process scheduling on linux os.

UNIT III SYNCHRONIZATION AND DEADLOCK 9

Process Synchronization – The Critical – Section problem – Peterson's solution – Mutex locks – Semaphores – Classic problems of synchronization – monitors. Deadlock: System model – deadlock characterization – Methods for handling deadlock – deadlock prevention – deadlock avoidance – banker's algorithm – deadlock detection – recovery from deadlock.

UNIT IV STORAGE MANAGEMENT 9

Memory management – Background – Swapping – Contiguous memory allocation – Segmentation – Paging – Segmentation with paging - Virtual memory: Background – Demand paging – page replacement – algorithms: FIFO, LRU, Optimal-allocation of frames – thrashing.

UNIT V FILE SYSTEMS AND DISK SCHEDULING 9

File concept – Access methods – directory and disk structure – file system mounting – protection – File system implementation: Directory implementation – Allocation methods – Free space management. Disk scheduling – Algorithms: FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK – disk management.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", Enhanced eText, 10th Edition , Wiley Asia Student Edition, 2018.

REFERENCES

1. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Prentice Hall of India, 2018.
2. Daniel P. Bovet, Marco Cesati, O'Reilly and Associates, "Understanding the Linux Kernel", 3rd Edition, 2005.
3. Rajib Mall, "Real - Time Systems: Theory and Practice", Pearson Education India, 2009

19CS44C	DATABASE MANAGEMENT SYSTEMS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: apply the SQL concepts and operations in a relational database design (K3)
CO2: apply the Sub-Queries and Join concept in relational database design (K3)
CO3: illustrate the use of T-SQL and stored procedures in real time scenarios (K3)
CO4: demonstrate the normalization design concept for effective query processing.(K3)
CO5: acquire knowledge about No-SQL databases in emerging applications (K3)

UNIT I RELATIONAL DATABASES 9

Introduction to Database System -–Views of data –Database System Architecture – ER Models – Enhanced-ER Model - Relational Model- ER-to-Relational Mapping - SQL : SQL Syntax – Data types – Operators - SQL Keys - DDL Statements - DML Statements- SQL Aliases – Operators - SQL Aggregate Functions

UNIT II ADVANCED QUERY STRUCTURES 9

SQL Clauses - Group By – Having - Sub Query – Nested Sub Query –Data Control Language -Null Functions –Indexes - Sequences – Clone tables – SQL Joins – Basics - Types: Self Join -Inner Join - Outer Join - Left Join – Right Join-Full outer Join – views - SQL Injections

UNIT III T-SQL AND STORED PROCEDURES 9

T-SQL: Scripts and Batches Declaring Variables - Using Statements - Error Handling - Global Variables Using Dynamic SQL - Stored Procedures : PL/SQL Functionalities - Control statements –Functions –Triggers – ODBC/JDBC connectivity – ODBC/JDBC Implementation - Case Study: Banking / University database system.

UNIT IV NORMALIZATION AND TRANSACTION MANAGEMENT 9

Functional Dependencies –Non loss Decomposition–Normalization: First, Second, Third Normal Forms, Dependency Preservation –Boyce/Codd Normal Form – Transaction: Basic Concepts -Transaction Recovery –ACID Properties - Concurrency - Deadlock - RAID - B+ Tree Indexing.

UNIT V NO-SQL DATABASES 9

Introduction - Four types of No-SQL databases : Document-oriented, KeyValue Pairs, Column-oriented and Graph - CRUD Operations - MongoDB, Cassandra, HBASE, Neo4j use and deployment - Use Cases: Event Logging - Content Management Systems - Ecommerce Applications.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S.Sudharshan, “Database System Concepts”, Tata McGraw Hill, 6th Edition, 2013.
2. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Pearson Education, 8th Edition, 2012.
3. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition, 2016.

REFERENCES

1. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Pearson Education, 5th Edition, 2009.
2. Shashank Tiwari, "Professional NoSQL", John Wiley and Sons, 2011.
3. Peter Membrey, “MongoDB Basics”, Apress; 1st Edition, 2014.
4. https://docs.microsoft.com/en-us/sql/?view=sql-server-ver15.
5. https://www.w3schools.com
6. https://www.geeksforgeeks.org

19CS45C COMPUTER NETWORKS

L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO 1: Understand the division of network functionalities into layers. (K2)
- CO 2: Enumerate different medium access control mechanisms.(K2)
- CO 3: Apply various flow, congestion and routing algorithms for a network and determine the optimal path. (K3)
- CO 4: Integrate the working of protocols in higher level layers. (K3)

UNIT I INTRODUCTION 9

Data Communications- Networks – Networks Type – Protocol Layering – TCP/IP Suite – OSI Model - Transmission medium – Switching Networks – Bridges.

UNIT II DATA LINK LAYER 9

Introduction – Link Layer Addressing – Error Detection and Correction – Block Coding – Cyclic Codes – Checksum –Data Link Layer Protocols: HDLC& PPP – Media Access Control - Wired LANs – Wireless LAN – IEEE 802.11 – Bluetooth.

UNIT III NETWORK LAYER 9

Introduction - IPV4 & IPv6 Addresses – Address Mapping - ARP, RARP, and DHCP - Unicast Routing Protocols –Multicast Routing Protocols.

UNIT IV TRANSPORT LAYER 9

Introduction - Transmission Control Protocol: Connections – Flow control - Error Control - Congestion control - Congestion avoidance-User Datagram Protocol: Datagram - Services- Applications.

UNIT V APPLICATION LAYER 9

Traditional applications: DNS-E-Mail (SMTP, MIME, POP3, IMAP, Web Mail) - FTP- HTTP – SNMP - Cryptography Techniques.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers, 2011.
2. Behrouz A. Forouzan, “Data Communication and Networking”, 5th Edition, Tata McGraw- Hill, 2013.

REFERENCES

1. William Stallings, “Data and Computer Communications”, 10th Edition, Pearson Education, 2017.
2. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.
3. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, 5th Edition, Prentice Hall 2010.

4. James F Kurose, Keith W Ross, "Computer Networking -A Top-Down Approach Featuring the Internet", Pearson Education, New Delhi, 6th Edition, 2012.

19CS46C	**FINANCE AND ACCOUNTING**	**L T P C QP**
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Explain the basic concepts and process of accounting and finance. (K2)
CO 2: Describe the financial status of an organization. (K2)
CO 3: Identify the concepts and operations of CVP analysis for decision making. (K3)
CO 4: Apply techniques like budgetary control and capital budgeting for planning and Controlling in an organization. (K3)
CO 5: Explain the application of accounting software. (K2)

UNIT I INTRODUCTION TO ACCOUNTING 9

Introduction and Definition - Accounting concepts and conventions - Final Accounts - Preparation of Trading, Profit and Loss Account and Balance Sheet.

UNIT II ANALYSIS AND INTERPRETATION OF FINANCIAL STATEMENTS 9

Meaning and importance - Comparative statement, Common size statement - Trend analysis and accounting ratios - latest trend in presenting financial data.

UNIT III ACCOUNTING FOR DECISION MAKING 9

CVP Analysis - Relevant Costs and Revenue for Decision Making - Pricing Decisions - Operational Decisions - Exploring New markets - Make or buy decisions.

UNIT IV ACCOUNTING FOR PLANNING AND CONTROLLING 9

Budgets, Budgetary Control – Meaning – Importance and applications - Capital budgeting - Meaning – Importance - steps in capital budgeting - Information needed - Methods of evaluating capital budgeting decisions.

UNIT V COMPUTERIZED ACCOUNTING SYSTEM 9

Meaning - Concept - Comparison between Manual and Computerized Accounting - Sourcing of Accounting Software - Accounting Packages.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. V.K.Gupta, R.L.Gupta, “Financial Accounting”, 3rd Edition, S.Chand, New Delhi, 2016.
2. Dr.V.R.Palanivelu, “Accounting for Management”, 3rd Edition, University science press New Delhi, 2013.
3. Manoj Bansal, Ajay Sharma, “Computerized Accounting System”, 1st Edition, Sahitya Bhawan Publications, Agra, 2019.

REFERENCES

1. S.N.Maheshwari, Suneel K.Maheshwari, Sharad K.Maheshwar, "Financial Accounting", Second Edition, Vikas Publishing House, 2018.
2. Peter Atrill, Eddie McLaney "Financial Accounting for Decision Makers", Seventh Edition, Pearson Education, 2013.
3. Dr.Alok Dwivedi, Prof.C.M.Tembhurnekar, "Computerized Accounting", First Edition, Sai Jyoti Pulication, Nagpur, 2016.

19CS47C OPERATING SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: identify the system calls to display the system information. (K2)
CO2: evaluate the process scheduling algorithms FCFS, SJF, Priority and Round robin.(K3)
CO3: simulate the process communication through various techniques (K2)
CO4: simulate memory management schemes (K2)
CO5: implement file allocation techniques (K3)

LIST OF EXPERIMENTS

1. Study and practice of basic commands, editors, shell programming in Linux Operating System.
2. Implementation of System calls in UNIX operating Systems
3. Execution of I/O system calls in Unix operating System
4. Execution of system Information in UNIX operating System
5. Implementation of CPU scheduling algorithms : i) FCFS ii) SJF iii) Priority iv) Round Robin
6. Implementation of producer-consumer problem using semaphores
7. Implementation of memory allocation techniques
8. Simulate bankers algorithm for the purpose of deadlock avoidance.
9. Simulate page replacement algorithms (FIFO, LRU and Optimal Strategies).
10. Simulate memory management schemes: paging and segmentation.
11. Simulate file allocation techniques (Linked, Indexed or Contiguous).
12. Implement any one client server applications using inter process communication, multithreading, synchronization and generate report.

P: 45; TOTAL: 45 PERIODS

SOFTWARE REQUIREMENTS

Linux: Ubuntu / OpenSUSE / Fedora / Red Hat

Sample Question Bank (Exercises not limited to this)

1. Implement the C program to create a new process and display its id using appropriate system call
2. Implement the C Program to get and set environment variables using appropriate system calls
3. Write a C Program to get the attribute of a file or directory on Linux using system calls
4. Implement the C Program to Display process information using process related system calls

5. Write a C program to display the files in the given directory
6. Implement the a C program to simulate the system call that blocks the calling process until one of its child processes exist or a signal is executed
7. Implement the C program SystemInfo.c that will read the /proc file system and print out the following (with an appropriate message in each case):
    a) The number of CPUs in your machine and their clock speed (note that different cores are counted as different CPUs)
    b) The version of Linux kernel running on your system
    c) The time in day:hr:min:sec when the system was last booted
    d) The average load on the system in the last 5 minutes
    e) The total usable and currently free memory in the system
    f) The swap partitions and their sizes
    g) The time did the CPU spend (over all processes) in the user mode, kernel mode, and in servicing interrupts.
    h) The number of context switches made by the system so far.
8. Consider three processes (process id 0, 1, 2 respectively) with compute time burst 2,4 and 8 time units. All processes arrive at time zero. Compute and print the waiting time and turnaround times of all the given processes and also print the average waiting time and turnaround time of this scheduling algorithm. Execute the program and record the observations.
9. Write a C program ProcessInfo.c that gets the following information specific to a process. The program takes the pid of the process as a command line argument.
    a) The command line with which the process was started
    b) The time spent by the process in running and in waiting
    c) The time spent by the process in the user mode, kernel mode, and in servicing interrupts
    d) Can you print out the contents of the address space of the process?
10. Implement two-process communication through Echo server application using pipes.
11. Write a multi-process message-passing utility. The messages are stored in a shared memory segment. A static library is created which provides a set of functions to send / receive messages; every user process links with this library and uses these functions for passing messages to other processes. Every access (read or write) to this shared-memory segment is to be guarded by semaphores to effect mutual exclusion. Named processes can transfer messages among each other using this interface.

    Data Structures: A message consists of the following fields:
    a. A sender name (a string of maximum length 10)
    b. A recipient name (a string of maximum length 10)
    c. A sending time (in whatever format you would like to store)
    d. A text message (a string of maximum length 100)
    e. A registered process consists of the following two fields:
        - A name (a string of maximum length 10)
        - A process ID

12. Implement the FCFS and Round Robin scheduling algorithm (quantum of 2 time units) for the given scenario. Consider the 3 processes, P1, P2 and P3 shown in the table. Compute and print the average waiting time and average turnaround time

Process	Arrival time	Time Units Required
P1	0	5

P2	1	7
P3	3	4

13. Implement the pre-emptive shortest job first scheduling algorithm for the given scenario. Consider the following table of arrival time and burst time for three processes P0, P1 and P2.compute and print the average waiting time and average turnaround time

Process	Arrival time	Burst Time
P0	0 ms	9 ms
P1	1 ms	4 ms
P2	2 ms	9 ms

14. Implement the First come First served (FCFS), Non Preemptive Shortest Job First (SJF), Round Robin (RR) (quantum=10ms) for the given scenario. Consider the following five processes, with the length of the CPU burst time given in milliseconds, Process p1 burst time 10, Process p2 burst time 29, Burst time Process p3 burst time 3, Process p4 burst time 7, and Process p5 burst time 12. compute and print the average waiting time and average turnaround time

15. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.(2 sessions)

16. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 Sessions).

17. Implement Producer-Consumer problem using semaphores. Let the producer have bounded buffer for storing the produced data. Design a suitable consumer to utilize the data which is produced by the consumer. The producer can produce only when the buffer is having space for accommodation and the consumer can consume only when the buffer has data items in it.

18. Develop a mini project for any one application using producer consumer concepts.

19. Implement the banker's algorithm for Deadlock Avoidance for the given scenario. Let n be the number of processes in the system and m be the number of resource types to be allocated

Available system resources:

Resource types	A	B	C	D
Instances	3	0	1	2

Processes (currently allocated resources):

Processes	**Resource Types**			
	A	**B**	**C**	**D**
P1	1	2	2	1
P2	1	1	3	3
P3	1	2	1	0

Processes (maximum resources):

Processes	**Resource Types**			
	A	**B**	**C**	**D**
P1	3	3	2	2
P2	1	2	3	4
P3	1	3	5	0

20. Implement the banker's algorithm for Deadlock Avoidance for the given scenario. Consider there are 5 processes P1, P2, P3, P4 and P5 and four resources ABCD. A has 6 instances, B has 3 instances, C has 4 instances and D has 2 instances.

Process	Allocation	Max	Available
	ABCD	ABCD	ABCD
P1	3011	4111	1020
P2	0100	0212	
P3	1110	4210	
P4	1101	1101	
P5	0000	2110	

i) Is the current state safe? If yes then find the safe sequence.
ii) If P5 requests for (1, 0, 1, 0), can this be granted?

21. Simulate a memory allocation policy using C or OS simulator. The requirements of this simulated system is given, which is needed to be used for the simulation task. At one large batch processing computer installation the management wants to decide what storage placement strategy will yield the best possible performance. The installation runs a large real storage computer under fixed partition multiprogramming. Each user program runs in a single group of contiguous storage locations. Users state their storage requirements and time units for CPU usage on their job control card. The operating system allocates to each user the appropriate partition and starts up the user‘s jobs. The jobs remain in memory until completion. A total of 50,000 memory locations are available, divided into block. An instance of the scene is indicated in the below table.

Job list			Memory list	
Job stream number	**Time**	**Job Size**	**Memory Block**	**Size**
1	5	5760	1	9500
2	4	4190	2	7000
3	8	3290	3	4500
4	2	2030	4	8500
5	2	2550	5	3000

Design suitable User interface to get the required data and present the simulated result in a pleasant form of your choice

22. Simulate and Compare page replacement algorithms using OS simulator. Consider the following page reference string A,B,C,D,B,A,E,F,A,B,C,G,F,C,F. How many page faults would occur for the following page replacement algorithm assuming three and four frames? Remember all frames are initially empty:
    i) FIFO ii) Optimal iii) LRU

23. Simulate and Compare page replacement algorithms using OS simulator. Consider the following reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with four free frames which are empty initially. Which algorithm gives the minimum number of page faults?

24. Design and build the following client server applications using inter process communication, multithreading, synchronization and generate report.
    - Tollgate monitoring system
    - Hotel Management System
    - Bank ATM system
    - Inventory management System
    - Coffee Vending machine
    - Ticket Reservation System
    - Digital Library System

19CS48C DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C

0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: generate the query using SQL commands. (K3)
CO 2: develop PL/SQL programs to enhance the database activities using stored procedures, stored functions and triggers. (K3)
CO 3: design and build No-SQL applications using Mongo-DB and Cassandra. (K3)

LIST OF EXPERIMENTS

1. Database creation and use of DDL commands.
2. Perform DML commands.

3. Implement DCL/TCL commands.
4. Perform database operations using advanced queries like ORDER BY and GROUP BY.
5. Demonstrate all types of join operations for the given database schema.
6. Design all the appropriate normal forms for the given database schema.
7. Write a PL/SQL block to satisfy some constraints.
8. Create procedures in PL/SQL block.
9. Implement triggers in PL/SQL block.
10. Design a NoSQL database.

SOFTWARE REQUIREMENTS

- Software tools: Oracle, MySQL, ERD plus
- GUI development: Python IDLE / JAVA/Visual C++

P: 45; TOTAL: 45 PERIODS

Sample Question Bank (Exercises not limited to this)

1. Build the following database schemas and perform the manipulation operations on these schema using SQL DDL,DML,TCL and DCL commands.

I. Database Schema for a customer-sale scenario

Customer(**Cust id : integer**, cust_name: string)
Item(**item_id: integer**, item_name: string, price: integer)
Sale(**bill_no: integer**, bill_date: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following:-

a) Neatly sketch schema diagram and identify join relationship among tables.
b) Create the tables with the appropriate integrity constraint Insert around 10 records in each of the tables
c) List all the bills for the current date with the customer names and item numbers
d) List the total Bill details with the quantity sold, price of the item and the final amount
e) List the details of the customer who have bought a product which has a price>200
f) Give a count of how many products have been bought by each customer
g) Give a list of products bought by a customer having cust_id as 5
h) List the item details which are sold as of today
i) Create a view which lists out the bill_no, bill_date, cust_id, item_id,price, qty_sold, amount
j) Create a view which lists the daily sales date wise for the last one week
k) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema.

II. Database Schema for a Student Library scenario

Student(**Stud_no : integer**, Stud_name: string)
Membership(**Mem_no: integer**, Stud_no: integer)
Book(**book_no: integer**, book_name:string, author: string)
Iss_rec(**iss_no:integer**, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following:-

a) Neatly sketch schema diagram and identify join relationship among tables.
b) Create the tables with the appropriate integrity constraints
c) Insert around 10 records in each of the tables
d) List all the student names with their membership numbers
e) List all the issues for the current date with student and Book names

f) List the details of students who borrowed book whose author is CJDATE
g) Give a count of how many books have been bought by each student
h) Give a list of books taken by student with stud_no as 5
i) List the book details which are issued as of today
j) Create a view which lists out the iss_no, iss _date, stud_name, book name
k) Create a view which lists the daily issues-date wise for the last one week
l) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema

III. Database Schema for a Employee-pay scenario

employee(**emp_id : integer**, emp_name: string)
department(**dept_id: integer**, dept_name:string)
paydetails(emp_id : integer, dept_id: integer, basic: integer, deductions:integer, additions: integer, DOJ: date)
payroll(emp_id : integer, pay_date: date)

For the above schema, perform the following:-

a) Neatly sketch schema diagram and identify join relationship among tables.
b) Create the tables with the appropriate integrity constraints
c) Insert around 10 records in each of the tables
d) List the employee details department wise
e) List all the employee names who joined after particular date
f) List the details of employees whose basic salary is between 10,000 and 20,000
g) Give a count of how many employees are working in each department
h) Give a names of the employees whose netsalary>10,000
i) List the details for an employee_id=5
j) Create a view which lists out the emp_name, department, basic, deductions, netsalary
k) Create a view which lists the emp_name and his netsalary
l) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema.

IV. Database Schema for a Video Library scenario

Customer(**cust_no: integer**,cust_name: string)
Membership(**Mem_no: integer**, cust_no: integer)
Cassette(**cass_no:integer**, cass_name:string, Language: String)
Iss_rec(**iss_no: integer**, iss_date: date, mem_no: integer, cass_no: integer)

For the above schema, perform the following:-

a) Neatly sketch schema diagram and identify join relationship among tables.
b) Create the tables with the appropriate integrity constraints
c) Insert around 10 records in each of the tables
d) List all the customer names with their membership numbers
e) List all the issues for the current date with the customer names and cassette names
f) List the details of the customer who has borrowed the cassette whose title is “The Legend”
g) Give a count of how many cassettes have been borrowed by each customer
h) Give a list of book which has been taken by the student with mem_no as 5
i) List the cassettes issues for today
j) Create a view which lists outs the iss_no, iss_date, cust_name,cass_name
k) Create a view which lists issues-date wise for the last one week
l) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema.

2. Draw the Entity-Relationship (ER) model for the following Schema using ERDplus software. Identify the entities, attributes and relationship exists between the entities in the schema. Clearly indicate the cardinality mappings as well as any role indicators in your ER diagram.

I) Database Schema for a customer-sale scenario
Customer(**Cust id : integer**, cust_name: string)
Item(**item_id: integer**, item_name: string, price: integer)
Sale(**bill_no: integer**, bill_date: date, cust_id: integer, item_id: integer, qty_sold: integer)

II) Database Schema for a Student Library scenario
Student(**Stud_no : integer**, Stud_name: string)
Membership(**Mem_no: integer**, Stud_no: integer)
Book(**book_no: integer**, book_name:string, author: string)
Iss_rec(**iss_no:integer**, iss_date: date, Mem_no: integer, book_no: integer)

III) Database Schema for a Employee-pay scenario
employee(**emp_id : integer**, emp_name: string)
department(**dept_id: integer**, dept_name:string)
paydetails(emp_id : integer, dept_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)
payroll(emp_id : integer, pay_date: date)

IV) Database Schema for a Video Library scenario
Customer(**cust_no: integer**,cust_name: string)
Membership(**Mem_no: integer**, cust_no: integer)
Cassette(**cass_no:integer**, cass_name:string, Language: String)
Iss_rec(**iss_no: integer**, iss_date: date, mem_no: integer, cass_no: integer)

3. Demonstrate all types of join operations for the database schema for the exercise1 (I-IV)
   a. Inner Join b. Left outer join c. Right outer join d. Full outer join

4. Demonstrate the concept of database connectivity with front end for the following application

   (a) Make a SQL data base of student details and collaborate it with student semester performance and display each student performance individually.
   (b) Develop a Library management system, where indexing of book according to the author or alphabetical order can be done. Issuing of books to the student can be managed and searching of books.

5. Develop the PL/SQL programs based on the given constraints.
   (a) Create a cursor, which displays list of products bought by a customer having cust_id as 5.
   (b) Create a cursor, which displays names of employees whose basic salary is between 10,000 and 20,000.

6. Develop the PL/SQL programs to demonstrate the concept of procedure.
   (a) Create a procedure to update the salaries of all employees 20% in their basic pay.
   (b) Create a procedure to demonstrate IN, OUT and INOUT parameters.

7. Develop the PL/SQL programs to demonstrate the concept of functions.

(a) Create a function to find sum of salaries of all employees working in department id 10.

8. Construct a PL/SQL program to retrieve customer name whose customer_id as 101 using %type and %rowtype attributes.

9. Create a Trigger which comes into action when updating is performed onto the Employee table. The new action triggered is: Insertion of a row into the Employee History table which has all information in Employee table in addition to the date and time when the salary was updated in the original Employee table.

10. Create a Trigger which comes into action when deletion is performed onto the Employee table. The new action triggered is: Insertion of a row into the Employee Resigned table which has all information in Employee table in addition to the date and time when the Employee was relieved from duty officially effecting the removal of his/her information from the Employee table.

11. Create a Trigger which comes into action when insertion is performed onto the Employee table. The new action triggered is: Computation and Display of age of the new employee after the addition of new employee information into the Employee table.

12. Create a database and collection using MongoDB environment. For example a document collection meant for analyzing Restaurant records can have fields like restaurant_id, restaurant_name, customer_name, locality, date, cuisine, grade, comments. etc. Create database using INSERT, UPDATE, UPSERTS, DELETE and INDEX. Practice writing simple MongoDB queries such as displaying all the records, display selected records with conditions

13. Create database in Casandra using – Create, Alter and Drop. Add records using Inset, Update, Delete and Truncate, Select records with specific conditions

Miniproject:

Design and build the following applications using SQL and front end tool and generate report

1. Student information system for your college.
2. Hospital Management System.
3. A video library management system.
4. Inventory management system for a hardware / sanitary item shop.
5. Banking System.
6. Railway Reservation System
7. Car Insurance Company

19CS49C	**NETWORKS LABORATORY**	**L T P C**
		0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: describe the basic concept of computer networks and analyze the functionalities of the OSI model. (K2)

CO 2: implement the various services of the data link layer. (K2)

CO 3: instruct to design, troubleshooting, modeling and evaluation of computer networks commands and Protocols. (K2)

CO 4: design cryptographic algorithms for avoiding basic level threats.(K2)
CO 5: implement the working protocols of the higher level layer. (K3)

LIST OF EXPERIMENTS:

1. Simulate the open system interconnection (OSI Layer model) model.
2. Configure a Network topology using network simulator.
3. Study of network devices and different types of network cables. Practically implement LAN using the cross-wired cable and straight through cable and clamping tool.
4. Implementation of Error Detection / Error Correction Techniques.
5. Design and develop a program for ARP and RARP protocols.
6. Simulation of TCP & UDP Performance using Simulation Tool.
7. Implement the Unicast routing protocol for finding the shortest path in a network.
8. Design and implement the conventional cryptographic algorithm (encryption and decryption) for secure communication.
9. Implement Chat application.

HARDWARE & SOFTWARE REQUIREMENTS

1. Hardware Requirements: RJ-45 connector, Clamping Tool, Twisted Pair Cable.
2. Software Requirements:
   - Command Prompt and Simulation Tools
   - Turbo C++/ C /JAVA
   - OS – LINUX/ UNIX/Windows 2008/ Windows XP/ NT

P: 45; TOTAL: 45 PERIODS

Sample Question Bank (Exercises not limited to this)

1. Simulate the open system interconnection (OSI Layer model) model that transmits a message from sender to receiver through different layers. At sender side, adds the appropriate header and trailer and receiver side removes the same.
2. Configure a Network topology using network simulator : Star ,Ring, Bus etc.
3. Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whois etc,.
4. Study of network devices and different types of network cables. Practically implement LAN using the cross-wired cable and straight through cable and clamping tool.
5. Implementation of the data link farming methods: Bit stuffing in a frame & Parity checking.
6. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
   Implementation and study of Goback-N and selective repeat protocols
7. Implement the Distance Vector Routing protocol for finding the shortest path.
   Implement the Link state Routing protocol for finding the shortest path.
8. Alice and Bob want to communicate each other securely. Design the various encryption and decryption algorithm for their secure communication using following techniques ,
   a. c = E (k, p) = (p + k) mod (26) & p = D (k, c) = (c – k) mod (26).
   b. Transposition the message using some keyword.
9. a. Applications using TCP sockets like:
   Echo client and echo server , DNS ,SNMP & File Transfer

b. Simulation of DNS using UDP sockets.

10 Implementation of concurrent chat server that allows current logged in users to communicate one with other.

11 Write a program to connect the server with the client and passes information from one system to another and vice versa that by creating / establishing a connection.

19CS51C	**JAVA PROGRAMMING**	**L**	**T**	**P**	**C**	**QP**
		3	**1**	**0**	**4**	**A**

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: apply object oriented concepts to solve real world problems (K3)
CO 2: explore java I/O streams and compute various strings handling methods (K3)
CO 3: develop effective applications using collection framework (K3)
CO 4: create user interfaces using Swing concepts (K3)
CO 5: build real time applications with JDBC and Struts (K3)

UNIT I JAVA BASICS 12

OOPS Concepts-Java Programming Constructs - Objects and Classes - Methods - Constructors -Access Specifiers - Data Types – Variables – Operators - Control Statements – Arrays - Inheritance – Method Overloading and Overriding - Abstract Class – Interfaces– Packages – Access Modifiers

UNIT II STRINGS, I/O AND FILE OPERATIONS 12

Strings – String methods – String Comparison – StringBuilder vs StringBuffer – Exception Handling – I/O Stream – Buffered Reader/Writer –FileInputStream – FileOutputStream – Threads : Life Cycle – Creating Thread Using Thread Class and Runnable Interface – Thread Priorities – Shutdown Hook –Suspending, Resuming and Stopping of Threads-Multi Threading

UNIT III COLLECTION FRAMEWORK 12

Collection framework – Collection Class: ArrayList, HashMap, Set, LinkedList –Iterating Collection –Collection Interface: List, Map- Collections class – iterating a collection – Filter – Optional Class – Map operations – Flatmap operations –Regular Expression - sorting a collection using Comparable and Comparator Interface – Aggregation operations – min, max operations

UNIT IV SWING FRAMEWORK 12

UI Controls (JLabel, JButton, JTextField, JPasswordField, JCheckBox, JRadioButton, JComboBox, JSpinner,JTable, JList, JOptionePane, JScrollBar, JMenuItem&JMenu, JProgressBar, JTabbedPane, JPanel, JScrollPane, JFrame) – Event Handling – ToolTip.

UNIT V JDBC 12

JDBC Architecture – CRUD Operations using console application – CRUD Operations using Java Desktop Application– Struts: Introduction to Struts-Architecture Configuration-Actions-Interceptors-Result Type.

L: 30; P: 30; TOTAL: 60 PERIODS

TEXT BOOKS

1. Anita Seth, B.L.Juneja, “JAVA one step ahead”, Oxford University Press Publication, 2nd Edition, 2018.
2. Deitel H M and Deitel P I, “Java - How to Program”, Pearson Education, New Delhi, 11th Edition, 2017.

REFERENCES

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, 2018.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume - I Fundamentals”, Prentice Hall, 10th Edition, 2016.
3. Hortsmann & Cornell, “CORE JAVA 2 Advanced Features – VOL-II”, Pearson Education, 10th Edition, 2017.
4. Sachin Malhotra and Saurabh Choudhary,” Programming in Java”, Oxford University press, 2nd Edition, 2018.
5. Chunk Cavaness, “Programming Jakarta Struts”, O’reilly media Publication, 2nd Edition, 2004.

19CS52C	**THEORY OF COMPUTATION**	**L T P C QP**
		3 1 0 4 A

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: prove the equivalence of regular expressions and finite automata. (K3)

CO2: acquire insights into the relationship among context free languages and context free grammars (K3)

CO3: construct and prove the equivalence of languages described by pushdown automata and context free grammars. (K3)

CO4: realize the concepts of turing machines and its construction methods. (K3)

CO5: recognize the concepts of undecidability and complexity theory. (K2)

UNIT I FINITE AUTOMATA 12

Introduction to Finite Automata (FA) – Basic notation and convention - Deterministic Finite Automata (DFA) – Nondeterministic Finite Automata (NFA) - Equivalence of NFA and DFA - NFA with ε moves – Equivalence of NFA’s with and without ε-moves – Regular Expression (RE) – Equivalence of FA and REs – DFA minimization - Regular Language (RL) - Closure properties of RLs - Pumping Lemma for Regular sets – Proving languages not to be regular.

UNIT II CONTEXT FREE GRAMMAR 12

Context Free Grammar (CFG) - Derivations and Languages – Parse tree - Relationship between derivation and derivation trees - Ambiguity in CFG - Simplification of CFG - Normal forms - Chomsky Normal Form (CNF) - Greibach Normal Form (GNF) – Problems related to CNF and GNF - Pumping lemma for Context Free Language (CFL) - Examples of non-CFLs

UNIT III PUSHDOWN AUTOMATA 12

Pushdown Automata (PDA) - Moves – Instantaneous descriptions –Acceptance by empty stack – Conversion from PDA to CFG – Conversion from CFG to PDA – Problems - Closure properties of CFL – Deterministic CFL.

UNIT IV TURING MACHINES 12

Turing Machines (TM) - Configuration – Models – Computable languages and functions – Programming techniques for turing machine construction – Non deterministic turing machine- Configuration graphs.

UNIT V UNDECIDABILITY 12

Undecidability - Recursive and recursively enumerable languages - Encoding of turing machine -Halting problem – Reduction - Application of Reduction - Rice's Theorem - Introduction to Computational Complexity theory – class P & NP - NP complete problems.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Peter Linz, "Introduction to Formal Languages and Automata", Jones & Bartlett Publisher, 6th Edition, 2016.
2. Michael Sipser, "Introduction to the Theory of Computation", Cengage Publisher, 3rd Edition, 2014.
3. S.Arora, B.Barak, "Computational Complexity: A Modern Approach", Cambridge University Press, 1st Edition, 2009.

REFERENCES

1. J. Martin, "Introduction to Languages and the Theory of computation", Tata McGraw Hill, 3rd Edition, 2009.
2. Kamala Krithivasan and R.Rama, "Introduction to Formal Languages, Automata Theory and Computation" Pearson, 1st Edition, 2009.
3. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3rd Edition, 2008.
4. Thomas A. Sudkamp, "An Introduction to the Theory of Computer Science, Languages and Machines", Pearson Education, 3rd Edition, 2007.

19CS53C PROFESSIONAL ETHICS AND HUMAN VALUES

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
CO2: Expose awareness on professional ethics. (K2)
CO3: Analyze the engineering ethical breach from past study. (K2)
CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)
CO5: Discuss about the global issues with regard to ethics. (K2)

UNIT I HUMAN VALUES 9

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike W Martin and Roland Schinzinger, “Ethics in Engineering”, 4th Edition, McGraw-Hill, New York 2017.
2. Govindarajan M, Natarajan S and Senthil Kumar VS, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2013.

REFERENCES

1. John R Boatright, “Ethics and the Conduct of Business”, 4th Edition, Pearson Education, New Delhi, 2017.
2. Charles D and Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2012.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, “Engineering Ethics - Concepts and Cases”, Fourth Edition, Wadsworth Thompson Learning, United States, 2005.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford 2001.

19CS54C	EMBEDDED SYSTEMS	L T P C QP
		3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the elements of Embedded System (K2)

CO2: Discuss the LPC2148 peripherals (K2)
CO3: Write simple interfacing program for LPC2148 peripherals (K2)
CO4: Understand the programming fundamentals of ARM programming (K2)
CO5: Write simple interfacing programs using python and Raspberry Pi (K2)

UNIT I INTRODUCTION TO EMBEDDED SYSTEM 9

Definition: Embedded system, Intelligent System, Expert system – software architecture, hardware Architecture; Embedded System design process–ARM Processor- CPU: Programming input and output-Supervisor mode, exception and traps Binary image creation from source file. Role of bootloader-significant of Device driver and Device tree

UNIT II ARM ARCHITECTURE VARIANTS – FUNCTIONAL BLOCK DIAGRAM OF LPC 2148 9

Functional Block diagram of internal peripherals: GPIO, UART, PWM, ADC, SPI-Bus Protocols: UART, I2C,SPI

UNIT III ARM PROGRAMMING USING C 9

Introduction to ARM programming environment - Interfacing program for LEDs and Switches - Serial IO interfacing (UART) – LCD interface - Motor Interfacing - Sensor Interfacing (Temperature, Pressure).

UNIT IV ARDUINO FUNDAMENTALS AND PROGRAMMING 9

Arduino IDE Overview-Operators in Arduino – Function Libraries – Control Statement – Loops – Arrays – String - Math library - Random Number – Interrupts – Integration of Sensors and Actuators with Arduino -sensor Interface with Arduino -Working model of Digital Humidity and Temperature Sensor – Basic Working Principle of Servo-Actuator – Case Study : Traffic Control System

UNIT V EMBEDDED SYSTEM PROGRAMMING USING PYTHON 9

Raspberry Pi Introduction - Raspberry Pi programming environment – Python Concepts: Arithmetic – flow control – loops. Lists- Strings – File handling – Functions – modules. Graphical programming – (GUI) – Simple Interfacing program

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark Siegesmund, “Embedded C Programming: Techniques and Applications of C and PIC MCUS”, An imprint from Elsevier, 1st Edition, 2014.
2. Charalampos Doukas, “Building Internet of Things with the Arduino (Volume 1)”, Create Space Independent Publishing Platform, 2015.
3. Alex Bradbury, Ben Everard, “Learning Python with Raspberry Pi”, John Wiley & Sons Ltd, 1st Edition, 2014.
4. Richard Blum Christine Bresnahan, “Python Programming for Raspberry Pi”, Sams Publishing, 2nd Edition, 2016.
5. www.arm.com- (LPC 2148 User manual)

19CS55C CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: identify common network security vulnerabilities and attacks (K2).
CO2: apply standard cryptographic algorithms to avoid basic level threats. (K3).
CO3: comprehend the issues involved in hash functions, authentication applications and key management (K2).
CO4: realize the importance of security practice and system security (K2).
CO5: acquire the knowledge of internet security protocols.(K2).

UNIT I INTRODUCTION AND CLASSICAL CRYPTOGRAPHY TECHNIQUES 9

Introduction: Security Trends - OSI security architecture – Principles of Security- Security Attacks- Security services Security mechanisms - **Classical Encryption Techniques:** Substitution Ciphers - Transposition Ciphers- Steganography.

UNIT II SYMMETRIC AND ASYMMETRIC KEY ALGORITHMS 9

Symmetric Key Algorithms: Stream and Block Ciphers - Data Encryption Standards (DES) Advanced Encryption Standard (AES)-RC4.

Asymmetric Key Algorithms: Rivest Shamir Adleman (RSA) algorithm - Elgamal Encryption Algorithm.

UNIT III HASH FUNCTION, KEY MANAGEMENT AND AUTHENTICATION APPLICATIONS 9

Hash functions: Message Digest 5(MD5) – Secure Hash Algorithm (SHA) - Digital signatures.**Key Management:** Distribution of Public Keys, Distribution of Secret Keys using Public-Key Cryptography -Diffie Hellman key Exchange.

Authentication Applications: Kerberos-X.509 certificates - Public key infrastructure.

UNIT IV NETWORK SECURITY 9

E-mail Security: Pretty Good Privacy-S/MIME. **IP Security:** IP Security Architecture - Authentication Header- Encapsulation Security Payload (ESP). IP Security Key Management**:** Oakley Key Determination Protocol-Internet Security Association and Key Management Protocol (ISAKMP).**System Security:** Firewalls: Firewall Characteristics - Types of Firewalls - Firewall Configurations.

UNIT V INTERNET SECURITY 9

Secure Socket Layer (SSL) - Transport Layer Security (TLS) - Secure Hypertext Transfer Protocol (SHTTP) - Time Stamping Protocol (TSP) – Wireless Application Protocol (WAP) Security.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. William Stallings," Cryptography and Network Security", Pearson Education, 7th Edition, 2017.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill Publishers, 3rd Edition, 2017.

REFERENCES

1. B.A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 3rd Edition, 2016.
2. William Stallings," Network Security Essentials: Applications and Standards", Pearson Education, 6th Edition, 2018.
3. Eric Maiwald," Fundamentals of Network Security", Tata McGraw Hill, 1st Edition, 2017.

19MC02C CONSTITUTION OF INDIA

L	T	P	C
3	0	0	0

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the salient features of the Indian Constitution. (K2)
CO2: discuss the structure and functions of parliament. (K2)
CO3: elaborate the structure and functions of state legislature. (K2)
CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
CO5: discuss the foreign policy of India. (K2)

UNIT I INDIAN CONSTITUTION 9

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM 9

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM 9

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT IV THE JUDICIARY 9

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS 9

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, “Introduction to the Constitution of India”, Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, “Our Constitution”, National Book Trust, New Delhi, 2010.
3. Shukla V N, “Constitution of India”, Eastern Book Company Ltd., New Delhi, 2011.

19CS56C	JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: implement object oriented programming features such as Inheritance, interfaces, Polymorphism and exception handling for different scenarios (K2)
CO2: design and develop GUI applications using AWT, Applet, Swing, collection frame work and facilitate appropriate event handling facilities. (K3)
CO3: design and develop web applications which communicate with database. (K3)

LIST OF EXPERIMENTS

1. Implementation of methods, classes, and inheritance concepts.
2. Exercises on interfaces and package concepts.
3. Exercises on string manipulation and exception handling.
4. Implementation of Multithreading concept
5. Exercises on file handling and stream concepts.
6. Implementation of event handling.
7. Exercises on swing components
8. Implementation of collection classes.
9. Development of database connectivity that displays a simple message on the screen.

Mini Project to be developed for any one of the following applications

Employee payroll calculation, Hospital Management, Bank Management, Library Management, Attendance Calculation, Grade sheet Calculation, Railway Reservation System, Electricity Bill generation, Inventory Control System, ATM System etc.,

SOFTWARE REQUIREMENTS

1. Front end: JAVA, IDE: Net beans / Eclipse
2. Back end: Oracle

P: 45; TOTAL: 45 PERIODS

Sample Question Bank (Exercises not limited to this)

1. Write a program to define a class for a student result processing system.
2. Write a Java program to sort an array of positive integers of an given array, in the sorted array the value of the first element should be maximum, second value should

be minimum value, third should be second maximum, fourth second be second minimum and so on.

3. Write a Java Program to create a class named StudentInfo with the following data members (i)name (ii)address (iii) branch (iv)department

   Method: (i)display() to show the student details

   Derive a subclass from the super class and name it StudeentRegular.Further,extend this class and create another class StudentETC that will inherit the methods and variables of class StudentInfo and having the following data Members (i)marks (ii)attendance

   Method:display() to show marks and attendance along with other details.

4. Demonstrate a program for method overloading. Consider the different types of transaction modes used for transferring money. (Credit card, Debit card, Net banking etc).

5. Develop an abstract class Reservation which has an abstract method called Reserve(). Derive the sub-classes ReserveTrain and ReserveBus classes from Reservation and implement the abstract method Reserve(). The class Reservation has a default constructor to initialize the member variables source, destination. The subclasses have to get the no of passengers and amount during the implementation of abstract method.

6. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.

7. Develop a program for banking application with exception handling. Handle the exceptions in following cases:
   - Account balance <1000
   - Withdrawal amount is greater than balance amount
   - Transaction count exceeds 3
   - One day transaction exceeds 1 lakh.

8. Write a Java Program in which two threads with names A and B play a random number generation game. The one who generates the maximum is the winner. The program should declare the winner.

9. Write a Java Program in which a particular text is stored in a string buffer and find the number of times the specified characters appear in the string and print the total number of these letters. Then replace all letters ‘a’ appearing in the string with letters ‘e’ in the string contained in the string buffer.

10. Write an applet Program to show a person walking.(Hint: Make 4 to 5 images showing different aspects of walking and show the images one after another with a delay of 1/30 of a second)

11. Write a java program that handles all mouse events and shows the event name at the center of the window when mouse event is fired (Use Adapter Classes).
12. Write a Program using Swing to construct a table of class timetable for a week with 5 subjects, 3 hours per subject per week, and 5 labs with 2 hours per week. The class works for 5 days 5 hours per day.
13. Develop a JDBC application in which the records of table 'WeatherDetail' are updated in a batch. The table is having the fields State, Maximum Temperature, Minimum Temperature, These records describe the weather conditions of states in a particular country.
14. Develop a Java Program using Maps in which You are given a phone book that consists of people's names and their phone number. After that you will be given some person's name as query. For each query, print the phone number of that person.

    Input Format The first line will have an integer denoting the number of entries in the phone book. Each entry consists of two lines: a name and the corresponding phone number. After these, there will be some queries. Each query will contain a person's name. Read the queries until end-of-file.

    Constraints: A person's name consists of only lower-case English letters and it may be in the format 'first-name last-name' or in the format 'first-name'. Each phone number has exactly 10 digits without any leading zeros. For each case, print "Not found" if the person has no entry in the phone book. Otherwise, print the person's name and phone number.
15. Write a program to develop a login validation form using struts.
16. Develop a mini project for any one application using Java concepts.

19CS57C EMBEDDED SYSTEMS LABORATORY

	L	T	P	C
	0	0	3	1.5

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: Work with Arduino chipset for interfacing external sensors. (K3)
CO2: Work with ARM chipset for interfacing external sensors. (K3)
CO3: Work with Raspberry pi chipset for interfacing external sensors. (K3)

LIST OF EXPERIMENTS

I. Arduino Experiments

1. LCD Display Interfacing
2. IR Sensor Interfacing
3. PIR Sensor Interfacing
4. I^{2}C Communication

II. ARM LPC2148 Interfacing Experiments

1. PWM – LED Interfacing
2. Switches – Buzzer Interfacing
3. Motor Interface

4. LCD Display Interfacing

III. **Raspberry Pi Interfacing Experiments**

1. Distance Measurement using HCSR 04 Sensor.
2. Temperature measurement using DHT11 sensor
3. Pressure measurement using BMP280 sensor
4. Analog sensor interfacing using LM35D and ADC080
5. Onboard webserver for External Communication

P: 45; TOTAL: 45 PERIODS

19CS58C CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: explore the classic cryptographic techniques and algorithms to encipher the plain text. (K3)

CO2: experiment security algorithms with efficiently implement key exchange algorithm and hashing techniques (K2).

CO3: configure the secure shell (SSH) for providing secure environment. (K3).

CO4: perform basic protocol data unit (PDU) capture, analysis and display filtering using wireshark features. (K3)

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
    - a) Ceaser Cipher
    - b) Substitution Cipher
    - c) Hill Cipher
    - d) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
    - a) Rail fence
    - b) Row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement the Diffie-Hellman Key Exchange algorithm to use insecure email to agree on a secret "shared key" and further encryption for a long message.
6. Calculate the message digest of a text using the SHA-1 algorithm and implement the hash code using MD5.
7. Authentication using Digital Signature Algorithm - Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the Configured parameters.
8. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
9. Perform basic PDU capture, analysis and display filtering for a simple scenario using Wireshark.

10. Examine how networking packets are transferred and exchanged in a TCP/IP network. Student will develop an understanding of the protocols in packets transfer and corresponding protocols like Address Resolution Protocol (ARP), and Internet Control Message Protocol (ICMP) using Wireshark software.
11. Demonstrate Intrusion Detection System IDS) using any tool eg. Snort or any other s/w.

Mini Project to be developed for any one of the following applications

1. Sniffing for Passwords.
2. Sniffing HTTP Traffic
3. Analysis of RTP Packet Delay and Loss
4. Employee website monitoring using packet analysis.
5. Network Intrusion Detection using Pattern Matching.

SOFTWARE REQUIREMENTS

1. Operating System - Linux (Ubuntu)
2. Wireshark
3. Snort

P: 30; TOTAL: 30 PERIODS

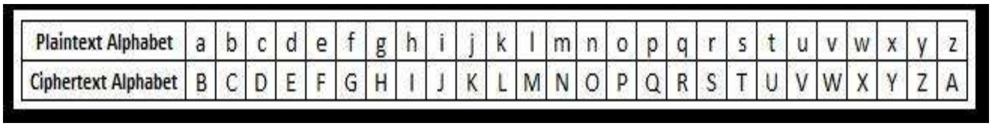
Sample Question Bank (Exercises not limited to this)

1. a. Alice meets Bob and Says “jrg lv juhdw”. If she is using Caesar Cipher with key 29, what does she want to convey? Implement this using C Program.
   - b. Alice meets Bob and Says “efgfoe uif fbtu xbmm pg uif dbtumf”. If she is using Caesar Cipher with key 131, what does she want to convey? Implement this using C Program.
   - c. Consider a scheme involving the replacement of alphabets as follows.

Original	a	b	c	……………………………	x	Y	Z
Changed to	z	y	x	……………………………	c	B	A

If Alice sends a message “hnzig xrgb uli z hnzig kozmvg”, what should Bob infer from this? Implement this using C Program.

d. Consider a scheme involving the replacement of alphabets as follows.



Plaintext Alphabet	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
Ciphertext Alphabet	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A

If Alice sends a message “B TJNQMF NFTTBHF”, what should Bob infer from this? Implement this using C Program.

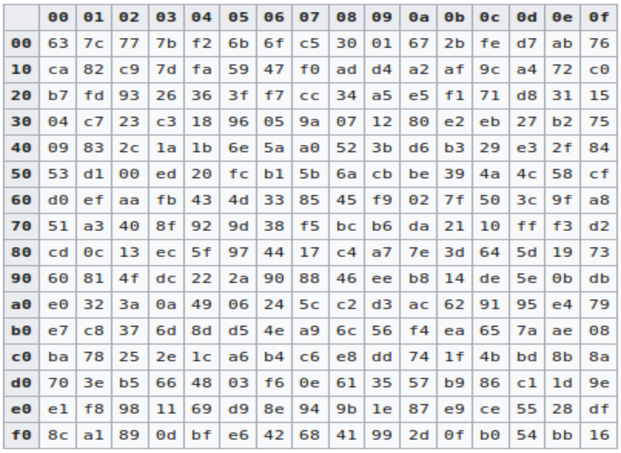
e. Using the vignere cipher encrypts the word “explanation” using the key “leg”. Also decrypt the same. Implement this using C Program.

f. Using the vignere cipher encrypts the word “life is full of surprises” using the key “health”. Also decrypt the same. Implement this using C Program.

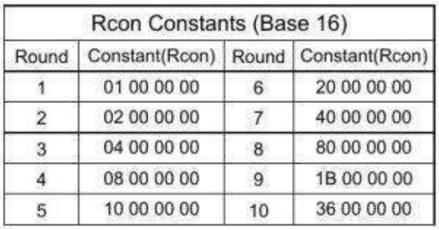
g. Solve using playfair cipher. Encrypt the word “Semester Result” with the keyword “Examination”. Implement this using C Program.

h. Use the playfair cipher to encipher the message, “Attack Cancelled on MONDAY. Wait for next message” with the keyword “MORNING”. Implement this using C Program.

i. Encrypt the following using play fair cipher using the keyword MONARCHY. "SWARAJ IS MY BIRTH RIGHT". Implement this using C Program.
2. Implement the key generation of Simple DES algorithm using C. Consider the 10 bit key input is '1000010000'. Generate two keys each of size 8 bits. The P10 box will do the permutation in the order 2,4,6,8,10,1,3,5,7,9. Also The P8 box will do the permutation in the order 1,5,7,9,2,3,8,10.
3. Perform encryption and decryption using the RSA algorithm for the following. Implement this using C Program.
    a) p=17; q=31, e=7; M=2
    b) p=11: q=13, e=11; M=7
4. Given the message 09810461, how to decode it using RSA algorithm with p=43, q=59 and e=13. Implement this using C Program.
5. Consider the key generation of AES algorithm. Suppose the round key for round 8 is "EA D2 73 21 B5 8D BA D2 31 2B F5 60 7F 8D 29 2F". Find the round key for round 9? Implement this using C.



	00	01	02	03	04	05	06	07	08	09	0a	0b	0c	0d	0e	0f
00	63	7c	77	7b	f2	6b	6f	c5	30	01	67	2b	fe	d7	ab	76
10	ca	82	c9	7d	fa	59	47	f0	ad	d4	a2	af	9c	a4	72	c0
20	b7	fd	93	26	36	3f	f7	cc	34	a5	e5	f1	71	d8	31	15
30	04	c7	23	c3	18	96	05	9a	07	12	80	e2	eb	27	b2	75
40	09	83	2c	1a	1b	6e	5a	a0	52	3b	d6	b3	29	e3	2f	84
50	53	d1	00	ed	20	fc	b1	5b	6a	cb	be	39	4a	4c	58	cf
60	d0	ef	aa	fb	43	4d	33	85	45	f9	02	7f	50	3c	9f	a8
70	51	a3	40	8f	92	9d	38	f5	bc	b6	da	21	10	ff	f3	d2
80	cd	0c	13	ec	5f	97	44	17	c4	a7	7e	3d	64	5d	19	73
90	60	81	4f	dc	22	2a	90	88	46	ee	b8	14	de	5e	0b	db
a0	e0	32	3a	0a	49	06	24	5c	c2	d3	ac	62	91	95	e4	79
b0	e7	c8	37	6d	8d	d5	4e	a9	6c	56	f4	ea	65	7a	ae	08
c0	ba	78	25	2e	1c	a6	b4	c6	e8	dd	74	1f	4b	bd	8b	8a
d0	70	3e	b5	66	48	03	f6	0e	61	35	57	b9	86	c1	1d	9e
e0	e1	f8	98	11	69	d9	8e	94	9b	1e	87	e9	ce	55	28	df
f0	8c	a1	89	0d	bf	e6	42	68	41	99	2d	0f	b0	54	bb	16



Rcon Constants (Base 16)			
Round	Constant(Rcon)	Round	Constant(Rcon)
1	01 00 00 00	6	20 00 00 00
2	02 00 00 00	7	40 00 00 00
3	04 00 00 00	8	80 00 00 00
4	08 00 00 00	9	1B 00 00 00
5	10 00 00 00	10	36 00 00 00

6. User A and B uses the Diffie-Hellman key exchange technique with a common prime q=71 and a primitive root $\alpha = 7$. If user A has private key X_A=5, what is A's public key Y_A? If user B has private key X_B=12 what is B's public key Y_B? What is the shared secret key? Implement this using C
7. Consider the prime number 37 and its primitive root is 13. Alice chooses her private key is 10 and bob chooses his private key is 7. Apply Diffie Hellman algorithm to find out the secret key exchanged between Alice and Bob. Implement this using C.
8. User A and B uses the Diffie-Hellman key exchange technique with a common prime q=11 and a primitive root $\alpha = 7$. If user A has private key X_A=3, what is A's public key Y_A? If user B has private key X_B=6 what is B's public key Y_B? What is the shared secret key? Implement this using C..
9. Consider the input message of size 500 characters. Generate hash value of this message using 128 bit hash generation algorithm. It is decided to change the last 20 characters in the original message. How many bits in the digest/hash will change? Implement this using C.
10. Consider the input message of size 200 characters. Generate hash value of this message using 160 bit hash generation algorithm. It is decided to change the last 10

characters in the original message. How many bits in the digest/hash will change? Implement this using C.

19CS61C OBJECT ORIENTED ANALYSIS AND DESIGN

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: realize the importance of Object Oriented software development (K2)
- CO 2: perform Object Oriented Analysis by using UML diagrams (K3)
- CO 3: construct the appropriate UML diagrams for Object Oriented design (K3)
- CO 4: identify Object Oriented methodologies to develop OO Design patterns and frame works (K2)
- CO 5: apply various testing strategies for real world applications (K3)

UNIT I INTRODUCTION 9

An Overview of Object Oriented Systems Development - Object Basics - Object Oriented Systems Development Life Cycle- Foundations of Object model OOA, OOD and OOP - Unified Modeling Language.

UNIT II OBJECT ORIENTED ANALYSIS 9

Object Analysis - Nature of an object State, Behavior and Identity -Use case Diagram- Identifying use cases and relationships – Class Diagram - Identifying Attributes and Methods - Case studies.

UNIT III OBJECT ORIENTED DESIGN 9

Design process and Design axioms - Interaction Diagram: Sequence and Collaboration Diagram- Activity Diagram- State Chart Diagram- Package Diagram

UNIT IV OBJECT ORIENTED METHODOLOGIES 9

Rumbaugh Methodology - Booch Methodology - Jacobson Methodology – Patterns- Frameworks- Unified Approach.

UNIT V OBJECT ORIENTED TESTING 9

Testing- Issues in OO Testing: Units, Implications and Levels – Class Testing – OO Integration Testing – Component and Deployment Diagrams.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Ali Bahrami,"Object Oriented System Development", Tata McGraw Hill, 1st Edition, 2008.
2. Paul C.Jorgensen, "Software Testing: A Craftsman's Approach", Auerbach Publications, Taylor and Francis Group, 3rd Edition, 2008.

REFERENCES

1. Grady Booch, James Rumbaugh, Ivar Jacobson," The Unified Modeling Language User Guide", Addison Wesley, 2nd Edition, 2015.

2. Craig Larman, “Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and Iterative Development”, Pearson Education, 3rd Edition, 2008.

19CS62C	**PRINCIPLES OF COMPILER DESIGN**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**2**	**4**	**A**

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: design a lexical analyzer for a simple language (K3)
CO 2: apply different parsing algorithms to develop the parsers for a given grammar (K3)
CO 3: generate three address codes for a simple program (K3)
CO 4: optimize the source code using suitable code optimization techniques (K3)
CO 5: implement the back-end of the compiler (K3)

UNIT I LEXICAL ANALYSIS 15

Introduction to Compiler - Analysis of the source program - The phases – Cousins - The grouping of phases - Compiler construction tools. The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens – Develop a lexical analyzer to recognize a few patterns in C - Create a symbol table, while recognizing identifiers - Implementation of Lexical Analyzer using Lex Tool.

UNIT II SYNTAX ANALYSIS 15

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General - Strategies - Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - CLR Parser - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC- Implementation of Arithmetic Calculator using LEX and YACC.

UNIT III INTERMEDIATE CODE GENERATION 15

Intermediate languages – Declarative Statement - Assignment statements - Boolean expressions - Case statements - Backpatching - Procedure calls - Generate three address code for a simple program using LEX and YACC.

UNIT IV CODE OPTIMIZATION 15

Introduction - The principle sources of optimization - Peephole optimization - Optimization of basic blocks - Loops in flow graphs - Introduction to global data-flow analysis - Code improving transformations – Implementation of simple code optimization techniques.

UNIT V CODE GENERATION 15

Issues in the design of a code generator - The target machine - Run-time storage management - Basic blocks and flow graphs - Next-use information - A simple code generator - Register allocation and assignment - The Directed Acyclic Graph (DAG) representation of basic blocks - Generating code from DAGs – Implementation of back-end of the compiler (three address code is given as input and the 8086 assembly language code is produced as output).

L: 45; P: 30; TOTAL: 75 PERIODS

TEXT BOOK

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D.Ullman, Compilers: Principles, Techniques and Tool, Pearson Education, 2nd Edition (Reprint), 2013.

REFERENCES

1. K.Muneeswaran, “Compiler Design”, Oxford University Press, 1st Edition, 2013.
2. V. Raghavan, “Principles of Compiler Design”, Tata McGraw Hill Education Publishers, 1st Edition, 2017.
3. C.N.Fisher, R.J.LeBlanc “Crafting a Compiler with C”, Pearson Education, 3rd Edition, 2010.
4. Steven S. Muchnick, “Advanced Compiler Design & Implementation”, Morgan Kaufmann Publishers, Elsevier India, 1st Edition, 2008.
5. Seth D. Bergmann, “Compiler Design: Theory, Tools, and Examples”, William C Brown Pub, 2016.
6. https://rdw.rowan.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1001& context=oer.
7. http://dinosaur.compilertools.net
8. http://epaperpress.com/lexandyacc

19CS63C	**INTERNET AND WEB TECHNOLOGY**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: construct a website using HTML and Cascading Style Sheets. (K3)
CO2: build dynamic web page with validation using Java Script and AngularJS. (K3)
CO3: develop and deploy an Enterprise Application. (K3)
CO4: design a web page in PHP and present the data in XML format. (K3)
CO5: acquire knowledge in AJAX and web services. (K2)

UNIT I INTRODUCTION, HTML 5.0 AND CSS 3.0 9

Web Essentials: Clients, Servers and Communication – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5: Tables – Lists – Image- Frames - Forms **-** control elements – CSS3- Inline, embedded and external style sheets – Rule cascading – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations – CSS Flex Property.

UNIT II CLIENT SIDE SCRIPTING 9

Java script: Introduction- Control statements- Functions- Objects- Event handling- Form Validation - Document Object Model (DOM) - Async/Await-Promises. **AngularJS:** Introduction – Directives - Expressions-Controllers- Filters - Tables- Form validation.

UNIT III SERVER SIDE SCRIPTING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- GET and POST Methods- Session Handling – Cookies. **Java Server Pages (JSP):** Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP AND XML 9

PHP: Introduction **-** Variables- Program control- Built-in functions-Connecting to Database –Cookies-Regular Expressions; **XML:** Basics - Document Type Definition- XML Schema - DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation.

UNIT V AJAX AND WEB SERVICE 9

AJAX: Client Server Architecture-XML Http Request Object- Call Back Methods; **Web Services:** Introduction- Java web services -Basics – Creating, Publishing, Testing and Describing a Web services – Web Services Description Language -Consuming a web service, Database Driven web service from an application –SOAP - REST.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Paul Deitel, Harvey Dietel and Abbey deitel, “Internet and World Wide Web-How to Program”, Prentice Hall, 5th Edition, 2018.
2. Brad Dayley, “Learning AngularJS”, Addison-wesley professional, 1st Edition,2014.

REFERENCES

1. Chris Bates, “Web Programming – Building Intranet Applications”, Wiley Publications, 3rd Edition, 2018.
2. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2nd Edition, 2014.
3. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, “Mastering HTML, CSS & Javascript Web Publishing”, BPB Publications, 1st Edition, 2016.

19CS64C BUSINESS PROCESS MANAGEMENT

L	T	P	C	QP
2	0	0	2	B

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO 1: define the required processes and able to identify process improvement opportunities / strategies. (K2)
CO 2: plan a BPM strategy for an organization. (K3)
CO 3: propose business solutions in written and verbal forms for process innovation and redesign Projects. (K2)
CO 4: explain the role of Information Technology and other resources in BPM. (K2)
CO 5: synthesis the principles of organizational strategy and process design. (K2)

UNIT I INTRODUCTION TO BUSINESS PROCESS MANAGEMENT 6

Ingredients of Business Process, BPM Life Cycle, Process Identification – The context of process identification, Definition of the process architecture, process selection.

UNIT II PROCESS MODELING 6

Essential Process Modeling – First Steps with BPMN, Branching and merging, Business Objects, Resources, Process decomposition, Process model reuse.

UNIT III ADVANCED PROCESS MODELING 6

Rework and repetition, Handling events, Handling exceptions, Process and Business rules. Process Discovery - The setting of process discovery, process discovery methods, process modeling methods.

UNIT IV QUALITATIVE AND QUANTITATIVE PROCESS ANALYSIS 6

Value added analysis, waste analysis, stakeholder analysis and issue documentation, root cause analysis. Flow analysis, Queues, Simulation.

UNIT V PROCESS AWARE INFORMATION SYSTEM 6

Types of Process Aware Information System, Advantages of Introducing a BPMS, Challenges of Introducing a BPMS. Process implementation with executable models.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, "Fundamentals of Business Process Management", 2nd Edition, Springer, 2018.
2. Akhil Kumar, "Business Process Management", 1st Edition, Routledge, 2018.

REFERENCES

1. Carl F. Lehmann, "Strategy and Business Process Management: Techniques for Improving Execution, Adaptability, and Consistency", CRC Press, 2016.
2. John Jeston, Johan Nelis, "Business Process Management", 3rd Edition, Routledge, 2014.
3. Van der Aalst, Wil, "Process Mining: Data Science in Action", 2nd Edition, Springer 2016.

19CS65C INTERNET AND WEB TECHNOLOGY LABORATORY

L T P C
0 0 3 1.5

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: create website using HTML and style sheets. (K3)
CO 2: design interactive web pages using javascript and angularJS. (K3)
CO 3: develop and deploy a web application using PHP, JSP and servlet.(K3)

LIST OF EXPERIMENTS

1. Web Page Creation using HTML5 and CSS3

2. Implement BMI calculator using javascript.
3. Client Side Scripts for Validating Web Form Controls using javascript.
4. Perform temperature conversion using angularJs.
5. Working with directives concept using angularJs.
6. Validate the form using PHP regular expression.
7. Store a form data into database using PHP
8. Programs using XML and XSLT.
9. Create three-tier applications using JSP and Databases.
10. Invoking servlets from HTML forms.

Mini Project to be developed for any one of the following applications

1. Examination Result Analysis System.
2. Create a technical blog for hosting the symposium related information.
3. Design and simulate a digital wallet platform (Google pay) and online payment system enabling people to make payments.
4. Leave Application Management System.
5. Create a discussion forum for online health consultation website.
6. Online old Books dealer Portal.
7. E Commerce for Online Medicine Shopping.

SOFTWARE REQUIREMENTS

1. HTML5
2. Java, IDE: Net beans / Eclipse
3. JSP
4. WAMPP
5. XML editor
6. Oracle, mysql

P: 45; TOTAL: 45 PERIODS

Sample Question Bank (Exercises not limited to this)

1a. **Create a web page with the following using HTML**
a. To embed a map in a web page
b. To fix the hot spots in that map
c. Show all the related information when the hot spots are clicked.

1b. **Create a web page with the following.**
a. Cascading style sheets.
b. Embedded style sheets.
c. Inline style sheets.
Use our college information for the web pages.

2. **BMI Calculator:** The following HTML snippet shows the skeleton of a BMI calculator. Write the calculate() function that takes the weight and height in the text boxes and displays the BMI in the span with the id of “score.” You may find the compute BMI function in the Compute BMI exercise helpful for this task. You should also describe the person’s body type based on their BMI score using the

following criteria:

- Underweight: < 18
- Normal: 18 – 25
- Overweight: 25 – 30
- Obese: > 30.

The person’s body type should be displayed in the span with the id of “type” and you may assume valid input into the text boxes.

3. **Design a HTML document to collect feedback from participants after attending a Technical workshop using HTML forms and validate the same using javascript.**

   The form should contain text boxes, radio button, option button, text area and Submit button. Display the information accepted in a formatted form. After submitting the form, it should be validated and display the message “Thanks for your feedback”.

4. **Create a temperature converter using HTML and angularJS**.

5. **Consider a use case where we need an HTML structure to display movie titles.**

   The HTML snippet looks like this:

   ```
   <div class="movie">
      <div class="title">
         Movie Title
      </div>
      <div class="movie">
         Movie name
      </div>
   </div>
   ```

   The code given above seems rich in terms of CSS classes and HTML tags, but the code is not repeatable. In a case where multiple movies will need to be displayed, this code structure would become messy. Use directives in angularJs to resolve the problem.

6. **Design a web page for Online aadhaar registration with various HTML components.**

   The form should collect the Pre-Enrolment ID, NPR receipt, FullName, District in textboxes, Address using text area and Gender using radio Button. Develop a PHP script to receive the aadhar registration details and store it into a table.

7. **Implement the following web application using PHP.**

   A user validation web application, where user submits the login name and password to server. These are checked against the data already available in database and if the data matches a successful login page is returned. Otherwise a failure message is shown to the user.

8. **Create and save an XML document at the server, which contains ten users information.**

   Write a program which takes User Id as input and returns the user details by taking the user information from the XML document.

9. **Develop a JSP code to perform the following job.**

   Insert the details of the three or four users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.

10. **Design a web page for an Email Registration Form with various HTML components.** Develop a Servlet application to receive the email registration information and store the details into a table. If passwords are mismatch then display the message “Enter a Correct password” and provide a link to the Registration form for reentering the details again.

19CS66C	**COMPREHENSION**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Enhance the comprehensive knowledge for attending interviews and competitive exams. (K4)
CO2: Pursue their higher education and research. (K3)
CO3: Undergo entrance exams such as GATE, GMAT. (K3)
CO4: Demonstrate the comprehensive knowledge being acquired through core engineering courses. (K3)
CO5: Develop logical and analytical skills to ensure on campus placement. (K4)

COURSE CONTENT AND LAYOUT

The students will be engaged to review the fundamental core courses also based on their area of interest, they can select any 2 courses under below Special Interest Group (SIG)

FUNDAMENTAL CORE COURSES

The highlights of the following core courses will be reviewed through Aptitude Test and Mock interviews to improve their competency

- Data Structures and Algorithms
- Compiler Design
- Digital Logic Design
- C , C++ and JAVA Programming
- Computer Networks
- Operating System
- Computer Organization and Architecture
- Database Management Systems
- Software Engineering

SPECIAL INTEREST GROUPING

To bring deeper understanding and exchange information among special interest groups (not limited) by concentrating on any two area of specializations as listed below

- Angular JS
- Web Technology

- Social Networks
- Distributed Computing
- Advanced Database Technology
- Data Warehouse and Data Mining
- Artificial Intelligence
- Deep Learning

- ➢ The staff-coordinator is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
- ➢ The technical seminars and group discussions will be assisted by subject experts in the department.
- ➢ Each student must participate in all the activities and their performance assessment must be recorded.

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Dr.R.S.Aggarwal, “Quantitaive Aptitude for Competitive Examinations”, S Chand Publications, New Delhi, 2017.
2. Herbert Schildt,”Java: A Beginner's Guide”, 8th Edition, McGraw-Hill Education, 2018.
3. Thomas Anderson and Michael Dahlin ,"Operating Systems: Principles and Practice (Volume 1 of 4)”, Recursive Books, 2nd Edition, 2015.
4. Gerardus Blokdyk, “DBMS Management A Complete Guide”, 5STARCooks, 2020 Edition, 2021.
5. Roger Pressman & Bruce Maxim, “ISE SOFTWARE ENGINEERING: A PRACTITIONERS APPROACH”, McGraw-Hill Education, 9th Edition, 2019.
6. Shakuntala Devi, “Puzzles To Puzzle To You” Orient Paperbacks, 1st Edition, 2005.

ASSESSMENT PROCEDURE

- The staff-coordinator per group is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
- The technical seminars, group discussions and comprehensive viva will be conducted and assisted by subject experts in the department.
    1. Technical Seminars: Each student will be required to make one technical presentation for minimum 15 minutes duration in this course. Individual topics will be assigned to the students by the department.
    2. Group Discussion: Assessment must focus on evaluating Teamspirit and Body Language of student‘s participation
    3. Comprehensive Viva: Viva should be handled on their area of interest in both written / oral mode
- Each student must participate in the suggested activities and their performance assessment must be recorded

Suggested Activities for improving placements:

1. WrittenTest:

a. Verbal

- Synonyms
- Antonyms
- Sentence completion
- Passage writing

b. Aptitude

- Quantitative and Logical

c. Analytical

- Critical Reasoning

2. Mock Interviews:

a. Pure HR Panel

- Communication Skills
- Attitude
- Interpersonal Skills
- Openness to learn
- Eligibility Check
- Stresstest
- Co-curricular achievements
- Extra-curricular achievements

b. Management Interview

- Industry Orientation
- Industry Trends
- Career Goals
- Adaptability
- Culture Fitment

c. TechPanel:

- Programming languages you know about.
- Data Structures
- Project related
- Subject Knowledge
- Practical applicability of basic concepts
- Certifications
- Problem Solving

Suggested Activities for Encouraging Higher Studies

1. Mock GATE Examination

- Solving previous year question papers
- Objective type test for Aptitude and Verbal practices.

2. Technical Review (Suggested to practice any Two Interview process)
Set one Interview Process
Written Test procedure:

1. Verbal – Synonyms, Antonyms, Sentence completion &passage

2. Aptitude – Quantitative and Logical reasoning, Old TCS questions
3. Analytical – Critical Reasoning - Refer Barron's GRE

Technical interview procedure:

- **Technical interview:** C, C++ & java. And interviewer will ask the questions based on your Area of Interest
- **HR interview:** It will be like stress interview. There is a possibility for asking the technical questions. But technical questions will ask to test the patience and coolness of a candidate. Some interviewer asks questions rapidly. Sometimes candidate will be asked to talk about current affairs.

Round 1:	***AMCAT ONLINE TEST***	computer programming, quantitative, logical and verbal
Round 2:	***TECHNICAL HR***	In this round, there will be one HR, face to face process. Only way to clear this round SPEAK SPEAKSPEAK. Be confident and maintain eye contact
Round 3:	***FINAL HR***	*It took around 10 min…There were 2HRs* **–** *Personal Questions*

Set Two Interview Process

Set Three Interview Process

1. Written Test procedure:

- Verbal – Synonyms, Antonyms, Sentence completion & passage
- Aptitude – Quantitative and Logical reasoning, Old TCS questions
- Analytical - Critical Reasoning - Refer Barron'sGRE

2. Group Discussion : A GD is a methodology used by an organization to gauge whether the candidate has certain personality traits and/or skills (Communication skills, Interpersonal Skills, Leadership Skills, Motivational Skills, Team Building Skills)

3. HR Interview: Both Technical and personal Interview

19CS67C PRODUCT DEVELOPMENT LABORATORY

	L	T	P	C
	1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)
CO2: verify the functionality of the concept through prototyping (K4)

UNIT I NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION 20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

UNIT II PROTOTYPING AND DEMONSTRATION 25

Prototype development and demonstration - cost estimation - product documentation

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Michael G Luchs, Scott Swan, Abbie Griffin, “Design Thinking: New Product Development Essentials from the PDMA”, Willey, 2015
2. Christian Muller-Roterberg, “Design Thinking”, Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata Mc Graw Hill Education, 4th Edition, 2011.
4. George E Dieter, Linda C Schmidt, “Engineering Design”, Mc-Graw Hill International Edition, 5th Edition, 2013.
5. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2013

Mentor Activities

- Forming multidisciplinary/interdisciplinary batches among the students
- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students’ activities through demonstration and presentations

End semester Assessments can be made through

- Product demonstration and presentation

Other points

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four
- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

19CS71C RESEARCH PAPER AND PATENT REVIEW – SEMINAR

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: understand the emerging technology / research development in the engineering Field (K2)
- CO2: acquaint with the concepts published in reputed journals on their area of interest (K2)
- CO3: examine patents and procedures available in the data base. (K3)
- CO4: effectively communicate the contents to the target audience and handle the questions with confidence (K3)
- CO5: Check for patent plagiarism (K2)

The Students will make a technical presentation on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

P: 30 TOTAL: 30 PERIODS

19CS72C PROJECT WORK – I

L T P C
0 0 6 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: identify an innovate or creative idea / concept / solution to a problem (K3)
- CO2: perform the detailed literature survey related to concept / idea (K2)
- CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modelling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

P: 45; TOTAL: 45 PERIODS

19CS81C PROJECT WORK – II

L T P C
0 0 12 6

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design and develop the working model (K3)
CO2: work independently to complete the project along with team members (K2)
CO3: demonstrate the results and documents the report (K4)

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

P: 180; TOTAL: 180 PERIODS

19CS82C INTERNSHIP / IN-PLANT TRAINING

L T P C
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: acquire the knowledge of different industrial / organizational activities (K2)
CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department
2. A report should be submitted after the successful completion of internship / in-plant training.

P : 60; TOTAL : 60 PERIODS

19CS01E	DATA VIRTUALIZATION	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Recognize the needs of data virtualization, virtual data services and data Virtualization solutions.(K2)

CO2: Realize the concepts of exploratory data analysis. (K2)

CO3: Apply the data virtualization concepts in information management and data governance.(K3)

CO4: Acquire insights into the relationship among data virtualization and Business agility.(K2)

CO5: Explore the storage virtualization concepts. (K3)

UNIT I INTRODUCTION 9

Data Virtualization: Introduction, challenges - Building virtual data services, General architectural framework – Data Abstraction Layer –Platforms – Key Capabilities - Data integration – Solutions.

UNIT II EXPLORATORY DATA ANALYSIS 9

Incorrect Data and Data Quality, Complex and Irregular Data Structures, Implementing Transformations in Wrappers or Mappings, Analyzing Incorrect Data, Data Stores and Data Transmission, Exploratory Data Analysis for data integration.

UNIT III DATA MANAGEMENT AND GOVERNANCE 9

Data Virtualization Information Modelling and Database Design– Data Virtualization on Data Profiling – Data Virtualization on Data Cleansing – Data Virtualization on Data Governance and Security.

UNIT IV DATA VIRTUALIZATION TO BUSINESS AGILITY 9

Business Agility Challenges, Business Agility Data Integration Flexibility, Time-To-Solution Agility, Optimized Data Integration, Benefits to Business Agility. Case Study on business agility.

UNIT V STORAGE VIRTUALIZATION 9

Storage Virtualization Definition, Forms of Virtualization, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization, Storage Networking Technologies and Virtualization

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Tom Clark, “Storage Virtualization: Technologies for Simplifying Data Storage and Management”, Pearson Education, 1st Edition**,** 2018.
2. Judith R. Davis and Robert Eve, “Data Virtualization: Going beyond Traditional Data Integration to Achieve Business Agility”, Nine Five Zero, 1st Edition 2011.

REFERENCES

1. Rick F. vander Lans, “Designing a Data Virtualization Environment A Step-By-Step Approach “, redhat, 2016.
2. Gustavo A. A. Santana, “Data Center Virtualization Fundamentals”, Cisco Press, 1st edition, 2013.
3. Lawrence C. Killer, “Data Virtualization for Dummies, Denodo Edition, 2018.
4. https://www.elsevier.com/books/data-virtualization-for-business-intelligence-systems/van-der-lans/978-0-12-394425-2.

19CS02E	BIG DATA ANALYTICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the characteristics of big data and concepts.(K2)
CO2: Understand the importance of visualization and analytics .(K3)
CO3: Apply the requirements for a Big Data Analytics System for departmental organizational requirements using Hadoop. (K3)
CO4: Analyze Spark and its uses for big data processing. (K2)
CO5: Utilize and apply the Analytical methods, Technology and tools in the industry.(K3)

UNIT I INTRODUCTION TO BIG DATA 9

Basics of big data – Issues – Case for Big data – Big data options Team challenge – Big data sources - Acquisition – Nuts and Bolts of Big data. Features of Big Data - Evolution of Big data– Best Practices for Big data Analytics - Big data characteristics.

UNIT II DATA ANALYTICS AND VISUALIZATION 9

Predictive Analytics- Simple linear regression- Multiple linear regression- classification – clustering - association. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications. Case Studies: social media data analysis

UNIT III HADOOP ENVIRONMENT 9

Introduction – Components of Hadoop - Analyzing the Data with Hadoop – Scaling out - Hadoop Streaming - Design of HDFS - Java interfaces to HDFS Basics - Developing a Map Reduce Application - Map Reduce concepts -Anatomy of a Map Reduce Job run – Failures - Job Scheduling - Shuffle and Sort – Task execution - Map Reduce Types and Formats - Map Reduce Features

UNIT IV SPARK 9

Installing spark - Spark applications - Jobs - Stages and Tasks - Resilient Distributed databases - Anatomy of a Spark Job Run - Spark on YARN - SCALA: Introduction - Classes and objects - Basic types and operators – Built-in control structures - functions and closures - inheritance.

UNIT V ANALYTICS FOR UNSTRUCTURED DATA 9

The Hadoop Ecosystem – NoSQL - In-Database Analytics - SQL Essentials - In-Database Text Analysis - Advanced SQL.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, Wiley, 2018.
2. Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia “Learning Spark”, O'Reilly, 1 st Edition, 2015.
3. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 1 st Edition, 2015.

REFERENCES

1. Kim H. Pries, Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers”, CRC Press, 2015.
2. https://www.sciencedirect.com/topics/computer-science/hadoop-ecosystem

19CS03E	DATA SCIENCE	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand fundamentals of data analysis.(K2)
CO2:.Explore the data analysis techniques (K2)
CO3: Analyze the key concepts in predictive data analysis.(K3)
CO4: Apply data science in data visualization techniques(K3)
CO5: Apply the concepts in real-world applications using python (K3)

UNIT I DATA SCIENCE FUNDAMENTALS 9

Linear Algebra, Graph theory, Probability, Measures of central tendency: mean, median and mode, Measuring asymmetry: skewness – Measures of location of dispersions

UNIT II STATISTICAL TECHNIQUES 9

Basic analysis techniques - Statistical hypothesis generation and testing - Chi-Square test - t-Test - Analysis of variance - Correlation analysis - Maximum likelihood test.

UNIT III PREDICTIVE DATA ANALYSIS 9

Predictive models : Regression, classification, time series forecasting, clustering, association rule mining, text mining : Sentimental Analysis

UNIT IV DATA VISUALISATION 9

Introduction – Data visualization methods: Mapping - Time series - Connections and correlations – Scatter plot maps - Trees, Hierarchies and Recursion – Data visualization using Tableau

UNIT V DATA SCIENCE TOOLS 9

Python Programming: Working with data set, data manipulation, Data analysis models using python: Pre-processing, predictive models - Application development with Jupyter, Data Science Experience (IBM - DSX).

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Vijay Kotu, Bala Deshpande, "Data Science: Concepts and Practice", Morgan Kaufmann Publishers, 2nd Edition ,2019.
2. Cathy O'Neil and Rachel Schutt. "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 1st Edition, 2014.

REFERENCES

1. Lillian Pierson, "Data Science For Dummies", John Wiley & Sons, 2nd Edition, 2017.
2. Hadley Wickham, Garrett Grolemund," R for Data Science: Import, Tidy, Transform, Visualize, and Model Data", O'Reilly Media Inc, 1st Edition, 2017.

19CS04E	DATA MINING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Apply pre-processing methods based on characteristics of data. (K3)
CO2: Comprehend features of classification techniques.(K2)
CO3: Identify appropriate clustering technique to analyze the data.(K3)
CO4: Use association rule mining to generate rules. (K3)
CO5: Use recent trends of Data mining in Business applications (K3)

UNIT I DATA MINING AND DATA PREPROCESSING 12

Introduction to KDD process – Knowledge discovery from databases – Need for data pre Processing – Data cleaning – Data integration and transformation – Data reduction – Data discretization and concept hierarchy generation.

UNIT II CLASSIFICATION 9

Basic concepts – decision tree induction – bayes classification methods – rule based classification – model evaluation and selection – techniques to improve classification accuracy –classification: advanced concepts – bayesian belief networks - support vector machine –classification using frequent patterns.

UNIT III CLUSTER ANALYSIS 9

Cluster Analysis: Basic concepts and Methods – Cluster Analysis – Partitioning methods - Hierarchical methods – Density Based Methods– Grid Based Methods - Evaluation of Clustering – Advanced Cluster Analysis: Probabilistic model Based clustering – Clustering High Dimensional Data.

UNIT IV ASSOCIATION RULE MINING 9

Association Rule Mining: Market Basket Analysis - Frequent pattern mining – Apriori algorithm - Generating Association rules from frequent items - Improving the efficiency of Apriori algorithm – Mining Multilevel association rules - Multidimensional association rules – Constraint based association Mining. Applications of Data Mining-Temporal and Sequence Mining, Web and Text Mining.

UNIT V APPLICATIONS AND RECENT TRENDS 6

Dataset Collection- Disease Prediction-Weather Prediction-Student's future learning behavior prediction- Anomaly detection-Stock market Analysis-Commercial applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Jiawei Han,Micheline Kamber and Jian Pei "Data Mining:Concepts and Techniques", Elsevier, 3rd Edition ,2012.
2. Charu C. Aggarwal, "Data Mining: The Textbook", Springer International Publisher, 2015.
3. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, 10th Reprint, 2007.

REFERENCES

1. Pawel Cichosz, "Data Mining Algorithms: Explained Using R", John Wiley & Sons, 2015.
2. Pang-Ning Tan,Vipin Kumar,Michael Steinbach, "Introduction to Data Mining", Pearson Education India, 2012.
3. Daniel T. Larose, "Data Mining and Predictive Analytics", John Wiley & Sons, 2015.
4. http://www.learningdom.com.
5. http://www.dataminingblog.com

19CS05E	BUSINESS ANALYTICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the concepts and methods of business analytics and solve decision problems (K2)

CO2:design effective data visualizations techniques and evaluate different data mining concepts (K3)

CO3:develop a greater familiarity with a range of techniques and methods through a diverse set of theoretical and applied readings (K2)

CO4: apply appropriate analytical methods to find solutions to business problems(K3)

CO5: analyze and appreciate variety of performance measures for various optimizations problems (K3)

UNIT I INTRODUCTION 9

Business Analytics Definition, Decision Making, A Categorization of Analytical Methods and Models, Big Data, applications, Descriptive Statistics: Types of Data, Modifying Data in Excel, Creating Distributions from Data, Measures of Location & Variability, Analyzing Distributions, Measures of Association between Two Variables, Data Cleansing.

UNIT II DATA VISUALIZATION AND DESCRIPTIVE DATA MINING 9

Data Visualization: Overview of Data Visualization, Tables, Charts, Advanced Data Visualization, Data Dashboards. Descriptive Data Mining: Cluster Analysis, Association Rules, Text Mining. Probability: Conditional Probability, Random Variables, Discrete Probability Distributions, Continuous Probability Distributions.

UNIT III STATISTICAL INFERENCE AND REGRESSION 9

Statistical Inference: Point Estimation, Sampling Distributions, Interval Estimation, Hypothesis Tests, Big Data, Statistical Inference, and Practical Significance. Linear Regression: Simple Linear Regression Model, Least Squares Method, Assessing the Fit of the Simple Linear Regression Model, the Multiple Regression Model. Inference and Regression: Categorical Independent Variables, Modeling Nonlinear Relationships, Model Fitting, Big Data and Regression

UNIT IV TIME SERIES ANALYSIS AND PREDICTIVE DATA MINING 9

Time Series Analysis and Forecasting: Time Series Patterns, Forecast Accuracy, Moving Averages and Exponential Smoothing, Regression Analysis for Forecasting. Predictive Data Mining: Data Sampling, Preparation, and Partitioning, Performance Measures, Logistic Regression, k-Nearest Neighbors, Classification and Regression Trees.

UNIT V OPTIMIZATION MODELS 9

Linear Optimization Models: A Simple Maximization and Minimization Problem, General Linear Programming Notation and More Examples. Integer Linear Optimization Models: Types, Solving Integer Optimization Problems with Excel Solver, Applications Involving Binary Variables, Modelling Flexibility Provided by Binary Variables. Nonlinear Optimization Models: Local and Global Optima, A Location Problem, Markowitz Portfolio Model.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, "Business Analytics", Cengage Learning, 3rd Edition ,2019.
2. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspetive,Person, , 4th Edition, 2018.

REFERENCE

1. S. Christian Albright, Wayne L. Winston, "Business Analytics: Data Analysis & Decision Making" Cengage Learning, 5th Edition, 2015.

19CS06E	**SOCIAL MEDIA ANALYTICS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the concept of semantic web and related applications.(K2)
CO2: Learn knowledge representation using ontology.(K2)
CO3: Understand human behaviour in social web and related communities and visualization of social networks.(K2)
CO4: Understand the prediction of Human Behaviour and privacy Issues.(K2)
CO5: Apply social network in real time applications.(K3)

UNIT I INTRODUCTION 9

Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and counter measures.

UNIT V APPLICATIONS 9

A Learning Based Approach for Real Time Emotion Classification of Tweets- A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting- Social Network Analysis for Biometric Template Protection- Analysis of Social media data with Google Analytics.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st Edition, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st Edition, 2010.

REFERENCES

1. GuandongXu,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st Edition, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

		L	T	P	C	QP
19CS07E	**ANALYTIC COMPUTING**	**3**	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand basic concepts and terminologies of data analytics. (K3)
CO2: Know the importance of qualitative data, get insights and techniques.(K3)
CO3: Understand the Big Data flow and Big Data Analytics. (K3)
CO4: Explore various parameters tools and techniques used for web analytics.(K3)
CO5: Predict the possible next outcome of the social network and to Mine the opinion of the user.(K3)

UNIT I DATA ANALYTICS 9

Data Analytics Overview- Terminologies in Data Analytics - Types of Data-Qualitative and Quantitative Data-Data Levels of Measurement-Normal Distribution of Data-Statistical Parameters-Types of Data Analytics-Descriptive Analytics- Diagnostic Analytics-Predictive Analytics-Prescriptive Analytics-Data Analytics for different sector-Analytics for Products or Services.

UNIT II QUALITATIVE ANALYSIS & PREDICTIVE DATA ANALYTICS 9

Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys.

Predictive data analytics: Predictive Analysis-Different kinds of predictive analysis-Predictive Models-Descriptive Modeling-Decision Modeling-Predictive Analysis Methods.

UNIT III BIG DATA ANALYTICS 6

Introduction to Big Data Analytics-Framework for Big Data Analysis-Approaches for big data analysis- ETL in Big Data-Understanding Text Analytics and Big Data-Predictive Analysis on Big Data, Role of Data Analyst.

UNIT IV WEB ANALYTICS 9

Web Analytic fundamentals: Capturing data-Web logs-Separate data serving and data capture-Integration-Selecting optimal web analytic tool-Understanding click stream data quality-Identifying unique page definition-Using cookies-Link coding issues. GOOGLE ANALYTICS: Brief introduction - Adwords- Categories of traffic-SEO- Limitations.

UNIT V SOCIAL NETWORK DATA ANALYTICS 12

An introduction - Online Social Networks: Research Issues,-Data Mining Methods for Social Media- visualizing social networks, Taxonomy of Visualizations- The Convergence of Visualization- Interaction and Analytics - Tools for Social Network Analysis- UCINET – PAJEK – ETDRAW – Splus – R – NodeXL – SIENA and RSIENA – Real world Social Networks (Facebook- Twitter- etc.)

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. EMC Education Services, ‘Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, John Wiley & Sons, New Delhi, 2015.
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
3. Charu C. Aggarwal, “Social Network Data Analytics”, Springer, 2011.
4. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd Edition, 2010.
5. Michael Beasley, “Practical Web Analytics for User Experience: How Analytics can help you Understand your Users”, Morgan Kaufmann, 2013.

REFERENCES

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics”, John Wiley & sons, 2012.
2. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O‟Reilly, 2011.
3. Jiawei Han, MichelineKamber “Data Mining Concepts and Techniques”, Elsevier,Reprinted, 2nd Edition, 2008.
4. Arthur Zhang,”Data Analytics: Practical Guide to Leveraging the Power of Algorithms,

Data Science, Data mining", Kindle Edition, 2017.

5. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science OfCustomer Centricity ", Sybex, 1st Edition, 2009.
6. Sule Gündüz-Ogüdücü, A. Şima Etaner-Uyar, "Social Networks: Analysis and Case Studies", Springer, 2014.

19CS08E	ALGORITHMIC GAME THEORY	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: Comprehend a conceptual overview to the tools of game theory and its applications.(K2)
- CO2: Analyze situations in which two or more individuals (or firms, political parties, countries) interact in a strategic manner (K4)
- CO3: Analyze the situations involving conflict and/or cooperation (K4)
- CO4: Introduce the concepts of social choice theory (K2)

UNIT I STATIC GAMES OF COMPLETE INFORMATION 9

Introduction – Decision Theory –Strategic Game - Nash Equilibrium – Multiple Nash Equilibrium Applications - Mixed Strategy Equilibrium.

UNIT II DYNAMIC GAMES WITH COMPLETE INFORMATION 9

Extensive Form Games – strategies and equilibrium in extensive form games - Backward Induction and sub game perfection.

UNIT III STATIC GAMES OF INCOMPLETE INFORMATION 9

Bayesian Games – Bayesian Nash Equilibrium – Applications

UNIT IV DYNAMIC GAMES WITH INCOMPLETE INFORMATION 9

Perfect Bayesian Equilibrium – Signaling Games – Applications.

UNIT V SOCIAL CHOICE THEORY 9

Social choice and social welfare functions - Condorcet's paradox - Desirable properties of social choice procedures (Pareto condition, independence of irrelevant alternatives) – Popular voting procedures (Borda) - Arrow's theorem.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Martin Osborne, "An Introduction to Game Theory", Oxford University Press, 2nd Edition, 2012.
2. G.Chalkiadakis, E.Elkind, and M.Wooldridge, "Computational Aspects of Cooperative Game Theory", Morgan & Claypool, 2011.

REFERENCES

1. Michael Maschler, Eilon Solan, Shmuel Zamir, “Game Theory”, Cambridge University Press, 1st Edition, 2013.
2. Y. Shoham and K. Leyton-Brown, “Multiagent Systems”, Cambridge University Press, 2009.
3. Drew Fundenberg and Jean Tirole, “Game Theory”, MIT Press, 1st Edition, 2005.
4. Y. Narahari, “Game Theory and Mechanism Design”, IISc Press and the World Scientific, 2014.

19CS09E	BLOCKCHAIN ARCHITECTURE AND DESIGN	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand blockchain, blocks, transactions and models (K2)

CO2: Recognize the basic security and its significance in Bitcoin (K2)

CO3: Implement consensus protocol mechanisms and mining concepts (K3).

CO4: Understand the different consensus mechanisms used in permissioned blockchains (K2)

CO5: Implement the consensus mechanisms in hyperledger tool (K3)

UNIT I INTRODUCTION 9

Basics- History – Bitcoin: Technology behind Bitcoin – Bitcoin Transaction Life Cycle. - Architecture: Smart Contracts – Crowdfunding. – Block in a Blockchain: Structure of a Block – Block Header – Transactions in a Block. - Conceptualization: Permission-less Model – Blockchain as a Tree – Accepting the longest chain – Orphaned Blocks – Permissioned Model – Applications

UNIT II CRYPTO PRIMITIVES AND BITCOIN 9

Cryptographic Hash Function - Properties of Hash Function – Hash Pointer – Merkle Tree - Blockchain as a Hash chain – Digital Signature - Symmetric and Asymmetric Key Cryptography – Bitcoin - Creation of Coins – Sending Payments – Double Spending - - Transaction in Bitcoin Network – Mining in a Bitcoin network - Bitcoin Scripts.

UNIT III CONSENSUS AND MINERS 9

Consensus in Bitcoin - Proof of Work (PoW) – Hashcash PoW – Bitcoin Proof of Work System – Tampering PoW Blockchain – Sybil Attacks – Denial of Service Attacks - Proof of Stack – Proof of Burn – Proof of Elapsed Time – Miners – Life of a Miner – Mining Difficulty – Mining Pool Methods.

UNIT IV PERMISSIONED BLOCKCHAINS 9

Basics- Smart Contracts – Consensus – State Machine Replication – Distributed Consensus – Different Algorithms – PAXOS – RAFT- Byzantine General Problem (BGP) – Practical Byzantine Fault Tolerance (PBFT).

UNIT V HYPERLEDGER AND ETHEREUM 9

Hyperledger Fabric V1 – Architecture - Decomposing the consensus process - Hyperledger fabric components - Chaincode Design and Implementation - Ethereum Blockchain: Smart Contracts – Structure – Operations - Incentive Model.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" , Princeton University Press , Kindle Edition ,2016.

REFERENCES

1. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 2nd Release, 2015.
2. Blockchain Technology, Kindle Edition, BBVA innovation center.
3. http://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf
4. Joseph Bonneau et al, "SoK: Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy, 2015.
5. https://www.coursera.org/learn/blockchain-basics#about

19CS10E	COMPUTATIONAL GRAPH THEORY	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: Understand and apply the basics of graphs as a modeling tool in computer science and engineering (K3)
- CO2: Comprehend the connectivity & planarity of graphs and illustrate the structures of trees (K3)
- CO3: Apply the concepts of matching & coloring and understand the concepts of directed graphs (K3).
- CO4: Understand the flows and substructures of dense and sparse graphs (K2)
- CO5: Provide a conceptual overview to minors and well quasi ordering of trees (K2)

UNIT I INTRODUCTION 9

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree.

UNIT II TREES, CONNECTIVITY AND PLANARITY 9

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets -Connectivity and separability – Combinational and geometric graphs – Planer graphs –Representation of a planer graph – Hyper graphs.

UNIT III MATCHING, COLOURING AND DIRECTED GRAPH 9

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness.

UNIT IV FLOWS AND SUBSTRUCTURES 9

Flows – Circulations - Flows in networks - Flow-coloring duality - Tutte's flow conjectures - Substructures in Dense Graphs – Subgraphs – Substructures in Sparse Graphs - Topological minors – Minors.

UNIT V MINORS AND WELL QUASI ORDERING 9

Well-quasi-ordering - The graph minor theorem for trees - Tree-decompositions - Tree-width path width, upper and lower bounds for tree width, relation of tree width and minors.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Narsingh Deo, “Graph Theory: With Application to Engineering and Computer Science”, Prentice Hall of India, 2004.
2. Reinhard Diestel, “Graph Theory”, Springer-Verlag Berlin Heidelberg, 5th Edition 2017.

REFERENCES

1. Jay Yellen, Jonathan L. Gross, Mark,” Graph Theory and Its Applications”, CRC Press, 2019.
2. Lowell W. Beineke, Robin J. Wilson, Ortrud R. Oellermann,” Topics in Structural Graph Theory ” Cambridge University Press, 2013.

19CS11E	QUANTUM COMPUTING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the differences between classical and quantum computing.(K2)
CO2: Apply the concepts of quantum mechanics to understand basic quantum algorithms.(K3)
CO3: Understand the algorithms for quantum computational models (K2)
CO4: Utilize quantum algorithms to make the transmission from classical AI to Quantum AI.(K3)
CO5: Analyzing the Applications of quantum algorithms and error correction Standards (K3).

UNIT I QUANTUM COMPUTING FOUNDATIONS 9

Overview of traditional computing – Superposition, Entanglement and Reversibility - A Brief History of Quantum Computing - Qubits, Operators and Measurement- Complexity Theory - Quantum Computing and the Church-Turing Thesis.

UNIT II QUBITS AND QUANTUM MODEL OF COMPUTATION 9

State of a quantum system – Time evolution of a closed system – Composite systems – Measurement – Mixed states and general quantum operations – Quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – quantum circuits –Building a Quantum computer - Development Libraries for Quantum Computer Programming : Case study: quirk

UNIT III BASIC QUANTUM ALGORITHMS 9

Super dense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch-Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform – Eigen value estimation

9

UNIT IV ADVANCED QUANTUM ALGORITHMS

Order-finding problem – Eigen value estimation approach to order finding – Shor's algorithm for order finding – Finding Discrete Logarithms – Hidden subgroups – Grover's quantum search algorithm – Quantum Computing Methods- Machine Learning on Quantum Processors - Solving Linear Systems- Quantum Random Number Generator.

UNIT V QUANTUM COMPLEXITY, ERROR CORRECTION AND APPLICATIONS 9

Computational complexity – black-box model – lower bounds for searching – general black-box lower bounds – polynomial method – block sensitivity – adversary methods – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-tolerant quantum computation – Applications : Optimization - Tensor Networks - Case Study : Intel Quantum Simulator.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Jack D.Hidary , “Quantum Computing: An Applied Approach” Springer Nature Switzerland AG ,2019.
2. P. Kaye, R. Laflamme, and M. Mosca, “An introduction to Quantum Computing”, Oxford University Press, 2007.

REFERENCES

1. V. Sahni, “Quantum Computing”, Tata McGraw-Hill Publishing Company, 2007.
2. Neil Gershenfeld, Physics of Information Technology, Cambridge University Press, 2000
3. Michael A. Nielsen and Isaac L. Chuang,” Quantum Computation and Quantum Information” , Cambridge University Press, 2000
4. Mika Hirvensalo, “Quantum Computing”, Springer-Verlag New York, 2000.
5. https://github.com/iqusoft/intel-qs
6. https://arxiv.org/abs/2001.10554
7. https://algassert.com/quirk
8. https://www.cse.iitk.ac.in/users/rmittal/course_s21.php
9. https://onlinecourses.nptel.ac.in/noc19_cy31/preview

19CS12E	MULTI-CORE PROGRAMMING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the importance of multi-core processors, and their architecture (K2)
CO2: Realize the necessitate and challenges in parallel and multi-threaded programming (K2)
CO3: Develop parallel programs using OpenMP (K2)
CO4: Design and Develop distributed applications using MPI library functions (K3)
CO5: Apply the openMP and MPI libraries to build parallel applications (K3)

UNIT I MULTI-CORE PROCESSORS 9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

UNIT II PARALLEL PROGRAM CHALLENGES 9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives: mutexes, locks, semaphores, barriers – deadlocks and livelocks – communication between threads: condition variables, signals, message queues and pipes.

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP 9

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation.

UNIT V PARALLEL PROGRAM DEVELOPMENT 9

Two n-Body Solvers- Parallelizing and Evaluation in OpenMP- Tree search – Recursive and Non-Recursive DFS –Data structures and Performance of the serial implementations- static and dynamic parallelization of tree search using Pthreads and evaluation - Parallelizing the tree-search programs using OpenMP and its performance- Implementation of tree search using MPI with static and dynamic partitioning.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Victor Alessandrini, “Shared Memory Application Programming Concepts and Strategies in Multicore Application Programming”, Morgan Kaufmann, 2nd Edition 2016.
2. Yan Solihin, “Fundamentals of Parallel Multicore Architecture”, CRC Press, 2016.

REFERENCES

1. Peter S. Pacheco,“An Introduction to Parallel Programming”, Morgan-Kauffman, Elsevier, 2011.
2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011.

19CS13E	MIRCOSERVICE ARCHITECTURE	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the fundamentals of a microservices architecture.(K2)
CO2: Identify the characteristics of popular microservices, and understand the design differences.(K2)
CO3: Expose an Application Program Interface for the Microservice application.(K3)
CO4: Evaluate various approaches to infrastructure used in deploying microservices.(K3)
CO5: Exploit the security and migration of Microservice Architecture.(K2)

UNIT I INTRODUCTION OF MICROSERVICES ARCHITECTURE 9

Introduction to Service Oriented Architecture(SOA) – web services- Demystifying MicroService Architecture (MSA)- Need for MSA- Issues with traditional Enterprise Applications- Capabilities, Features and Benefits of MSA- Differences between SOA and MSA- Typical use cases of MSA – Trade-offs in MSA.

UNIT II MICROSERVICE ARCHITECTURE DESIGN PRINCIPLES 9

Key Architectural elements of MSA-Service Interaction-Communication Models for Microservices-Synchronous Communication-Representational State Transfer Architecture-REST and HTTP methods- Asynchronous Communication-Rabbit MQ-Apache Kafka.

UNIT III MICROSERVICE DISCOVERY AND DESIGNING API 9

Need for Microservice Discovery- Service Registration- Service Discovery and Tools- API Gateways-Creation of client specific API- Service Composition- Service Routing- Data Aggregation- API Design Mechanisms- REST API- Apache Thrift API- API Gateway Monitoring and Design Consideration- Service Orchestration and Choreography.

UNIT IV PATTERNS AND PLATFORM FOR MICROSERVICE ARCHITECTURE 9

Decomposition Patterns- Composition Patterns- Database Patterns- Observability Patterns- Cross cutting Patterns- Additional Database Architecture Patterns – Deployment Patterns- Challenges in MSA Approach- Foundational capabilities of Microservices Platforms- Classification of Microservices Platforms- Deployment platforms – Service Resiliency Platform- API platforms- Microservice Development Platforms.

UNIT V SECURITY AND MIGRATION OF MICROSERVICE ARCHITECTURE 9

Basic security requirements- Pragmatic Architecture for secure MSA- Security Mechanisms for MSA Applications- MSA Migration-Advantage of MSA –Motivating Drivers for MSA Migration- Issues in MSA Migration – Migration process –Candidate applications for MSA migration.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Chellammal Surianarayanan, Gopinath Ganapathy, Pethuru Raj "Essentials of Microservices Architecture- Paradigms, Applications and Techniques" CRC Press, Taylor & Francis Group, 1st edition, 2019.

REFERENCES

1. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, Mike Amundsen, "Microservice Architecture: Aligning Principles, Practices, and Culture", O'Reilly, 1st edition, 2016.
2. Eberhard Wolff, "Microservices: Flexible Software Architecture" Addison-Wesley Professional, 1st edition, 2016.
3. Sam Newman, "Building Microservices: Designing Fine-Grained Systems" O'Reilly, 1st edition, 2015.
4. www.udemy.com/course/microservices-architecture/.

19CS14E	COMPUTATIONAL METHODS OF OPTIMIZATION	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1. Formulate optimization problems and apply the concept of optimality criteria for various types of optimization problems. (K2)
- CO2. Apply the optimality criteria through evolutionary approach (K3)
- CO3. Examining the concept of optimization through swarm intelligence (K3).
- CO4. Apply science based concepts in optimization (K3).
- CO5. Acquire knowledge about optimization through human behaviour (K2).

UNIT I INTRODUCTION 9

Optimization Problems, Definition of Minimum Points, Unconstrained Optimization: Direct Search Methods, Derivative Search Methods, Constraine Optimization: Linear Constraints, Linear Inequality Constraints. General Structure of Optimization Algorithms – Constraints – Feasible Region – Branches of Mathematical Modelling.

UNIT II EVOLUTIONARY BASED APPROACH 9

Evolutionary Algorithms - Evolutionary Strategies - Genetic Algorithms - Genetic Programming - Differential Evolution - Estimation of Distribution Algorithms

UNIT III SWARM INTELLIGENCE-BASED APPROACH 9

Swarm Intelligence - Ant Colony Optimization - Bee Metaheuristics - Particle Swarm Optimization - Artificial Immune Systems - Bacterial Foraging Algorithm

UNIT IV SCIENCES-BASED APPROACH 9

Simulated Annealing - Biomolecular Computing: DNA Computing, Membrane computing - Quantum Computing: Fundamentals, Hybrid methods - Metaheuristics Based on Sciences

UNIT V HUMAN BASED APPROACH 9

Memetic Algorithms - Tabu Search, Scatter Search and Path Relinking - Search Based on Human Behaviours: Seeker Optimization Algorithm, Teaching Learning based Optimization, Imperialist Competitive Algorithm, Metaheuristics inspired by Human Behaviours

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Ke-Lin Du, M.N.S. Swamy, "Search and Optimization by Metaheuristics:Techniques and Algorithms", Inspired by Nature, 2016.
2. Xin-She Yang, "Nature-Inspired Algorithms and Applied Optimization", Springer, 2018.

REFERENCES

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 1st Edition, 2000.
2. Leandro N.De Castro, Fernando J.Von Zuben, "Recent Developments in Biologically Inspired Computing, Idea Group Inc., 2005

19CS15E	ARTIFICIAL INTELLIGENCE	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Use appropriate search algorithms for any AI problem (K3)
CO2: Provide the apt agent strategy to solve a given problem (K3)
CO3: Represent a problem using first order and predicate logic (K2)
CO4: Design software agents to solve a problem (K3)
CO5: Design some of the applications that use Artificial Intelligence (K3)

UNIT I INTRODUCTION 9

Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS 9

Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.

UNIT III KNOWLEDGE REPRESENTATION 9

First Order Predicate Logic: Prolog Programming - Unification – Forward Chaining-Backward Chaining – Resolution.

Knowledge Representation: Ontological Engineering, Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information.

UNIT IV SOFTWARE AGENTS 9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving**.**

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. S.Russel, P.Norvig, Artificial Intelligence - A Modern Approach, Pearson Education, New Delhi, 4th Edition, 2020.
2. I. Bratko, Prolog: Programming for Artificial Intelligence, Addison-Wesley Educational Publishers Inc., 4th Edition, 2011.

REFERENCES

1. M. Tim Jones," Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; 1st Edition, 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. Gerhard Weiss, "Multi Agent Systems", MIT Press, 2nd Edition, 2013.
4. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.
5. https://silp.iiita.ac.in/wp-content/uploads/PROLOG.pdf.

19CS16E MACHINE LEARNING IN HEALTHCARE

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Recognize the fundamentals of electronic health record (EHR) (K2)
CO2: Comprehend the EHR frameworks and National EHR efforts. (K2)
CO3: Understand the basics of healthcare and basic operations on clinical data. (K2)
CO4: Analyze the machine learning projects. (K3)

UNIT I INTRODUCTION TO EHR 9

EHR: Definition – Functions – Significance – Factors affecting implementation of EHR – EHR architecture requirements. Standard for healthcare - EN 13940. Standard for EHR Functional Specifications - HL7 EHR-S FM. Standard for EHR communication – Message standard for healthcare data. Standard for healthcare data - Clinical document standards – Standard for medical Image and communication - Standard for patient health summary

UNIT II EHR FRAMEWORKS AND NATIONAL EHR EFFORTS 9

Standard frameworks: openHR – Integrating the healthcare enterprise.Case studies: National EHR efforts: Australia's HealthConnect, Austria's ELGA, Canada's EHRS Blueprint, Denmark's MedCom, India's Health IT Initiatives

UNIT III INTRODUCTION TO HEALTHCARE AND CLINICAL DATA 9

Overview of Health Care Systems and Key Challenges: Physicians, Physician Practices, and Physician Payment - Hospitals, Other Provider Organizations, and Related Payment Systems - Intermediaries, Health Insurance Plans, and Health Care Financing. Introduction to Clinical Data: Data available from Healthcare systems - Representing time, timing of events for clinical data mining - Data Analytics – Tuning – Reasoning – Challenges of Big data. Evaluation and Metrics for machine learning in healthcare.

UNIT IV MACHINE LEARNING FOR HEALTHCARE ANALYTICS PROJECTS-I 9

Breast cancer detection: SVM and KNN models – data visualization with machine learning – relationship between variables – understanding machine learning algorithms – training models – predictions in machine learning. Diabetes onset detection: deep learning grid – building Keras model – grid search using scikit-learn – reducing over fitting using dropout regularization – finding optimal hyper parameters – optimizing the number of neurons – predictions using optimal hyper parameters.

UNIT V MACHINE LEARNING FOR HEALTHCARE ANALYTICS PROJECTS-II 9

DNA classification: classifying DNA sequences using NLP. Diagnosing coronary artery disease: dataset – fixing missing data – splitting the data set – training the neural network – comparison of categorical and binary problems. Autism screening with supervised learning: Autism Spectrum Disorder screening with machine learning – splitting the data set – building the network – testing the network.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Machine Learning for Healthcare Analytics Projects, Eduonix Learning Solutions, 2018
2. Pradeep Sinha, Gaur Sunder, Prashant Bendale, Manisha Mantri, Atreya Dande, "Electronic Health Record Standards, Coding Systems, Frameworks, and Infrastructures", IEEE press, Wiley publication, 2013.
3. Arjun Panesar, "Machine Learning and AI for Healthcare", Apress, 2019.
4. Dr.Parag Suresh Mahajan, "Artificial Intelligence in Healthcare", Second Edition, (Kindle Edition, 2019)

REFERENCES

1. Fai Jiang, Yi Dong,"Artificial intelligence in healthcare: past, present and future", Stroke and Vascular Neurology 2(4), 2017
2. Prashant Natarajan, John C. Frenzel, Detlev H. Smaltz, "Demystifying Big Data and Machine Learning for Healthcare", CRC Press, 2017.
3. https://www.coursera.org/specializations/ai-healthcare

19CS17E	**MACHINE LEARNING**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Know the basic concepts and techniques of Machine Learning (K2).
CO2: Design neural network to solve classification and function approximation problems (K3).
CO3: Implement typical clustering algorithms for different types of applications(K3).
CO4: Identify applications suitable for different types of machine learning with suitable Justification (K3).
CO5: Understand graphical models of machine learning algorithms(K3).

UNIT I INTRODUCTION 9

Introduction to Machine Learning - Types of Machine learning - Basic Concepts in Machine Learning -Examples of Machine Learning Applications, Perspectives and Issues in Machine Learning, Concept of Learning Task, Concept Learning as Search, Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants, Perceptron, Linear Separability, Linear Regression, Case Study : Inventory Prediction

UNIT II SUPERVISED LEARNING 9

Supervised learning, Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting, Evaluating and debugging learning algorithms. Classification Case Study: Object Recognition

UNIT III UNSUPERVISED LEARNING 9

Clustering K-means, Association analysis with the Apriori algorithm, Expectation Maximization algorithm. Mixture of Gaussians, Factor analysis, Principal components analysis, Independent components analysis. Case Study: Planning a vacation.

UNIT IV REINFORCEMENT LEARNING 9

Markov decision process (MDP). Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR), Linear Quadratic Gaussian, Q-learning. Value function approximation, Policy search, Reinforce, POMDPs.

UNIT V GRAPHICAL MODELS 9

Markov Chain Monte Carlo Methods, Sampling, Proposal Distribution, Markov Chain Monte Carlo, Graphical Models, Bayesian Networks, Markov Random Fields, Hidden Markov Models, Tracking Methods..

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 1st Edition, 2012.
2. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 1st Edition, 2006.
3. Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning Using Python”,Wiley, 1st Edition, 2019.

REFERENCES

1. Dr. Rajiv Chopra, “Machine Learning”, Khanna Book Publishing Co. (P) LTD, 1st Edition, 2018.
2. Anuradha Srinivasaraghavan, Vincy Joseph, “Machine Learning”, Wiley publication, 1st Edition, 2019.

19CS18E	NATURE AND BIO INSPIRED COMPUTING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Understand the natural phenomena that motivate the algorithms (K2)
CO 2: Understand genetic algorithm and differential evolution (K2)
CO 3: Understand swarm optimization and ant colony for feature selection. (K2)
CO 4: Select the appropriate strategy or optimal solution based on bio-inspired algorithms (K3)
CO5: Apply the optimization algorithms for the problems.(K5)

UNIT I NATURAL COMPUTING 9

From nature to natural computing, sample idea, Philosophy of natural computing, Natural computing approaches, Conceptualization – general concept, Problem solving as a search track, Hill climbing, Simulated annealing.

UNIT II EVOLUTIONARY COMPUTING 9

Evolutionary computing: Evolutionary biology, Evolutionary computing – standard evolutionary algorithm; Genetic algorithm, evolutionary strategies, Evolutionary programming.

UNIT III SWARM INTELLIGENCE 9

Swarm intelligence-biological motivation, from natural to artificial, standard algorithm of Ant colony optimization, Ant clustering algorithm, Particle swarm optimization.

UNIT IV BIOLOGICAL MOTIVATION 9

Biological motivation, from natural to artificial, standard algorithm of cuckoo search, bat algorithm, flower pollination, firefly algorithm, framework for self tuning algorithms - case study of firefly algorithm.

UNIT V APPLICATIONS 9

Travelling Salesman problem- NP Hard Problem- Routing Problem- Machine Learning Problem- The Ant Net Algorithm -Heating System Planning Problem- Job Shop Scheduling Problem for Minimization of Makespan

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Tao Song , Pan Zheng , Mou Ling Dennis Wong,Xun Wang ,“ Bio-Inspired Computing Models and Algorithms” , World Scientific Publishing Pvt. Ltd., Kindle 1st Edition, 2019.
2. D. Floreano and C. Mattiussi, “ Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, MIT Press, 2nd Edition 2010.
3. L. N. de Castro, “Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications”, CRC Press, 1st Edition, 2006.
4. Marco Dorigo, Thomas Stutzle, “Ant Colony Optimization”, MIT Press, 1st Edition 2006.
5. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, “Swarm Intelligence: From Natural to Artificial Systems,” Oxford University press, 1st Edition, 2000.

REFERENCES

1. Sam Jones (Editor), “Bio Inspired Computing-Recent Innovations and Applications”, Clanrye International; 2nd Edition, 2015.
2. Yang Xiao, “Bio-Inspired Computing and Networking”, CRC Press.2016.
3. Adries Engelbrecht, “Computational Intelligence”, Wiley, 2nd Edition, 2007.
4. D.Floreano and C. Mattiussi, “Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, MIT Press, 1st Edition, 2008.
5. Russell C. Eberhart, Yuhui Shi , James Kennedy, “ Swarm Intelligence: The Morgan Kaufmann Series in Evolutionary Computation”, 1st Edition, 2001.
6. M. Goodrich, Tamassia, “Algorithm Design & Applications”, Wiley, 1st Edition, 2017.

19CS19E	NATURAL LANGUAGE PROCESSING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify the different linguistic components of natural language (K2)
CO2: Design a morphological analyser for a given natural language (K3)
CO3: Decide on the appropriate parsing techniques necessary for a given language (K2)
CO4: Understand the role of semantics of sentences and pragmatics (K2)
CO5: Design applications involving natural language (K3)

UNIT I INTRODUCTION 9

Introduction to Natural Language Processing, Origins and challenges of NLP -Language and Grammar, Information Retrieval. Language Modeling: Various Grammar-based Language Models -Statistical Language Model, Representation and understanding, Linguistic background.

UNIT II MORPHOLOGY AND PART-OF-SPEECH PROCESSING 9

Morphology and Part-Of-Speech Processing Introduction –Regular Expressions and Automata-Non-Deterministic FSAs. Transducers –English Morphology -Finite-State Morphological Parsing -Porter Stemmer -Tokenization-Detection and Correction of Spelling Errors. N-grams –Perplexity - Smoothing -Interpolation -Backoff. Part-of-Speech

Tagging –English Word Classes -Tagsets -Rule-Based -HMM -Transformation-Based Tagging-Evaluation and Error Analysis. Hidden Markov and Maximum Entropy Models

UNIT III SYNTAX ANALYSIS 9

Syntax Analysis Finite-State and Context-Free Grammars -Dependency Grammars. Syntactic Parsing – Ambiguity -Dynamic Programming Parsing Methods –CKY-Earley and Chart Parsing-Partial Parsing-Evaluation. Statistical Parsing –Probabilistic Context-Free Grammars –Probabilistic CKY Parsing of PCFGs –Probabilistic Lexicalized CFGs –Collins Parser – Shallow parsers – Dependency parsing.

UNIT IV SEMANTIC ANALYSIS & PRAGMATICS 9

Semantic and Pragmatic Interpretation Representation of Meaning –Desirable Properties -Computational Semantics -Word Senses -Relations Between Senses –WordNet -Event Participants-Proposition Bank -Frame Net -–Metaphor. Computational Lexical Semantics –Word Sense Disambiguation-Supervised Word Sense Disambiguation -Dictionary and Thesaurus Methods – Word Similarity - Minimally Supervised WSD - Hyponymy and Other Word Relations - Semantic Role Labeling -Unsupervised Sense Disambiguation. Computational Discourse - Discourse Segmentation - Unsupervised Discourse - Segmentation - Text Coherence -Reference Resolution – Phenomena – Features and algorithms - Pronominal Anaphora Resolution.

UNIT V APPLICATIONS 9

Applications Information Extraction –Named Entity Recognition -Relation Detection and Classification –Temporal and Event Processing -Template-Filling -Biomedical Information Extraction. Question Answering and Summarization - Information Retrieval -Factoid Question Answering -Summarization -Single and Multi-Document Summarization - Focused Summarization -Evaluation. Dialog and Conversational Agents –Properties of Human Conversations -Basic Dialogue Systems.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Sowmya Vajjala, Bodhisattwa Majumder and Anuj Gupta,” Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems”, O’ Reilly, 1st Edition, 2020.
2. Emily M. Bender and Alex Lascarides “Linguistic Fundamentals for Natural Language Processing II: 100 Essentials from Semantics and Pragmatics”, Morgan and Claypool , 1st Edition, 2019.
3. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Pearson Publication, 1st Edition, 2014.
4. James Allen “Natural Language Understanding”, Pearson Publication 8th Edition, 2012.

REFERENCES

1. NitinIndurkhya, Fred J. Damerau, “Handbook of Natural Language Processing”, (Chapman & Hall/CRC Machine Learning & Pattern Recognition), 2nd Edition, 2010.

2. Alexander Clark, Chris Fox, Shalom Lappin, “The Handbook of Computational Linguistics and Natural Language Processing”, Wiley-Blackwell, 2nd Edition, 2010.
3. https://nptel.ac.in/courses/106/105/106105158/
4. https://www.coursera.org/learn/language-processing

19CS20E	COMPUTER VISION AND IMAGE PROCESSING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explore the goals of computer vision and methods of image formation. (K2)
CO2: Realize the fundamental image processing techniques of computer vision. (K2)
CO3: Explore the computational methods on digital images.(K3)
CO4: Extract features form Images and do analysis of Images.(K3)
CO5: Elaborate understanding on object detection techniques.(K2)

UNIT I IMAGE FORMATION AND IMAGE PROCESSING 9

Introduction to Computer Vision - Goals of Computer Vision - Image Formation and Radiometry -Image formation- Radiometric quantities - Shape from shading - Photometric stereo-2D transformations- 3D transformations- Single camera setup of image formation - Image formation in a stereo vision setup - Basics of stereo correspondence-Inverse Radon transform- back-projection method - Inverse Radon transform - Fourier transform method

UNIT II IMAGE PROCESSING CONCEPTS 9

Fundamentals-Point operations-Geometric operations-Spatial operations-Operations between images-Discrete Fourier transform - Discrete cosine transform - K-L transform-Wavelet transform-Curvelet transform - Ridgelet transform- Shearlet transform-Contourlet transform- Spatial domain filtering-Frequency domain filtering-Homomorphic filtering-Wiener filter for image restoration-Colour models-Colour constancy-Colour image enhancement and filtering

UNIT III MORPHOLOGY AND IMAGE SEGMENTATION 9

Mathematical Morphology - Binary morphological operations- Applications of binary morphological operations - Grayscale morphological operations - Distance transformation - Image Segmentation – Threshold - Region-based segmentation methods-Edge detection-based segmentation - Deformable models for image segmentation – Image Segmentation Applications

UNIT IV IMAGE FEATURES 9

Image Descriptors and Features - Texture Descriptors - Texture representation methods - Gabor filter - MPEG-7 homogeneous texture descriptor- Local binary patterns -Colour Features - Edge Detection- Gradient-based methods-Laplacian of

Gaussian operator-Difference of Gaussian operator- Canny edge detector- Hough transform for detection of a line and other shapes- Chain code and shape number - Fourier descriptors - Boundary representation by B-spline curves- SUSAN edge and corner point detector - Moravec corner detector- Feature extraction applications

UNIT V PATTERN RECOGNITION 9

Introduction - Linear Regression - Linear discriminant functions for pattern classification - Minimum distance classifier - Elementary Statistical Decision Theory - Gaussian Classifier - Parametric approaches - Non-parametric approaches - Clustering for Knowledge Representation-Dimension Reduction - Unsupervised-Supervised - Semi-supervised linear dimension reduction - Finding patterns in an image - Shape similarity measurement by Hausdorff distance-Object recognition applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. M.K.Bhuyan, “Computer Vision and Image Processing: Fundamentals an Applications”, CRC Press, 2nd Edition, 2020.
2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Pearson Education, 4th Edition, 2018.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2016.

REFERENCES

1. Sonka, Hlavac, and Boyle. Thomson, “Image Processing, Analysis, and Machine Vision”, Cengage Learning, 4th Edition, 2017.
2. D. Forsyth and J. Ponce, “Computer Vision - A modern approach”, Pearson Education, Inc., 2nd Edition, 2015.
3. B. K. P. Horn, “Prentice Hall Robot Vision”, McGraw-Hill, 1st Edition, 2015.

19CS21E	STORAGE AREA NETWORKS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify the challenges in managing information and analyze the potency of different storage networking technologies (K2).

CO2: Understand about components and implementation of Network Attached Storage (NAS) (K2).

CO3: Understand the different types of backup, archives and forms of virtualization (K2).

CO4: Identify the cloud computing infrastructure and services to store the massive data (K3).

CO5: Apply the secure storage infrastructure and management activities (K3).

UNIT I STORAGE SYSTEMS 9

Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host, Connectivity, Storage. RAID: Implementation Methods, Techniques, RAID Impact on Disk Performance. Intelligent Storage Systems: Components, Storage Provisioning.

UNIT II PRINCIPLES OF DESIGN THINKING 9

Fibre Channel Storage Area Networks: Components, connectivity, Architecture, Zoning, Topologies, Virtualization, IP SAN, FCoE, iSCSI, FCIP, Network Attached Storage: Components, I/O Operation, File Sharing Protocols, File-Level Virtualization, Object based Storage, Unified Storage: Object based Storage Devices, Content Addressed Storage.

UNIT III BACKUP, ARCHIVE AND REPLICATION 9

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication, Data Archive, Local Replication: Terminology, Applications, Technologies, Virtualized Environment. Remote Replication: Technologies, Three-Site Replication, Virtualized Environment Remote Replication and Migration.

UNIT IV CLOUD COMPUTING AND VIRTUALIZATION 9

Cloud computing: Technologies, Characteristics, Benefits, Infrastructure, challenges, Cloud Service Models, Cloud Deployment Models, Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances, Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications. Case study: own Cloud configuration.

UNIT V SECURING AND MANAGING STORAGE INFRASTRUCTURE 9

Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, SAN Security Implementations, Securing Storage Infrastructure: Virtualized Environment, Cloud Environments. Storage Infrastructure: Monitoring, Management activities and Challenges, Information Lifecycle management, Storage Tiering.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Robert Spalding, “Storage Networks: The Complete Reference”, McGraw Hill Education, Indian Edition, 1st Edition, 2017.
2. Waman S Jawadekar, Sanjiva Shankar Dubey, “Management Information System: Text and Cases”, McGraw Hill, 6thEdition, 2020.
3. Ramesh Behl, James A. O’Brien, George M. Marakas, “Management Information Systems”, McGraw Hill India, 11th Edition, 2019.

REFERENCES

1. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas, "Introduction to Storage Area Networks", IBM, International Technical Support Organization, Red Books, 9th Edition, 2017.
2. Rahul De, "MIS: Managing Information Systems in Business, Government and Society", Wiley; 2ndEdition, 2018.
3. https://doc.owncloud.com/server/admin_manual/configuration/

19CS22E	**WIRELESS ADHOC NETWORKS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course students will be able to

- CO1: Understand the basis of wireless Ad-hoc networks. (K2)
- CO2: Acquire design, operation and the performance of MAC layer protocols of wireless Ad-hoc networks. (K2)
- CO3: Recognize operation and the performance of routing protocol of wireless Ad-hoc network.(K3)
- CO4: Aware about design, operation and the performance of transport layer protocol of Wireless Ad-hoc networks.(K2)
- CO5:Investigate the importance of security in wireless Ad-hoc networks.(K3)

UNIT I WIRELESS LANS AND PANS 9

Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF. Wireless ad hoc networks: Introduction, Issues in Wireless Ad Hoc Networks.

UNIT II MAC PROTOCOLS 9

Introduction, Issues in Designing a MAC protocol for Wireless Ad Hoc Networks, Design goals of a MAC Protocol for Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT III ROUTING PROTOCOLS 9

Introduction, Issues in Designing a Routing Protocol for Wireless Ad Hoc Networks, Classification of Routing Protocols, Table Driven Routing Protocols: OLSR & STAR, On Demand Routing Protocols: AODV & TORA, Hybrid Routing Protocols: ZRP & ZHLS, Location aware Protocols: GPSR & GLR, Cluster based Routing Protocols: LEACH & TEEN, Power Aware Routing Protocols : DEAR & MEHDSR.

UNIT IV TRANSPORT LAYER PROTOCOLS 9

Introduction, Issues in Designing a Transport Layer Protocol for Wireless Ad Hoc Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Wireless Ad Hoc Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT V SECURITY IN WIRELESS ADHOC NETWORKS 9

Security in Wireless Adhoc Networks Introduction – Security issues in adhoc networks-Keying Management- Security Requirements - Attacks on adhoc Networks - Secure Routing: Secure AODV, ARAN, SEAD and MASK-Intrusion detection systems-Policy Management.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Mohammed Ilyas, “The hand book of wireless adhoc networks”, CRC Press, 1st Edition, 2017.
2. Jing selena He, ShoulingJi, Yipan, and Yingshu Li, “Wireless adhoc and sensor Networks Management, Performance and Applications”, 2nd Edition, CRC Press, 2019.
3. C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall Professional Technical Reference, 2nd Edition, 2008.
4. Farooq Anjum and Petros Mouchtaris, “Security for wireless ad hoc networks”, Wiley Interscience publication, 1st Edition, 2010.

REFERENCES

1. Hai Lu, Yiu wing and Xiaawen “Adhoc and sensor Wireless Networks: Architectures, Algorithms and Protocols”, Benthem press, 1st Edition, 2018.
2. Luigi, Gennaro, Giuseppe, Yaser and Claudis, “Ad-Hoc Networks and Wireless”, ADHOC-NOW 2020 Proceedings, Springer, 4th Edition, 2020.
3. Jesus Hamilton Ortiz and Alvaro, “Adhoc Networks”, ITexLi, 1st Edition, 2017.
4. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 1st Edition, 2011.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks - Technology, Protocols, and Applications”, John Wiley, 1st Edition, 2010.

19CS23E	**TCP / IP**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the architecture, design and behaviors of the internet and of the TCP/IP suite of protocols (K2)

CO2: Build an understanding of the fundamental concepts of internetworking. (K3)

CO3: Express their knowledge in various congestion control techniques and mechanisms in Quality of Service in networking.(K2)

CO4: Design active router queue management to avoid congestion control.(K3)

CO5: Acquire the knowledge of STCP and identify the issues in transport and application layers. (K2)

UNIT I NETWORK MODELS 9

Layered Tasks - OSI Model - TCP/IP Protocol suite -Addressing. Connecting devices: Passive Hubs - Repeaters - Active Hubs - Bridges - Two Layer Switches - Routers - Three Layer Switches - Gateway - Backbone Networks

9

UNIT II INTERNETWORKING CONCEPTS

Principles of Internetworking, Connectionless Interconnection - Application Level Interconnection - Network Level Interconnection - Internet Architecture - Interconnection through IP Routers TCP - UDP & IP: TCP Services - TCP Features – Segment - TCP Connection - Flow Control - Error Control - Congestion Control - Process to Process Communication - User Datagram - Checksum - UDP Operation - IP Datagram - Fragmentation, Options - IP Addressing: Classful Addressing - IPV6.

UNIT III CONGESTION AND QUALITY OF SERVICE 9

Data Traffic - Congestion: Congestion Control - Congestion Control in TCP - Congestion Control in Frame Relay - Source Based Congestion Avoidance - DEC Bit Scheme - Quality of Service - Techniques to Improve QOS: Scheduling - Traffic Shaping - Admission Control - Resource Reservation - Integrated Services and Differentiated Services.

UNIT IV QUEUE MANAGEMENT 9

Buffer Management - Drop Tail - Drop Front- Random Drop - Passive Buffer Management Schemes - Active Queue Management: Early Random Drop - RED Algorithm.

UNIT V STREAM CONTROL TRANSMISSION PROTOCOL 9

Introduction - Packet Format – Flow Control - Error Control - Congestion Control. Mobile Network Layer: Entities and Terminology - IP Packet Delivery - Agents - Addressing - Agent Discovery, Registration - Tunnelling and Encapsulating - Inefficiency in Mobile IP. Mobile Transport Layer : Classical TCP Improvements - Indirect TCP - Snooping TCP - Mobile TCP - Fast Retransmit/Fast/Recovery – Transmission - Timeout Freezing-Selective Retransmission - Transaction Oriented TCP.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill Education, 5th Edition, 2017.
2. Behrouz A Forouzan, “TCP/IP Protocol Suite”, McGraw-Hill Education, 4th Edition, 2017.

REFERENCES

1. W. Richard Stevens, Kevin R. Fall, “TCP/IP Illustrated”, Addison-Wesley Professional, 2nd Edition, 2012.
2. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” Elsevier, 5th Edition, 2014.
3. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, 2015.

19CS24E	CYBER FORENSICS AND ETHICAL HACKING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basics of computer forensics (K2)
CO2: Apply a number of different computer forensic tools to a given scenario (K3)
CO3: Analyze and validate forensics data (K3)
CO4: Identify the vulnerabilities in a given network infrastructure (K2)
CO5: Implement real-world hacking techniques to test system security (K3)

UNIT I INTRODUCTION TO COMPUTER FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.

UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Computer Forensics Tools: Deleted Digital Data Restoration Tools - Data Recovery Pro, Recuva, Deleted Partitions Restoration Tools – Ease US Partition Recovery Wizard, Active Partition Recovery.

UNIT III ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

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UNIT IV ETHICAL HACKING 9

Introduction to Ethical Hacking – Foot printing and Reconnaissance – Scanning Networks – Enumeration – System Hacking – Malware Threats – Sniffing

UNIT V ETHICAL HACKING IN WEB 9

Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications – SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms.

L : 45; TOTAL : 45 PERIODS

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 1st Edition, 2016.
2. Kimberly Graves, “CEH official Certified Ethical Hacking Review Guide”, Wiley India Edition, 1st Edition, 2016.

REFERENCES

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2nd Edition, 2015.
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2020.

3. AnkitFadia, “Ethical Hacking”, Macmillan India Ltd, 2nd Edition, 2006.
4. Kenneth C.Brancik, “Insider Computer Fraud”, Auerbach Publications Taylor Francis Group, 1st Edition, 2019.

19CS25E	**SOFTWARE DEFINED NETWORKS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to**:**

CO1: Comprehend the evolution of software defined networks.(K2)
CO2: Express the specifications of SDN Controllers. (K2)
CO3: Describe the SDN solutions for the Data Centre Network.(K3)
CO4: Explicate network function virtualization and ecosystem.(K2)
CO5: Comprehend various SDN Applications.(K3)

UNIT I INTRODUCTION 9

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Need for SDN – Evolution of SDN – SDN Working Principle – SDN Operation - SDN Devices - SDN Controller - SDN Applications - Alternate SDN Methods

UNIT II OPEN FLOW SDN CONTROLLERS 9

Open Flow Specification – Drawbacks of Open SDN- SDN via APIs- SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Protocol Models - SDN Controller Models - Application Models

UNIT III DATA CENTERS AND OTHER NETWORK ENVIRONMENT 9

Definition – Demands - Tunnelling Technologies - Path Technologies - Ethernet Fabrics - SDN Use Cases - Comparison of Open SDN, Overlays, and APIs - Real-World Implementations -Wide Area Networks - Service Provider and Carrier Networks - Campus Networks - Hospitality Networks - Mobile Networks

UNIT IV NETWORK FUNCTION VIRTUALIZATIONAND SDN ECOSYSTEM 9

Definition – Uses - Standards - Open Platform NFV - Leading NFV Vendors - SDN vs NFV - In-Line Network Functions – Software Vendors - White-Box Switches - Cloud Services and Service Providers

UNIT V SDN APPLICATIONS 9

Terminology - Application Types - History of SDN Controllers - Reactive Java Application - Controller Considerations - Network Device Considerations - Creating Network Virtualization Tunnels - Offloading Flows in the Data Center - Access Control for the Campus - Traffic Engineering for Service Providers

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 1st Edition, 2019.

2. Paul Goransson Chuck Black Timothy Culver," Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann, 2nd Edition, 2016.

REFERENCES

1. SiamakAzodolmolky, "Software Defined Networking with Open Flow", Packet Publishing, 2nd Edition, 2017.
2. Vivek Tiwari, "SDN and Open Flow for Beginners", Amazon Digital Services, Inc., 1st Edition, 2017.
3. Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", CRC Press, 1st Edition, 2014.

19CS26E	CLOUD COMPUTING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: Recognize the fundamental concepts of Cloud Computing (K2)
CO2: Familiar with the various types of virtualization and its importance (K2)
CO3: Explore the various cloud infrastructures and application (K2)
CO4: Analyze the methods used for secure cloud access and application development (K3)
CO5: Analyze the various cloud platforms to provide cloud based services for complex applications. (K3)

UNIT I CLOUD COMPUTING BASICS 9

Introduction to Cloud Computing: Roots of Cloud Computing-Layers and Types of Clouds-Desired Features of a Cloud-Cloud Infrastructure Management – Infrastructure As A Service Providers-Platform As Service Providers-Challenges and Risks-Migrating into a Cloud: Broad Approaches to Migrating into the Cloud-The Seven-Step Model of Migration into a Cloud.

UNIT II VIRTUALIZATION 9

Basics of Virtualization: Characteristics – Taxonomy of Virtualization Techniques – Hardware Level Virtualization – Operating System Level Virtualization – Virtualization and Cloud Computing – Pros and Cons of Virtualization – Case Study: XEN, VMware.

UNIT III CLOUD ARCHITECTURE AND SERVICES 9

Cloud Architecture – Cloud Services: Infrastructure as a Service – Platform as a Service – Software as a Service – Types of Cloud: Private Cloud – Public Cloud – Hybrid Cloud – Community Cloud – Challenges – Cloud Applications- Scientific Applications – Business Applications

UNIT IV IAAS & PAAS 9

Virtual Machines Provisioning and Migration Services - Virtual Machines Provisioning and Manageability- Virtual Machine Migration Services - VM Provisioning and Migration in

Action - Provisioning in the Cloud Context - Aneka-Integration of Private and Public Clouds - Technologies and Tools for Cloud Computing - Aneka Cloud Platform - Aneka Resource Provisioning Service - Hybrid Cloud Implementation - CometCloud Architecture - Autonomic Behaviour of CometCloud - CometCloud-based Applications.

UNIT V INDUSTRIAL PLATFORMS AND APPLICATION DEVELOPMENT 9

Service creation environments - Compute Services – Storage Services – Communication Services – Additional Services - Google App Engine – Architecture core concepts – Application life cycle – Cost model – Azure core concepts – SQL Azure – platform appliance- Develop cloud based applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, “Mastering in Cloud Computing”, Tata McGraw Hill Education Private Limited (New Delhi), 1st Edition, 2017.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski “Cloud Computing Principles and Paradigms” John Wiley & Sons, Inc., Hoboken, New Jersey, 1st Edition, 2013.

REFERENCES

1. Barrie Sosinsky, Cloud Computing Bible, Wiley Publishing, Inc, 1st Edition, 2014.
2. Michael Miller, Cloud Computing: “Web-Based Applications That Change the Way You Work and Collaborate Online”, 2nd Edition, 2009.

19CS27E	ROBOTIC PROCESS AUTOMATION IN CLOUD	L	T	P	C	QP
		3	0	0	3	A

COURSEOUTCOMES

Upon completion of this course, the student will be able to

CO1: recognize the basic concepts of the robotic process automation and its tools (K3)
CO2: explore the various concepts of the cloud to provide cloud based services (K2)
CO3: analyze the various azure services and tools used in various applications (K3)
CO4: apply and understand the various security and privacy policies in azure (K3)
CO5: create cloud azure subscriptions and to analyze its services and support (K4)

UNIT I INTRODUCTION TO RPA AND ITS TOOLS 9

Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots. Blue Prism Introduction – Architecture - Operating Model- Features - Applications. Introduction to Automation Anywhere – Architecture - Features – Deployment - Security – Applications. Introduction to UiPath - Architecture and Operating Model – Orchestrator – Multi Tenant Architecture – Applications.

UNIT II CLOUD CONCEPTS 9

Introduction to Cloud Computing: definition, private, public and hybrid cloud. Roots of Cloud Computing-Layers and Types of Clouds Desired Features of a Cloud-Cloud Infrastructure Management-Infrastructure As A Service Providers-Platform As Service Providers-Challenges and Risks-Migrating into a Cloud: Broad Approaches to Migrating into the Cloud-The Seven-Step Model of Migration into Cloud. Benefits and challenges of cloud computing, public vs private clouds. Benefits and challenges to the Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

UNIT III CLOUD AZURE SERVICES 9

Introduction – Azure architectural components – Azure regions – Azure resource manager (ARM) - Azure core products in market place and its usage scenarios – Azure solutions: IOT, Big data and Artificial Intelligence – Azure Management tools – Azure and Power shell – Azure CLI- Azure Advisor.

UNIT IV CLOUD AZURE SECURITY AND PRIVACY 9

Introduction – Azure security and Network connectivity – Azure Firewall –DDoS protection – Azure identity services- Azure security tools - Azure security center – key vault – Information Protection – Azure governance methodologies – Azure privacy, compliance and data protection standards – Microsoft Privacy statements – Trust Center – Service trust portal – Compliance manager.

UNIT V CLOUD AZURE SUBSCRIPTIONS AND SUPPORT 9

Azure subscriptions – uses and options – Case study: Creation of Azure user subscription - planning and management costs – products and services – factors affecting costs – cost management- support plans – service level agreement (SLA) – Azure service lifecycle.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Alok Mani Tripathi, “Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool- UiPath”:- Create Software robots with the leading RPA tool- UiPath, 2018.
2. Gerardus Blokdyk, “Robotic Process Automation A Complete Guide”, 2020.
3. Jim Cheshire, “Microsoft Azure Fundamentals – Exam Ref Second Edition AZ-900”:- Microsoft Press, 2020.
4. John W. Ritting house, James F. Ransome, “Cloud Computing” by CRC Press, 2017.

REFERENCES

1. Tim Woodruff, “Learning Service Now: Administration and Development on the Now Platform, for Powerful IT Automation”, 2nd Edition Book, 2018.
2. Aashish Rudra Srivastava, “Service New Automation” Packt Publishing Limited, 2018.
3. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, Mastering in Cloud Computing-‖, Tata McGraw Hill Education Private Limited (New Delhi), 2015.

4. Sanjay Chaudhary, Gaurav Somani," Research Advances in Cloud Computing", Springer Publications, 2018.
5. https://azure.microsoft.com/en-in/overview/what-is-azure/ for Microsoft azure platform.
6. Mustafa Toromon and Tom Janetscheck, "Mastering Azure security", 2020
7. Dr.Kumarsaurabh, "Cloud computing – Architecting next gen-transformation paradigms", 4th Edition, Wiley publications, 2017.

19CS28E	**CLOUD SECURITY**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the fundamentals of cloud security (K2)
CO2: Explore the cloud security architecture (K2)
CO3: Apply the key concepts of cloud platforms and provide storage services for load balancing in cloud architecture. (K3)
CO4: Assess the security of virtual systems and Analyse attacks on the VM (K3)
CO5: Examine the risks involved in cloud security (K2)

UNIT I INTRODUCTION TO CLOUD SECURITY 9

Cloud Security objectives-Cloud security services-Cloud security design principles-Secure cloud software requirements -Approaches to Cloud Software Requirements Engineering-Cloud Security Policy Implementation and Decomposition-Secure Cloud Software Testing.

UNIT II CLOUD SECURITY ARCHITECTURE 9

Cloud Computing Security Architecture-Architectural considerations, Identity Management and Access Control, Autonomic Security.

UNIT III CLOUD PLATFORMS 9

Structure & security – Storage services - Networking and databases service- App services and web apps- Virtual machine-Case studies using open stack.

UNIT IV VIRTUALIZATION BASED SECURITY ENHANCEMENT 9

Guest hopping - attacks on the VM - VM migration attack - hyper jacking- IBM security - virtual server protection - virtualization-based sandboxing - Storage Security- HIDPS - log management - Data Loss Prevention.

UNIT V CLOUD RISK MANAGEMENT 9

Cloud Computing Risk Issues: The CIA Triad-Threats to Infrastructure, Data and Access Control-Cloud Service Provider Risks-Cloud Computing Security Challenges: Security Policy Implementation.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Michael Collier, Robin Shahan, “Fundamentals of Azure”, Microsoft press, 1st Edition, 2016.
2. Dr.Immad M Abbadi, “Cloud Management and Security” Wiley-Blackwell publication, 2nd Edition, 2015.
3. Ronald L.Krutz and Russell Dean Vines,” Cloud Security: A Comprehensive Guide to Secure”, Wiley-India, 2nd Edition, 2013.

REFERENCES

1. Bernard Golden, “Amazon webservices”, John Wiley & Sons, Inc, 1st Edition, 2015.
2. Maddiestigler, “Beginning Serverless Computing-Developing with Amazon Web Services, Microsoft Azure, and Google Cloud”, APress, 2nd Edition, 2018.
3. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 1st Edition, 2014.

19CS29E	**INTERNET OF THINGS**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basics of IoT and its application sectors (K2)
CO2: Recognize and apply IoT protocols appropriately (K2)
CO3: Realize the IoT Reference Architecture and Real-World Design Constraints (K2)
CO4: Design a portable IoT using Raspberry Pi (K3)
CO5: Deploy an IoT application and connect to the cloud (K3)

UNIT I INTRODUCTION 9

Definitions and functional requirements –IoT conceptual framework – IoT architectural view – Technology behind IoT - Components of Internet of Things: Control units – Sensors – Communication modules – Power sources. Communication technologies: RFID – Bluetooth – ZigBee – WiFi – RF Links – Mobile Internet – Wired Communication – M2M communication – Examples of IoT.

UNIT II BASICS OF NETWORKING AND COMMUNICATION PROTOCOLS 9

Sensor technology – Actuator - Participatory sensing, industrial IoT and automotive IoT – Data acquiring and storage – organizing the data – analytics – knowledge acquiring, managing and storing processes - Sensor data communication protocols - Functions of CoAP, MQTT, OAuth2, XMPP, CoAPvs HTTP, CoAP Structure Model, Security Protocol and Application for CoAP.

UNIT III IOT PLATFORMS 9

Arduino Platform - Programming Arduino for the Internet of Things - Reading from Sensors - Communication: Connecting Arduino with a mobile device - Communicating using Bluetooth - Communicating using USB - connection with the Internet using Wifi / Ethernet.

UNIT IV RASPBERRY PI AND CLOUD SERVICES 9

Basic building blocks of an IoT Device - Raspberry Pi - Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Cloud Storage Models & Communication APIs - WAMP - AutoBahn for IoT - Xively Cloud for IoT.

UNIT V CASE STUDIES 9

The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case Studies Illustrating IoT Design: IoT in Cities / IoT in the Home/ IoT in Healthcare / IoT in Agriculture. autonomous vehicles, Google Assistant based IO Control. IoT Platforms Design Methodology case studies: Intel IoT Framework, Qualcomm IoT Framework, Microsoft IoT Framework.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands -on Approach", University Press, 1st Edition, 2015.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw-Hill Education Pvt. Ltd., 1st Edition, 2018.
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Academic Press, 1st Edition, 2014.
4. Charalampos Doukas, "Building Internet of Things with the Arduino", Create Space, 2nd Edition, 2013.
5. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From parallel processing to the Internet of Things", Morgan Kaufmann Publishers, 1st Edition, 2012.
6. Marco Schwatrz, "Internet of Things with Arduino Cookbook", Packt Publications, 1st Edition, 2016.

REFERENCES

1. Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things", published by Wiey, 1st Edition, 2015.
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", VPT, 1st Edition, 2014.
3. Marco Schwatrz, "Internet of Things with Arduino Cookbook", Packt Publications, 1st Edition, 2016.
4. Nick Antonopoulos and Lee Gillam, "Cloud Computing: Principles, Systems and Applications", 2nd Edition, Springer, 2017.
5. http://www.buildinginternetofthings.com/
6. http://www.theinternetofthings.eu
7. http://postscapes.com/projects
8. http://www.internetofthings.fi/
9. http://aws.amazon.com/

19CS30E	**ADVANCED JAVA PROGRAMMING**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand J2EE appraise and Collections Framework. (K2).
CO2: Apply the various network programming constructs in Java (K3)
CO3: Create web application using Java Server pages. (K4)
CO4: Develop web services-based application using SOAP and RESTful WS (K4)
CO5: design and develop enterprise applications using Spring and Ember JS (K3)

UNIT I J2EE AND COLLECTIONS FRAMEWORK 9

Introduction to J2EE – Java Platform-J2EE Architecture Types-Explore Java EE Containers, Types of Servers in J2EE Application-Enterprise java beans-Session Beans – Entity Beans – Persistent Entity Beans-Collections Framework: Enumerations - Stack - Queue – Sets – Maps - Utility Classes-Generics in Java- Primitive Wrapper classes-Comparable Interface-Comparator Interface.

UNIT II NETWORK PROGRAMMING IN JAVA 9

Looking up internet address: Inet Address class – Inet4Address- Network Interface Class – URL class: URL Encoder and Decoder classes- URI Class- Socket Class – Sockets for client sockets for server- Multicast Sockets-Java Messaging Services. JNI: primitive types – overloading & overriding native methods - Accessing Instance Fields of a Java Class in C/C++ - Resolving Native File Stream Conflicts.

UNIT III JAVASERVER PAGES 9

Introduction to JSP - Comparison with Servlet - JSP Architecture - JSP Life Cycle – JSP Scripting Elements - JSP Directives - JSP Implicit Objects - JSP Standard Tag Libraries - JSP Session Management - JSP CRUD Application.

UNIT IV JAVA WEB SERVICES 9

WS Components- WS Features-SOAP web services-RESTful web services- Web Services Security- JAX-WS in Java Application Servers-Develop and Execute SOAP and RESTful Web Service based Application.

UNIT V JAVA FRAMEWORKS 9

Spring Core Framework - Spring RESTful web services Framework - Spring Transaction Management Framework - Spring Validation Framework. Spring Boot: Introduction - Rest Annotation with In Memory Database & CRUD Operations - JPA Repository Concepts - Micro Services. Ember JS: Architecture – Templates – Routing – Models – Views.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Paul. Deitel, Harvey Deitel, “Java How to Program” Prentice Hall Publications, 11th Edition, 2017.
2. Elliotte Rusty Harold, “Java Network Programming”, O’Reilly Media Inc., 4th Edition,

2013.

3. Martin Kalin Java Web Services: Up and Running, O'Reilly Media, Inc., 2nd Edition, 2013.
4. Phillip Hanna, “JSP 2.0: The Complete Reference”, 2nd Edition, McGraw Hill Education, 2017.
5. Dinesh Rajput, “Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot” Packt Publisher, 2018.

REFERENCES

1. Patrick Naughton, “Complete Reference: Java 2”, Tata McGraw-Hill, 5th Edition, 2017.
2. Cay S.Hortsmann, Gray Cornell, “Core Java: Volume II – Advanced Features”, Pearson Education, 10th Edition, 2017.
3. Ed Roman, Rima Patel Sriganesh, Gerold Brose, “Mastering Enterprise Java Beans”, John Wiley & Sons Inc., 2012.
4. Jesse Cravens, Thomas Q Brady, “Building Web Apps with Ember.js: Write Ambitious JavaScript”, 1st Edition, O'Reilly Media, 2014.

19CS31E	**MOBILE APPLICATION DEVELOPMENT**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the Concepts of Mobile Application.(K1)
CO2: Analyze and Design UI in the context of mobile application. (K2)
CO3: Analyze how the Android platform uses Intents.(K2)
CO4: Understand the concept of Data storage and Content providers (K1).
CO5: Develop mobile applications for Android. (K3)

UNIT I INTRODUCTION 9

Mobile Applications – Characteristics and Benefits –Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Web vs Mobile App.

UNIT II USER INTERFACE 9

User Interface Design part 1: Views & View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. User Interface Design Part 2: Menus, Action Bars, and Notifications: Status, Toasts and Dialogs.

UNIT III INTENTS AND BROADCAST RECEIVERS 9

Introducing intents- Using intent to launch activities- Introducing Linkify- Using intents to Broadcast Events- Creating Intent filters and broadcast receivers –Using intent filters to services toimplicit intent- Using Intent Filters for Plug-Ins and Extensibility- Monitoring Device State Changes using Broadcast Intents.

UNIT IV CONTENT PROVIDERS AND DATA STORAGE 9

Content Providers: Contents provider, Uri, CRUD access, Browser, CallLog, Contacts, Media Store, and Setting. Data Access and Storage: Shared Preferences, Storage External, Network Connection. SQLite - SQLite Databases.

UNIT V ANDROID APPLICATION DEVELOPMENT 9

Designing Real world android application –Mapping out the application flow- Application source code- Managing jobs- Sever code- Building android application without SDK.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Joseph Annuzzi, Jr.,Lauren Darcey, Shane Conder "Introduction to Android Application Development", Addision-Wesley, 4th Edition, 2015.
2. Reto Meier, "Professional Android 4 Development", John Wiley and Sons, 2012.
3. W. Frank Ableson, RobiSen, Chris King, C. Enrique Ortiz, "Android in Action", 3rd Edition, 2012.

REFERENCES

1. ZigurdMednieks, Laird Dornin, G.BlakeMeike and Masumi Nakamura, "Programming Android", O‟Reilly, 2012.
2. http://developer.android.com/guide/index.html.

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19CS32E	UI / UX DESIGN	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the principles of UI/UX Design in order to design with intention. (K2)

CO2: Learn the effective user experience and the psychology behind user decision-making.(K2)

CO3: Understand the importance of design principles of good user interface. (K3)

CO4: Elucidate the implications for designing web application with multimedia and effects. (K3)

CO5: Develop meaningful user interface for mobile applications. (K3)

UNIT I INTRODUCTION 9

Introduction about UX - Five Main Ingredients of UX - Three "Whats" of User Perspective - Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

UNIT II USER OBSERVATION AND EXPERIENCE 9

User Research - Subjective Research - Objective Research - Sample Size - Three Basic Types of Questions. Observe a User: Watch How They Choose - Interviews - Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.

UNIT III USER INTERFACE DESIGN PRINCIPLES 9

Designing Behaviour: Designing with Intention - Rewards and Punishments - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust - Hidden versus Visible. Basic Visual Design Principles : Visual Weight - Contrast - Depth and Size - Color. Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - One Long Page or a Few Short Pages - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

UNIT IV WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-Pattern - F-Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

UNIT V MOBILE INTERFACE DESIGN 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Joel Marsh, “UX for Beginners”, O'Reilly Media, Inc., 1st Edition 2015.
2. Xia Jiajia, “UI UX Design”, O‟Reilly, Artpower International, 2016.
3. Brian Fling, “Mobile Design and Development”, O‟Reilly Media Inc., 1st Edition, 2009.

REFERENCES

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Pearson Education, 3rd Edition, 2004.
2. Alan Cooper, “The Essential Of User Interface Design”, Wiley Dream Tech Ltd., 2002.

19CS33E	SOFTWARE DESIGN ARCHITECTURE	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Analyze and design the object oriented model for a problem (K2)
CO2: Implement a combination of design patterns (K3)
CO3: Analyze, evaluate the application’s architecture (K3)
CO4: Develop Service Oriented Architecture (K5)
CO5: Design an architecture for real world problems (K5)

UNIT I OBJECT ORIENTED DESIGN 9

Object Oriented Modeling principles – Inheritance – Association, Aggregation, Composition - Class Responsibility Collaborator technique – UML class diagrams - Modularity, separation of concerns, information hiding, and conceptual integrity – Tradeoff between cohesion and coupling.

UNIT II DESIGN PATTERNS 9

Design patterns -User interface design issues. - Design principles: open-closed, dependency inversion, least knowledge- Identifying and refactoring anti-patterns - Micro kernel - Model-view-controller architectural pattern – Proxy design pattern - Master Slave Design Pattern.

UNIT III SOFTWARE ARCHITECTURE 9

Software Architecture - Patterns - Reference Model - Components - Stakeholders - Architectural styles: main program and subroutine, object-oriented, interpreters, pipes and filters, database centric, event-based - Layered and n-tier architectures - UML package - Behaviour of a system using UML activity diagrams. – Aspect Oriented architecture.

UNIT IV SERVICE-ORIENTED ARCHITECTURE 9

Web-based systems. – Web System services: SOAP over HTTP, WSDL, UDDI, BPEL - REST architecture: JSON over HTTP, URI. - REST design principles. – Microservice architecture.

UNIT V ARCHITECTURAL CASE STUDIES 9

Case Studies: Designing a URL shortening service like TinyURL - Designing youtube or Netflix - Designing a web crawler – KWIC (Key Word in Context), Instrumentation Software, Mobile Robotics - Email: SMTP, POP – Virtual Machine - SandBox.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Pearson Education India, 3rd Edition, 2015.
2. Humberto Cervantes, Rick Kazman, “Designing Software Architectures - A Practical Approach”, Pearson Education India, 1st Edition, 2017.
3. Craig Larman, “Applying UML Patterns: An Introduction to Object–Oriented Analysis, Design and Iterative Development”, Pearson Education India, 3rd Edition, 2015.

REFERENCES

1. Nick Rozanski, Edin Woods, “Software Systems Architecture - Working with Stakeholders Using Viewpoints and Perspectives”, Pearson Education India, 2 nd Edition, 2016.
2. Taylor, “Software Architecture: Foundations,Theory, and Practice”, John Wiley, 2010.
3. Clements, P., et al., “Documenting Software Architectures: Views and Beyond, Addison- Wesley”, 2nd Edition, 2010.
4. https://www.coursera.org/specializations/software-design-architecture
5. http://nptel.vtu.ac.in/econtent/courses/CSE/06IS72/index.php
6. http://csce.uark.edu/~cwt/COURSES/2011-01--CSCE-5013--SW-ARCH/syllabus.html
7. https://www.educative.io/courses/grokking-the-system-design-

interview/m2ygV4E81AR

		L	T	P	C	QP
19CS34E	**AUGMENTED REALITY AND VIRTUAL REALITY**	**3**	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: explore the interactive techniques in Virtual Reality(K3)
CO2: develop the simple framework of virtual reality(K3)
CO3: explore the research issues in Augmented Reality (K3)

UNIT I VIRTUAL REALITY 9

Introduction - Fundamental Concept and Components - Primary Features and Present Development on Virtual Reality. Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output -- Visual /Auditory / Haptic Devices.

UNIT II VISUAL COMPUTATION IN VIRTUAL REALITY 9

Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

UNIT III FRAMEWORKS AND APPLICATIONS 9

Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc. Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.

UNIT IV AUGMENTED REALITY 9

Introduction - Concepts-Hardware-Software- Taxonomy - Technology and features - Augmented reality methods - visualization techniques for augmented reality.

UNIT V AUGMENTED AND MIXED REALITY 9

Augmented Reality: Challenges – systems – functionality - wireless displays in educational augmented reality applications-mobile projection interfaces - marker-less tracking for augmented reality - enhancing interactivity in AR environments - evaluating AR systems.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Jesse Glover, Jonathan Linowes, "Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications", Kindle Edition, 1st Edition, 2019.
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.
3. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009.

REFERENCES

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Wiley-IEEE Press, 2nd Edition, 2006.
2. https://nptel.ac.in/courses/106/106/106106138/
3. https://booksite.elsevier.com/samplechapters/9780123749437/01~Front_Matter.pdf
4. http://staff.fhhagenberg.at/burger/publications/pdf/ifip-portugal94.pdf

19CS35E	WEB ANALYTICS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Recognize the concepts and terminologies required for web analytics (K2)
CO2: Comprehend the principles, methods and concepts used in web analytics.(K2)
CO3: Apply the appropriate metrics to analyze the web data. (K4)
CO4: Appreciate the concept of web goals and apply suitable filter in web analytics for tracking e-commerce sites. (K3)
CO5: Explore the use of tools and techniques involved in web analytics.(K2)

UNIT I INTRODUCTION 9

Web Analytics – Basics – Traditional Ways – Expectations – Data Collection – Click stream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing –Outcomes data – Competitive data – Search Engine Data.

UNIT II WEB ANALYTIC CONCEPTS 9

URLS – Cookies – Time on site – Page views – Understand standard reports – Website content quality – Navigation reports – Search Analytics – Internal search, SEO and PPC – Measuring Email and Multichannel Marketing - Competitive intelligence and Web 2.0Analytics – Segmentation – Connectable reports.

UNIT III WEB METRICS AND KPIs 9

Measuring Reach – Measuring Acquisition – Measuring Conversion – Measuring Retention – Focus on 'Critical Few'- Key Performance Indicators – Case Studies.

UNIT IV WEB GOALS AND FUNNELS 9

Filters - Ecommerce Tracking - Real Time Reports - Customer Data Alert - Adwords Linking - Adsense Linking -Attribution Modeling - Segmentation -Campaign Tracking - Multi-Channel Attribution

UNIT V WEB ANALYTIC TOOLS 9

Content organization tool – Process measurement tools- Visitor Segmentation Tools-Campaign Analysis – Commerce Measurement Tools -Google Analytics- Piwik Web Analytics – Emerging Analytics.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Michael Loban, Alex Yastrebenetsky, "Crawl, Walk, Run : Advancing Analytica Maturity with Google Marketing Platform", 2020.
2. Eric Fettman, Shiraz Asif, Feras Alhlou, “Google Analytics Breakthrough”, John Wiley & Sons, 2016.

REFERENCES

1. Brian Clifton,” Successful Analytics: Gain Business Insights by Managing Google Analytics”, Advanced Web Metrics Ltd, 2015.
2. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Sybex, 3rd Edition, 2012.
3. Michael Beasley, “Practical Web Analytics for User Experience: How Analytics can help you Understand your Users”, Morgan Kaufmann, 2013.
4. Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., “Game Analytics: Maximizing the Value of Player Data”, Springer, 2013.
5. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Content, and Usage Data”, 2nd Edition, Springer, 2011.

19CS36E	SOCIAL COMPUTING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of computational social sciences (K2)

CO2: Identify online social networks and understand how various social media networks are working and using SNA in their infrastructure (K3)

CO3: Apply social media analytics concepts, techniques and tools in social media applications(K3)

CO4: Analyze the mining methods on social web (K3)

CO5: Explore the use of tools and techniques involved in web analytics. (K2)

UNIT I INTRODUCTION TO COMPUTATIONAL SOCIAL SCIENCE 9

Introduction to Social computing – Human centered computing : Methods – benefits-Introduction to CSS- Examples of CSS investigations - Society as a complex Adaptive system - Main Areas of CSS: An Overview - Computation and Social Science: Computers and programs - Data structures - Modules and modularization - Computability and

Complexity – Algorithms - Introduction to Crowd sourcing: Components – activities - Crowd sourcing as a model for problem solving

UNIT II ONLINE SOCIAL NETWORKS 9

Introduction - Nodes, Edges and Network Measures, Basics of network structure and properties, Representing networks, Entity Resolution and Link Prediction - Social Network methods - Social network data – Graphs to represent social relations – Matrices to represent social relations – working with network data – Connection: Networks and actors – basic demographics – density – reachability – connectivity – distance - Types of social networks - Human Cognition and Belief systems - Decision Making Models - International Relations-Software for SNA.

UNIT III SOCIAL NETWORK DATA ANALYTICS 9

Introduction - Random walks in social networks and their applications a survey - Random walks on Graphs – Applications - Evaluation and datasets - Community Maintained Resources, Supporting technologies for community maintained resources – Social Media in the public sector, Analyzing public sector social media. Social Media Marketing, Mobile Marketing, Web Analytics, Social Media Analytics - Criteria of Effectiveness, Metrics, Techniques, Tools, Social Media Management, Centrality Measures-opinion mining, feature based sentiment analysis

UNIT IV VISUALIZING SOCIAL NETWORKS 9

Visualizing social networks – Introduction - A Taxonomy of visualizations – The convergence of Visualization, Interaction and Analytics - Data mining in social media – Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts– Integrating sensors and social networks – Multimedia information networks.

UNIT V MINING THE SOCIAL WEB 9

Mining twitter in all the rage – Exploring Twitter’s API - Mining Facebook - Exploring Facebook’s social Graph API – Analyzing social graph connections - Mining Google+ - Exploring the Google+ API - Mining web pages -Scraping, Parsing and crawling the Web - Using Natural Language processing to understand Human Language - Summarize Blog posts and more - Twitter Cookbook - Discovering the trending topics - Tabulating frequency analyzing - Getting all friends and Followers for a User.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Cioffi-Revilla, Claudio, “Introduction to Computational Social Science Principles and Applications”, Springer, 2nd Edition, 2017.
2. Mikhail Klassen, Matthew A. Russell “Mining the Social Web” O'Reilly Media, Inc. 3rd Edition, 2019.
3. Matthew Ganis, AvinashKohirkar, “Social Media Analytics”, Pearson Education India, 1st Edition, 2016.
4. Social Network Data Analytics by Charu C. Aggarwal, Springer India, 2015.

REFERENCES

1. Philip Kosky,George Wise, Robert Balmer and William Keat, "Exploring Engineering an Introduction to Engineering and Design", Academic Press, Elsevier, USA, 4th Edition,2015
2. Sharp, Rogers, Preece, Interaction Design-Beyond Human Computer Interaction, Wiley, 4th Edition, 2015.
3. www.ieagreements.org/IEA-Grad-Attr-Prof-Competencies.pdf

19CS37E	SOFTWARE TESTING TECHNIQUES	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Apply software testing fundamentals and testing design strategies to enhance Software quality. (K4)
CO2: Design test cases for unit test, integration test, system test, regression and acceptance test.(K3)
CO3: Discover how work test plan components, test measurements and reviews (K3)
CO4: Perform Testing in software with various testing tools (K4)
CO5: Develop and validate a test plan (K4)

UNIT I INTRODUCTION 8

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process -The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of defects- Defect classes the defect repository. Analysis of defect for a project.

UNIT II TEST CASE DESIGN STRATEGIES 9

Introduction to Testing Design Strategies - Black Box testing - Random Testing – Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing -White-Box testing - Test Adequacy Criteria - Coverage and Control Flow Graphs - Covering Code Logic Paths - White-box Based Test design.

UNIT III LEVELS OF TESTING 10

The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests - Integration tests- Designing Integration Tests - system testing - Regression Testing. Alpha –Beta and Acceptance Test- Usability and Accessibility Testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

UNIT IV TEST MANAGEMENT 9

People and organizational issues in testing – Organization structures for testing teams – testing services -Testing and Debugging Goals and Policies - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - Reporting Test Results - The role of three groups in Test Planning and Policy Development - Process and the Engineering Disciplines.

UNIT V AUTOMATED TESTING AND TEST TOOLS & BUG REPORTING 9

Automated Testing and Test Tools:JUNIT and SELENIUM-benefits-Test Tools-Software Test Automation-Bug Bashes and Beta Testing-Writing and Tracking Test Cases: Goals-Test Case Planning Overview-Bug's Life cycle-Bug-Tracking System-Software Quality Assurance.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing Principles and Practices" Pearson Education, 2017.
2. Ron Patton, "Software Testing", Sams Publishing, Pearson Education, 2nd Edition, 2014.
3. Renu Rajani, Pradeep Oak, "Software Testing Effective Methods, Tools and Techniques", Tata McGraw Hill, 2017.

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REFERENCES

1. M.G.Limaye, "Software Testing: Principles, Techniques and Tools‖", Tata McGraw-Hill, 1st Edition, 2009.
2. Ilene Burnstein, "Practical Software Testing: A Process-Oriented Approach", Springer International Edition, 2003
3. Boris Beiser, "Software Testing Techniques", Dreamtech press, New Delhi, 2009.
4. Paul Ammann and Jeff Offutt, "Introduction to Software Testing" Cambridge University Press, 2nd Edition, 2016.
5. https://www.softwaretestingmaterial.com/manual-testing-tutorial/
6. https://learn-automation.com/selenium-webdriver-tutorial-for-beginners/
7. https://www.springboottutorial.com/junit-tutorial-for-beginners

19CS38E	ADVANCED DATABASE TECHNOLOGY	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Realize the concepts of distributed databases. (K2)
CO2: Develop queries for ODMG model using SQL and oracle. (K3)
CO3: Analyze the various intelligent databases. (K3)
CO4: Acquire knowledge about emerging database models. (K2)
CO5: Develop queries for deductive databases. (K3)

UNIT I DISTRIBUTED DATABASES 9

Introduction – Functionality of Distributed DBMS (DDBMS) – Architecture – Distributed data storage –query processing –Transaction Management – Concurrency control – Replication Servers – Case study on distributed database design.

UNIT II OBJECT ORIENTED DATABASES 9

Concepts of Object Oriented Databases – Need for complex Datatype – Collection Types and Structured Types – ODMG Model – Object Definition Language - Object Query Language – Conceptual Design - Object Relational features in SQL, Oracle.

UNIT III INTELLIGENT DATABASES 9

Active Databases - Concepts and Triggers –Syntax and Semantics – Temporal Databases – Overview – NoSQL: Overview– Characteristics -Storage Types – Pros–Cons–Comparative Study of NoSQL Products - Case Study.

UNIT IV EMERGING DATABASES 9

Multimedia Databases – Types – Structure – Multimedia database design – Web databases - Case studies on web databases – Mobile Databases: Location and Handoff Management - MONGO DB : Setup and Configuration - CRUD Operations- POSTGRE SQL: Data types -CRUD Operations

UNIT V DEDUCTIVE DATABASES 9

Deductive Databases: Logic of Query Languages – Datalog - Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion- Recursive Queries in SQL

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education, Global Edition, 2017.
2. Dr.Sanjeev Sharma, Dr.JitendraAgrawal, Dr.ShikaAgrawal, “Advanced Database Management System”, Dreamtech press, New Delhi, 2017.
3. Dan Sullivan, “NoSQL for Mere Mortals”,Addison-Wesley Professional, 1st Edition 2015.

REFERENCES

1. Hans-Jürgen Schonig, “Mastering PostgreSQL 13: Build, administer, and maintain database applications efficiently with PostgreSQL 13”, 4th Edition, 2020.
2. Henry F Korth, Abraham Silberschatz and S. Sudharshan, “Database System Concepts”, McGraw Hill, 6th Edition, 2013.

19CS39E	SQL PROGRAMMING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the fundamental DDL statements in SQL (K2)
CO2:Understand the fundamental DML statements in SQL(K2)
CO3: Exemplifying the advanced Query structures in SQL (K2)
CO4: Apply Basic and Advanced SQL statements on real time Scenario’s using Joins and Procedures(K3)
CO5: Integrating the NO SQL Structures to construct real time application (K3)

UNIT I DATA DEFINITION LANGUAGE 9

Introduction –SQL Syntax – Data types – Operators - Databases: Create – Drop – Rename- Select - Tables: Create – Rename – Alter –Truncate – Delete – Drop – Copy – Temp table –SQL Keys : Primary Key –Foreign Key – Composite key – Unique Key –

Alternate Key.

UNIT II DATA MANIPULATION LANGUAGE 9

DML Statements – Select Statement –Insert Statement – Where clause –Sql Aliases – Operators - In – Between- Like -And – Or –Not -Union - Any- All –Exist – Some – Update Statement – Delete Statement: Data Base - Table –Rows–SQL Aggregate Functions.

UNIT III ADVANCED QUERY STRUCTURES 9

SQL Clauses: Order by- Asc – Desc-Random - Limit - Group By – Having - Sub Query – Nested Sub Query –Data Control Language: Privileges – Grant –Revoke – SQL Case statements -Null Functions –Indexes - Sequences – Auto Increment /Decrement – Clone tables –SQL Injections.

UNIT IV SQL JOINS AND PROCEDURES 9

SQL Joins – Basics -Types:Self Join -Inner Join - Outer Join - Left Join – Right Join-Full outer Join – views – Case studies: Customer Sale Scenario –SQL Procedures - PL/SQL Functionalities - Control statements –Functions – Cursor -Triggers – Exceptions - Case Study: Banking Transactions (Front End : Html5 /Php/Asp/Jsp Back End : WAMPP / SQL Server).

UNIT V ADVANCED NOSQL TRENDS 9

FIRE BASE: Real time Database & Firebase Fire Store – Setup and Configuration –Data Organization – CRUD Operations – MONGO DB : Setup and Configuration - CRUD Operations – Case Study : Real time applications using FIREBASE / Mongo DB – Reading web contents using neo4j.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education/Addison Wesley, 6 th Edition, 2017.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖, Tata McGraw Hill, 6th Edition, 2013.

REFERENCES

1. HoussemYahiaoui, “Firebase Cookbook: Over 70 recipes to help you create real-time web and mobile applications with Firebase”, Packt publishing, 2017.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Pearson Education, 5th Edition, 2009.
3. Peter Membrey, “MongoDB Basics”, Apress; 1st Edition, 2014.
4. Ian Robinson, Jim Webber, Emil Eifrem “Graph Databases: New Opportunities for Connected Data” "O'Reilly Media, Inc.", 10-Jun-2015
5. https://docs.microsoft.com/en-us/sql/?view=sql-server-ver15
6. https://www.w3schools.com
7. https://www.geeksforgeeks.org

19CS40E	BLOCKCHAIN FUNDAMENTALS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand a broad overview of the essential concepts of blockchain technology.(K2)
CO2: Describe the concepts of cryptographic primitives. (K2)
CO3: Recognize different types of consensus algorithms (K2)
CO4: Apply mining process in blockchain network. (K3)
CO5: Understand about the applications and Limitations of blockchain (K2)

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Centralized Vs Decentralized Systems- Limitations of Centralized Systems- Components of Blockchain-Layers of Blockchain-Block Structure- Blockchain Functionality - Tiers of Blockchain Technology: Blockchain 1.0- Blockchain 2.0- Blockchain 3.0- Types of Blockchain: Public Blockchain- Private Blockchain- Semi-Private Blockchain- Sidechains-Blockchain Wallets.

UNIT II BASIC CRYPTO PRIMITIVES 9

Cryptographic Hash Functions- Attacks on Hash Functions- Hash Pointers and Data Structures- Public Key Cryptography- Digital Signatures using Public Key Cryptography - Elliptic Curve Cryptography

UNIT III CONSENSUS ALGORITHMS 9

Distributed Consensus-Types of Consensus Algorithms: Proof of Work- Proof of Stake- -Delegated Proof of Stake-Proof Elapsed Time- Proof of Burn- Byzantine Fault Tolerance-Practical Byzantine Fault Tolerance- Blockchain Forks-Soft Fork - Hard Fork

UNIT IV MINING IN BLOCKCHAIN 9

Mining Hardware-CPU Mining- GPU Mining-FPGA Mining-ASIC Mining-Mining Pools-Solo Mining-Pool Mining-Mining incentives and strategies- Mining puzzles

UNIT V BLOCKCHAIN APPLICATIONS 9

Blockchain Applications - Supply Chain Management and Trade Finance - Challenges and Limitations in Blockchain- Cryptocurrency Regulation: Governing the digital economy-Stakeholders-Legal Aspects-Crypto currency Exchange- Global Market and Global Economy.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
2. Imran Bashir, “Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks” Packt Publisher, 2017.

REFERENCES

1. Koshik Raj, “Foundations of Blockchain”, Packt Publishers, 2019.
2. Michael J. Casey, Paul Vigna, ”The Truth Machine: The Blockchain and the Future of Everything”, St. Martin's Press Publication,2018
3. Josh Thompson, “Blockchain: The Blockchain For Beginners Guide To Blockchain Technology And Leveraging Blockchain Programming”, Create Space Independent Publishing Platform,2017.
4. Tiana Laurence, “Blockchain for Dummies”, 2nd Edition, John Wiley & Sons**,** 2019
5. https://swayam.gov.in/nd1_noc20_cs01/preview
6. https://www.coursera.org/lecture/cryptocurrency/mining-hardware-ELB8c

19CS41E	DIGITAL CURRENCIES AND CRYPTO ASSETS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the need of digital currency and primitives for making digital currency (K2)

CO2: Demonstrate the wallets in storing and transacting bitcoin. (K3)

CO3: Acquire a basic understanding of the mechanics underlying digital currency engineering (K2)

CO4: Understand crypto assets and its different types (K2)

CO5: Summarize blockchain regulations and future trends related to blockchain to be used in financial sector. (K2)

UNIT I INTRODUCTION TO DIGITAL CURRENCY 9

Introduction to digital currency – Need for digital currency - Traditional Payments – E-cash- Fiat Currency – Drawbacks in Fiat Currency – Fiat vs. Digital currency - Primitives for making a Digital currency - Digital Signatures – Hashing - Public key cryptosystems - A Tamper Proof Ledger – Anonymity Basics

UNIT II BITCOIN NETWORK 9

The Bitcoin network - Nodes, Wallets, and Addresses - Bitcoin Mining - Transactions in Bitcoin – Chaining and Orphan Transactions- Bitcoin Core - Bitcoin Scripts

UNIT III DIGITAL CURRENCY ENGINEERING 9

Uses of digital currencies, Tokens, Token vs Crypto Coin, Concept of Initial Coin Offerings (ICOs), Benefits of Using ICOs, Security token offerings (STOs), ICO vs. STO, Digital currency wallets.

UNIT IV CRYPTO ASSETS 9

Basic Attention Token (BAT) - Brave and Privacy-Centered Browsing – Bitcoin - Non-Fungible Token (NFT) - Importance of NFTs – Ethereum - Regulation of cryptoassets

UNIT V DIGITAL CURRENCY REGULATION 9

Introduction - History - Stance of the Government - Judicial approach to digital currency -

Possible Reasons for Ban - Virtual Currency Regulations - Global Perspective of Regulations on Blockchain - Future needs for Regulations.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies”, Princeton University, 2016.
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly Media, First Edition, 2014.
3. Richard Hayen, “Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology. - Bitcoin, FinTech, Smart Contracts, Cryptocurrency”, Risk Books Publisher, 2017

REFERENCES

1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, “Blockchain Technology: Cryptocurrency and Applications”, Oxford University Press, 2019.
2. Satoshi Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System”, Whitepaper
3. https://www.eduonix.com/blockchain-and-cryptocurrencies-for-beginners
4. https://www.coursera.org/learn/cryptocurrency
5. https://www.globallegalinsights.com/practice-areas/blockchain-laws-and-regulations/india#chaptercontent1

19CS42E	SMART CONTRACT AND SOLIDITY	L	T	P	C	QP
		2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the working and importance of smart contracts.(K2)
CO2: develop Smart Contracts on the Ethereum Block chain (K3)
CO3: understand the basics of solidity programming (K2)
CO4: present different Smart Contract development platforms (K2)
CO5: create and deploy a DApp on a Ethereum network (K3)

UNIT I INTRODUCTION 12

Introduction to Smart Contracts- Definitions – Features - Life Cycle - Smart Contract execution- Virtual Machine of a Block chain- Source code of a Smart Contract- Useful Terminologies

UNIT II ETHEREUM SMART CONTRACT 12

Ethereum Smart Contracts - Ethereum Higher-Level Languages -Developing Smart Contracts - The Solidity language: An object-oriented, high-level language for implementing smart contract - Designing a Solidity Smart Contract- Ether and Gas – Mining Ethereum.

UNIT III SOLIDITY PROGRAMMING 12

Solidity – Contracts- Constructors – Functions- Variables-Getters – Setters- Arrays -

Memory vs Storage - Mappings in Solidity – Structs - Error Handling and Restrictions – Libraries - Global Variables - Abstract Contracts – Inheritance- Interfaces-Events Installing Solidity - Solc Compiler - Ethereum Contract Application Binary Interface - Remix-IDE for Smart Contract Development.

UNIT IV SMART CONTRACT PLATFORMS 12

Smart Contract programming languages - Execution Environments - Environment Setup for Truffle and Ganache - Truffle Project Creation - Writing Smart Contracts - Developing Smart Contract - Programmer’s responsibility - Cost of running smart Contracts - Smart Contract development platforms - Picking the right block chain.

UNIT V BUILDING ETHEREUM DAPP 12

DApp – Metamask - Setting up a Private Ethereum Network: Install go-etherum – Create geth Data directory – Create a geth account – create genesis.json configuration File – Run the first Node of the Private Network – Run the second node of the Network – Creating Smart Contract – Deploying the Smart Contract – Client Application.

L: 30; P: 30; TOTAL: 60 PERIODS

TEXT BOOKS

1. Tiana Laurence, “Blockchain for Dummies”, 2nd Edition, John Wiley & Sons, 2019
2. Ritesh Modi, “Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain”, Packt Publishing Ltd, 2018
3. Andreas Antonopoulos and Gavin Wood, “Mastering Ethereum: Building Smart Contracts and Dapps”, Shroff Publisher/O′Reilly Publisher, 2018
4. Michael J. Casey and Paul Vigna, “The Truth Machine: The Blockchain and the Future of Everything”, Kindle Edition, St. Martin's Press, 2018.

REFERENCES

1. Kevin Solorio, Randall Kanna, David H. Hoover, “Hands-On Smart Contract development with Solidity and Ethereum”, O'Reilly Media, Inc., 2019
2. Lee, Wei-Meng, “Beginning Ethereum Smart Contracts Programming”, Apress, 2019
3. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/

19CS43E BLOCKCHAIN FRAMEWORKS LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Implement the basic concepts of Ethereum Smart Contract using Solidity (K3)
CO2: Implement the mining process in blockchain using Kotlin (K3)
CO3: Implement transaction and consensus mechanism using Golang (K3)
CO4: Implement the distributed application using Hyperledger Fabric. (K3)

LIST OF EXPERIMENTS

1. Implement a smart contract that stores and retrieves a value from blockchain.
2. Write a solidity program to call a function from another smart contract.
3. Deploy a smart contract on ethereum.
4. Build a smart contract for a simple open auction on ethereum.
5. Implement basic mining algorithm in blockchain using Kotlin.
6. Implement consensus mechanism in a blockchain using Golang.
7. Implement persistence process in blockchain application using Golang.
8. Demonstrate transactions with input and outputs to the blockchain using Golang.
9. Building a Basic Wallet Module using Golang.
10. Develop a Dapp using hyperledger fabric.

Mini Project to be developed for any one of the following applications

1. Vote chain – Electronic Voting System based on Blockchain
2. Blockchain-based Patient Data Management System
3. Blockchain-based Land Registries System
4. Blockchain in KYC verification
5. Transparent and Genuine Charity Applications based on Blockchain

P: 60; TOTAL: 60 PERIODS

SOFTWARE REQUIREMENTS

- Operating System: Linux /Windows
- Software: RemixIDE, JDK, IntelliJ IDEA 2021.2.3, LiteIDE /GoLand 2021.2.4
- Platform: Ethereum, Hyperledger Fabric

Sample Question Bank (Exercises not limited to this)

1. Write and deploy a smart contract to change the value of the existing smart contract which is deployed earlier?
2. Create a smart contract to demonstrate how to store and retrieve the details of the employees of an organization using structure, arrays, and functions.
3. Consider the scenario where the number of users is participating in the auction. The general concept is that everyone can send their bids during a bidding period. The bits are in the form of ethers. If the highest bid is raised, the previously highest bidder gets her money back. After the end of the bidding period, the highest bidder should win the auction. Write the appropriate smart contract to choose the auction winner.
4. Write a Golang program to implement the proof of stake consensus mechanism.
5. Write a kotlin program to implement a simple blockchain.
6. Write a Golang program to build a basic wallet module for blockchain.
7. Write a Golang program to simulate the input and output process of blockchain.
8. Write a smart contract to design a trusted crowdfunding environment.
9. Write a smart contract to design a system that detects the product is a fake one or a real one.
10. Write a smart contract to develop peer to peer ride-sharing system to avoid intermediaries.

19CS44E PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

L	T	P	C
0	0	6	3

COURSE OBJECTIVES

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Upskill in emerging technologies and apply to real industry-level use cases
CO2: Understand agile development process
CO3: Develop career readiness competencies, Team Skills / Leadership qualities
CO4: Develop Time management, Project management skills and Communication Skills
CO5: Use Critical Thinking for Innovative Problem Solving
CO6: Develop entrepreneurship skills to independently work on products

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3

Activity Name	Activity Description	Time (weeks)
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

TECHNICAL SKILLS		SOFT SKILLS	
Criteria	***Weightage***	***Criteria***	***Weightage***
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
Total	**70**	**Total**	**30**
Total Weightage		**100**	
Passing Requirement		**50**	
CONTINUOUS ASSESSMENT ONLY			

P: 90; TOTAL: 90 PERIODS

R-2019 B.E – CSE

ONE CREDIT ELECTIVE COURSES

19CS01L	**STATISTICAL FOUNDATIONS FOR DATA SCIENCE**	**L**	**T**	**P**	**C**	**QP**
		1	**0**	**0**	**1**	**C**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Understand the fundamentals of statistics for data science. (K2)
CO2: Deploy statistical foundations on data science. (K3)

UNIT I FOUNDAMENTALS OF DESCRIPTIVE STATISTICS 6

Introduction – types of data – types of variables – histogram charts – scatter plots - measures of central tendency: mean, median and mode, measuring asymmetry: skewness – Measuring variability: Variance. Standard deviation, Covariance. Correlation coefficient.

UNIT II INFERENTIAL STATISTICS 9

Distributions: Normal distribution , standard normal distribution, Central Limit Theorem – Estimations: Confidence Intervals- Hypothesis Testing

L:15; TOTAL:15 PERIODS

REFERENCES

1. Jianqing Fan, Runze Li ,Cun-Hui Zhang Hui Zou “Statistical Foundations of Data Science”, Chapman and Hall/CRC,1st Edition,2017.
2. Walter W. Piegorsch ,“Statistical Data Analytics: Foundations for Data Mining, Informatics, and Knowledge Discovery”, Wiley, 1st Edition, 2015.

19CS02L	**DATA VISUALIZATION USING TABLEAU**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
CO1: Understand the basic concepts of data visualization using tableau platform.(K2)
CO2: Assess the quality of the data and perform exploratory analysis.(K3)

LIST OF EXERCISES

1. Creation of Charts using Show me feature for data visualizations, Crosstabs and Heat Maps.
2. Creation of visualization using Bar, Stacked Bar, and Side by Side Bar Charts, Pie Charts
3. Creating Line and Area Charts for data visualizations.
4. Creation of visualization using
    - Packed Bubbles
    - Tree Maps, creating a Basic Scatter Plot and Creating a Basic Map.
5. Calculations in Tableau
    - Understanding String Calculations, Boolean, if-then Calculations, and case Statements, Date and Time Calculations and Understanding Aggregations and Disaggregation.
6. Implementation of Mapping functionalities in Tableau.

- Creating a Standard Map View to identify geographic roles and assemble a standard map view.

7. Execution of Dashboards and Stories.
   - Finding the working of dashboard actions and Ensuring the formatting of dashboards.
   - Understanding the various elements to the story user interface and assembling the dashboards into a story and Learning about how to size dashboards to fit into a story.
8. Develop visualization in Tableau and Export the dashboard to a pdf and Export the data into an Excel spread sheet.

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows
- **Software:** Tableau.
- **Memory Space:** 2 GB

REFERENCES

1. Daniel G.Murray, “Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software”, John Wiley & Sons, Inc., 1st Edition, 2013.
2. Ryan sleeper, “Practical Tableau”, O’Reilly Media, 1st Edition, 2018.

19CS03L	DATA VISUALIZATION USING POWER BI	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of data visualization using Power BI platform.(K2)
CO2: Assess the quality of the data and perform exploratory analysis.(K3)

LIST OF EXERCISES

1. Implementation of Data refresh in Power BI environment.
   - Implementing the Power BI refresh.
   - Implementing Power BI Desktop.
   - Configuring automatic refresh.
2. Creation of workspace and groups in Power BI
3. Modelling Power BI dashboards by using recent datasets
4. Visualization of data using Line, Column Charts and Area charts.
5. Creation of a multi row card for Improving reports by using custom visualizations.
6. Development of visualizations standard using Tables in Power BI.
7. Improving the report by using measures and using DAX in data models.
8. Develop a data visualization by creating a map showing total units sold by state and adding a Slicer for Sub-categories of products

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows
- **Software:** Microsoft Power BI.
- **Memory Space:** 2 GB

REFERENCES

1. Alberto Ferrari and Marco Russo “Introducing Microsoft Power BI”, Microsoft Press, 1st Edition, 2016.
2. Chris Webb,” Power Query for Power BI and Excel”. Apress; 1st Edition, 2014.
3. https://www.tutorialspoint.com/power_bi/power_bi_pdf_version.htm
4. https://data-flair.training/blogs/table-in-power-bi/

19CS04L	PYTHON FOR DATA SCIENCE	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts Python Programming(K2)
CO2: Apply the Data mining algorithms using python packages(K3)

LIST OF EXERCISES

1. Implementation of data manipulation with pandas
2. Mathematical Computations with NumPy
3. Implementation of Pre-processing Techniques.
4. Implementation of Classification Algorithms
5. Implementation of Clustering Algorithms
6. Implementation of data visualization using matplotlib
7. Analysis of Time Series data

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Python IDLE 2.0/3.0, Anaconda.

REFERENCES

1. Samir Madhavan, “Mastering python for data science”, Packt Publishers, 1st Edition 2015.
2. https://www.programiz.com/python-programming
3. https://jakevdp.github.io/PythonDataScienceHandbook/

19CS05L	R PROGRAMMING	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts R Programming(K2)
CO2: Apply the Data mining algorithms using R packages(K3)

LIST OF EXERCISES

1. Programs on data type in R
2. Programs on Build-in Functions in R
3. Creating and Manipulating Vector,Matrix,Factors in R.
4. Operations on Data Frames and Lists in R.
5. Programs on Operators in R
6. Programs on If-else statements, for loops, while loops in R.
7. Implementation of Classification Algorithms using R Packages
8. Implementation of Clustering Algorithms using R Packages.

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows.
- **Software:** RStudio.

REFERENCES

1. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design‖", No Starch Press, 2nd Edition, 2012.
2. https://www.r-project.org
3. http://heather.cs.ucdavis.edu/~matloff/R/RProg/

19CS06L	PR.OOF SYSTEMS IN CRYPTOGRAPHY	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Explore the Zero-Knowledge Proofs. (K3)
CO2: Apply Zero-Knowledge Proofs in real time problems. (K3)

UNIT I INTERACTIVE PROOFS AND ZERO-KNOWLEDGE PROOFS 8

Interactive Proofs - Intuitive notion of proofs - Zero-Knowledge (ZK) Proofs: Properties - Computational ZK - Chaum-Pederson ZK protocol - ZK-Proofs for NP Problems.

UNIT II APPLICATIONS 7

Discrete log of a given value - Hamiltonian cycle for a large graph - Authentication systems - Blockchains.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Sanjeev Arora and Boaz Barak, “Computational complexity: A Modern Approach”, Cambridge University Press, 2nd edition 2009.
2. https://crypto.stanford.edu/cs355/18sp/lec3.pdf
3. https://crypto.stanford.edu/pbc/notes/crypto/zk.html
4. https://en.wikipedia.org/wiki/Zero-knowledge_proof
5. https://homepages.cwi.nl/~schaffne/courses/ZK/2015/4th_lecture_ZKforNP.pdf

19CS07L	THEORETICAL FOUNDATIONS OF CRYPTOGRAPHY	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of digital signature. (K2)
CO2: Explore about the pseudo-random generators in cryptography (K2)

UNIT I DIGITAL SIGNATURES 6

Encryption- digital signatures- hash functions- commitments

UNIT II PSEUDO-RANDOM GENERATORS 9

One-way functions- pseudo-random generators- pseudo-random functions- trapdoor permutations.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Jonathan Katz and Yehuda Lindell, “Introduction to Modern Cryptography”, Chapman and Hall/CRC Press, 3rd Edition 2020
2. Oded Goldreich, the Foundations of Cryptography, Volume 2, Cambridge University Press, 2009.
3. Wenbo Mao, Modern Cryptography: Theory and Practice, Pearson Education, 1st Edition, 2004.

19CS08L	RANDOMNESS IN CRYPTOGRAPHY	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the notions of entropy in cryptography. (K2)
CO2: Explore about the leakage-resilient cryptography (K2)

UNIT I ENTROPY NOTION 6

Entropy notions - min-entropy- Shannon entropy- Computational variants of notions and the challenges in analyzing the notions.

UNIT II LEAKAGE-RESILIENT CRYPTOGRAPHY 9

Randomness extractors- privacy amplification protocols- leakage-resilient Cryptography- Design of error correcting codes with specialized properties.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography", Chapman and Hall/CRC Press, 3rd Edition 2020
2. Oded Goldreich, the Foundations of Cryptography, Volume 2, Cambridge University Press, 1st Edition 2009.
3. Wenbo Mao, Modern Cryptography: Theory and Practice, Pearson Education, 1st Edition, 2004.

19CS09L DEEP LEARNING ALGORITHMS

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Apply supervised CNN & RNN models for various datasets.(K3)
CO2: Build a classifier with pre-trained models and validate.(K3)

LIST OF EXERCISES

1. Build a classifier using k-Nearest Neighbour (kNN) algorithm for iris dataset to classify its class.
2. Create a Neural Network model to train and test the birds dataset to classify the bird species.
3. Construct a CNN model by considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set, then build an LENET algorithm and test the same.
4. Implement RNN model for smile detection. Print both correct and wrong predictions.
5. Design a LSTM network for sentiment analysis on a corpus of movie reviews. Label each phrase on a scale of zero to four. The sentiment corresponding to each of the labels are:
    - 0: negative
    - 1: somewhat negative
    - 2: neutral
    - 3: somewhat positive
    - 4: positive

6. Build and train the stacked Auto encoder for image classification. Use handwritten digits dataset

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Anaconda / Jupyter, Keras, Tensorflow, Google colab

REFERENCES

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MITPress book in preparation, 1st Edition 2016.
2. Dr.Adrian Rosebrock,, "Deep Learning for Computer Vision with Python: Starter Bundlell, PyImage Search", 1st Edition, 2017.

19CS10L	MACHINE LEARNING WITH TENSORFLOW	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts Tensorflow.(K2)
CO2: Design and Build applications on Machine learning.(K3)

LIST OF EXERCISES

1. Design and build a Tensor Flow 2.x input data pipeline and understand the key components.
2. Load CSV, Numpy Data and Image Data using Pandas and BigQuery
3. Perform preprocessing and explore features with Cloud Dataflow and Cloud Dataprep.
4. Preprocess data at scale using TF.Transform
5. Use the Keras Sequential and Functional APIs for simple model creation.
6. Train a TensorFlow model on Cloud ML Engine
7. Explore feature engineering using Keras and TensorFlow 2.x.
8. Optimize model performance with hyper parameter tuning.
9. Enhance ML model features with embedding layers.
10. Deploy a trained model to Cloud ML Engine
11. Experiment Feature Analysis Using Tensor Flow Data Validation and Facets
12. Build a custom estimator with all the tricks (convolutional layers, augmentation, batch normalization, etc.) that go into a good image classification model
13. Build a time-series forecasting model in Tensor Flow using a variety of techniques including CNNs and LSTMs
14. Use Tensor2Tensor to solve your own text problems, whether it is text summarization or text generation
15. Build a collaborative filtering recommendation system in Tensor Flow

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Software:** Google Colab Account, Anaconda 3x

REFERENCES

1. https://www.coursera.org/specializations/machine-learning-tensorflow-gcp
2. https://towardsdatascience.com/machine-learning-with-tensorflow-on-google-cloud-platform-code-samples-7c1bc07cd265

19CS11L	**DATA EXPLORATION USING PYTHON**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the functions available in pandas library.(K2)

CO2: Explore various dataset using pandas framework and visualize it using various plots.(K3)

LIST OF EXERCISES

1. Importing Pandas Library and exploring the functions in it.
2. Reading Datasets in Different Formats.
3. Import Any dataset using Pandas and perform the following operations:
    - Creating Copy of original data
    - Finding the attributes
    - Indexing and selecting Data
    - Finding Datatype of a Particular Attribute
    - Counting Unique Datatypes
    - Selecting Data Based on Datatype.
    - Summary Report of DataFrame
    - Checking Format of each Column
    - Finding unique elements of each Column
4. Import Any dataset using Pandas and perform the following operations:
    - Finding Cross Tabulation for one or more attributes
    - Finding Joint Probability
    - Finding Marginal Probability
    - Finding Conditional Probability
    - Finding Co-Relational Association between two variables
5. Import Any dataset using Pandas and perform the following operations:
    - Identify missing values
    - Fill the missing values using mean and median for numerical data
    - Fill the missing values using maximum count for categorical data
      Check missing values
6. Import Toyota.csv dataset using Pandas and perform the Data Visualization operations using Matplotlib library:
    - Plot Scatter Plot for Age and price of car.
    - Plot Histogram for Kilometer and frequency
    - Plot bar plot for fuel type and frequency
    - Plot Box plot for prices of car
    - Plot pair wise plot for fuel type

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Annaconda / Jupyter/ Google colab

REFERENCES

1. Ossama Embarak, “Data Analysis and Visualization Using Python Analyze Data to Create Visualizations for BI Systems”, Apress, 1st Edition, 2018.
2. Fabio Nelli,” Data Analysis and Visualization Using Python Analyze Data to Create Visualizations for BI Systems”, Jaico Publishing House, 1st Edition, 2015.

19CS12L	**MATHEMATICS FOR MACHINE LEARNING**	**L**	**T**	**P**	**C**	**QP**
		1	**0**	**0**	**1**	**C**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the mathematical concepts for Machine Learning (K2)
CO2: Understand how the concepts extend for real world ML problems (K2)

UNIT I LINEAR ALGEBRA 6

Scalars, Vectors, Matrices and Tensors - Vector and Matrix Norms – Eigen values and Eigen vectors – Norms and Eigen decomposition

UNIT II MULTIVARIATE CALCULUS 5

Introduction to Derivatives – Basics of Integration – Gradients and Gradient Visualization – Optimization.

UNIT III PROBABILITY THEORY 4

Introduction – Probability Distributions – Expectation, Variance and Covariance.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Marc Peter Deisenroth, A.Aldo Faisal, Cheng Soon Ong, “Mathematics for Machine Learning”, Cambridge University Press, 2020.
2. “Mathematical Foundation For Machine Learning and AI”, Udemy Course

19CS13L	**CYBER SECURITY TOOLS AND TECHNIQUES**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Work with security tools for network analysis. (K3)
CO2: Make use of recent security framework and techniques to detect security vulnerabilities and exploits. (K3)

LIST OF EXERCISES

1. Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following
    - Observer performance in promiscuous as well as non-promiscous mode.
    - Show that packets can be traced based on different filters
2. Use the Nessus tool to scan the network for vulnerabilities
3. Use Metasploit Framework in Terminal Mode to exploit the Bind-Shell overflow vulnerability
4. Detect ARP spoofing using open source tool ARPWATCH
5. Use NMAP with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc.
6. Wireless Exploitation & Defenses -Cracking WPA2-PSK Passwords Using Aircrack-Ng

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** wireshark, ethereal, tcpdump, Nessus Eclipse, Metasploit Framework, ARPWATCH, NMAP, Aircrack-Ng

REFERENCES

1. http://webpages.eng.wayne.edu/~fy8421/19sp-csc5290/labs/lab1-Instruction.pdf
2. https://www.javatpoint.com/wireshark
3. https://www.cs.cmu.edu/~dwendlan/personal/nessus.html
4. https://docs.rapid7.com/metasploit/msf-overview/
5. https://www.cyberciti.biz/faq/how-to-detect-arp-spoofing-under-unix-or-linux/
6. https://nmap.org/book/man-port-scanning-techniques.html
7. http://webpages.eng.wayne.edu/~fy8421/16sp-csc5991/labs/lab7-instruction.pdf

		L	T	P	C	QP
19CS14L	**VEHICULAR CLOUD NETWORKING**	**1**	**0**	**0**	**1**	**C**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of vehicular network and vehicular cloud network (K2)

CO2: acquire the correlation of vehicular networking on cloud environment. (K3)

UNIT I VEHICULAR NETWORK 5

Vehicular Network: Introduction, Components of Vehicular Network, Issues and challenges, Applications and Simulation Tools.

UNIT II VEHICULAR CLOUD NETWORKING 5

Cloud Computing Introduction-Vehicular cloud computing Introduction – Architecture-Service Types: Computing as a service-Storage as a service- Network as a service-Application as a service- Cooperation as a service- Cloudlets types: Static and Dynamic.

UNIT III APPLICATIONS OF VEHICULAR CLOUD NETWORKING 5

Vehicular Cloud Applications: Data Centers, Optimizing traffic signals, Parking lot data cloud, Shopping mall data center and Dynamic traffic light management

L:15; TOTAL:15 PERIODS

REFERENCES

1. Nanhay Singh, Omprakash Kaiwartya, Ram Shringar Rao, Sanjoy Das, "Cloud-Based Big Data Analytics in Vehicular Ad-Hoc Networks", IGI Global, 1st Edition, 2020.
2. https://jwcn-eurasipjournals.springeropen.com/articles/10.1186/s13638-018-1315-y
3. https://www.sciencedirect.com/science/article/abs/pii/S1084804513001793.
4. https://www.sciencedirect.com/science/article/abs/pii/S1389128618300057

19CS15L	SPECKLED COMPUTING	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of speckled computing.(K2)
CO2: Identify the applications of Speckled computing .(K3)

UNIT I INTRODUCTION 5

Specks- Specknet – Comparing Sensor networks and Specknets- Localization of specks- Programmable Specks- Architecture

UNIT II DESIGN ENVIRONMENT 5

Speck Net: Network services, Protocols, Distributed algorithms, Power Optimization.

UNIT III APPLICATIONS 5

Capturing movements of dancer, Data sensing and Information extraction, Physiological condition monitoring, Environment Monitoring.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Bijo P Joy "speckled computing", vinod gupta school of management IIT Kharagpur
2. http://www.iraj.in/journal/journal_file/journal_pdf/12-410-155418809160-62.pdf.
3. https://www.researchgate.net/publication/224570641_Speckled_Computing_Evolution_and_Challenges.

19CS16L	INTRODUCTION TO NETWORKS	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Build simple LANs, perform basic configurations for routers and switches.(K3)
CO2: Implement IP addressing schemes.(K3)

UNIT I INTRODUCTION 15

Introduction and explore the network - Configure a network operating system - Network Protocol and Communications - Network Access – Ethernet - Network Layer - IP addressing - Subnetting IP Network - Transport layer - Application Layer - Build a small network

L:15; TOTAL:15 PERIODS

REFERENCES

1. https://www.freeccnastudyguide.com/study-guides/ccna/ch1/intro-to-networks/
2. https://www.netacad.com/group/resources/ccna-rs-itn/6.0

19CS17L	ROUTING AND SWITCHING ESSENTIAL	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Recognize architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. (K2)
CO2: Build simple LANs, perform basic configurations for routers and switches, and implement IP. (K3)

UNIT I ROUTING ESSENTIALS 8

Routing Concepts - Routing Initial configuration - Routing Operation - Static Routing - Configuration & Troubleshooting - Dynamic Routing - Protocols and Routing Tables - Switched Networks - Switch Configuration - Device Configuration.

UNIT II SWITCHING ESSENTIALS 7

LAN Design and Switched Environment – VLANs - Segmentation - Implementation - VLAN Routing - Access Control Lists - ACL Operation - Standard IPv4 ACL – DHCP - DHCP v4 – DHCP v6 - NAT for IPv4 -Operation - Configuration - Device Discovery - Management and Maintenance.

L:15; TOTAL:15 PERIODS

REFERENCES

1. Todd Lammle , ‘CCNA Routing and Switching Complete Study Guide’, John Wiley & Sons, 2nd Edition, 2016.
2. https://www.netacad.com/group/resources/ccna-rs-rse/6.0

19CS18L	SCALING NETWORKS	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Configure and troubleshoot routers and switches for advanced functionality .(K3)

CO2: Resolve common issues with protocols in both IPv4 and IPv6 networks. (K2)

UNIT I LAN DESIGN 8

LAN Design: Campus Wired LAN Designs - Campus Network Device Selection. Scaling VLANs: VTP, Extended VLANs, and DTP - Troubleshoot Multi-VLAN Issues. Spanning Tree Protocol (STP): Spanning Tree Concepts - Varieties of Spanning Tree Protocols. Ether Channel and HSRP: Link Aggregation Concepts - Link Aggregation Configuration - First Hop Redundancy Protocols.

UNIT II DYNAMIC ROUTING 7

Dynamic Routing: Dynamic Routing Protocols - Distance Vector Dynamic Routing - Link-State Dynamic Routing. EIGRP: features and characteristics - Implement EIGRP for IPv4 - EIGRP Tuning and Troubleshooting. OSPF: Single-Area OSPF Operation - Varieties of Spanning Tree Protocols - Multiarea OSPF - OSPF Tuning and Troubleshooting.

L:15; TOTAL:15 PERIODS

REFERENCES

1. ‘Scaling Networks Companion Guide’, CISCO Press, 2014.
2. https://www.netacad.com/group/resources/ccna-rs-scaling/6.0

19CS19L	CONNECTING NETWORKS	L	T	P	C	QP
		1	0	0	1	C

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Configure and troubleshoot network devices .(K3)

CO2: Implement Virtual Private Networks.(K3)

UNIT I WAN CONCEPTS 8

WAN Concepts - WAN Technologies Overview - Selecting a WAN Technology - Point-to-Point Connections - Serial Point-to-Point Overview - PPP Operation - Troubleshoot WAN Connectivity - Branch Connections - Remote Access Connections – VPNs.

UNIT II ACCESS CONTROL LISTS 7

Access Control Lists - Standard ACL Operation and Configuration Review - Extended IPv4 ACLs - LAN Security – SNMP - QoS Overview - QoS Mechanisms - Network Evolution - Network Troubleshooting - Troubleshooting Methodology - Troubleshooting Scenarios

L:15; TOTAL:15 PERIODS

REFERENCES

1. “Connecting Networks Companion Guide”, CISCO Press, 2014.
2. https://www.netacad.com/group/resources/ccna-rs-connect/6.0

19CS20L	**SERVER SIDE DEVELOPMENT USING NODE.JS**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of Node.js Environment and Node Modules.(K2)
CO2: develop Node.js based real world web application development. (K3)

LIST OF EXERCISES

1. Installing Node, Node Hosting Environments
2. Exploring Node Building Blocks
    - Global and Process objects, buffers, Typed arrays and Strings, Streams
    - Event Handling- Event Queue, Event Emitter, Event Loop and Timers, Nested Callback
3. Creating and Publishing Node Modules
    - Installation and configuration of Node Package Manager
    - Program development using built-in Node Modules
    - Commander and Underscore,
    - OAuth configuartion
4. Node and the File System
    - The fs.Stats class, The File System Watcher, File Read and Write,
    - Directory access and Maintenance,
    - Program development using File Streams
5. Resource Access with Path
    - The HTTP Module: Server and Client
    - Using APACHE to proxy a Node Application Query String Parsing and DNS Resolution.

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** NodeJS4.0.0, Notepad++, Java 7, Browser

REFERENCES

1. Shelley Powers, “Learning Node: Moving to the Server-Side”, O'Reilly Media; 2nd Edition, 2016.
2. David Thompson, “Getting Started with GEO, CouchDB, and Node.js”, O'Reilly Media, Inc., 1st Edition, 2011.

19CS21L WEB APPLICATION DEVELOPMENT USING ANGULARJS

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Build optimized user interface applications. (K3)
CO2: Explore the Component and apply filter in the angularJS application. (K3)

LIST OF EXERCISES

1. Setup angular framework in local environment.
   - Create your first application using angular framework
   - Understanding ng attributes for building the applications
2. Implement expressions and data binding
3. Create and implement modules and controllers
4. Build and implement custom pipes
5. Develop a form with various input controls and perform validation for the same using HTML5 attributes (minlength, maxlength, pattern etc...).
6. Build and implement Custom directives
7. Create a Single page application (SPA) using angular framework
8. Develop a real time application involving the above concepts in angular JS

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Sublime Text / Aptana Studio 3/ Eclipse (Windows environment)
  Node.js and NPM,Angular CLI,PM2 Packages (Linux environment)

REFERENCES

1. Agus Kurniawan, “AngularJS Programming by Example”, PE Press, 1st Edition, 2014.
2. Andrew Grant, “Beginning AngularJS”, Apress, 1st Edition, 2014.

19CS22L NOSQL on MONGODB

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic structure of NoSQL Components (K2)
CO2: Implement database navigation operations using ODBC /JDBC (K3)

LIST OF EXERCISES

1. Study of Open Source NOSQL Database: Mongo DB (Installation, Basic CRUD operations, Execution)

2. Design and Develop Mongo DB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)
3. Implement aggregation and indexing with suitable example using Mongo DB
4. Implement Map reduces operation with suitable example using Mongo DB
5. Create simple objects and array objects using JSON
6. Implement Database navigation operations using ODBC/JDBC by connecting PHP/PYTHON/JAVA

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Mongo DB

REFERENCES

1. Peter Membrey, “MongoDB Basics”, Apress; 1st Edition, 2014.
2. https://docs.mongodb.com/manual/tutorial/
3. https://www.tutorialspoint.com/mongodb/index.htm

19CS23L APPLICATION DEVELOPMENT USING FLUTTER DEVELPOMENT

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of Flutter development (K2)

CO2: Develop the applications in various environment using the flutter (K3)

LIST OF EXERCISES

1. Flutter installation and dart introduction
    a. Install Android studio
    b. Install flutter SDK
    c. Install Flutter plugins for Android Studio and setup SDK path
    d. Learn dart basics
2. Running the Counter app in all platforms(Android & Web)
    a. Change flutter channel to support web
    b. Enable web in flutter config
    c. Run in both android and chrome
3. Create the Calculator app by using the grid view/List view with the flutter
4. Design the Registration form app by using different form fields and form validation with the flutter
5. Creating the authentication for registration and Log in page by using SQL Lite database with the flutter
6. Create a To-do list app for doing the daily scheduled activities by using the flutter

7. Explore the different animations available in the Flutter such as Fading widget, Moving Widget and Bouncing button.

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows/Linux
- **Software:** Android Studio, Flutter SDK

REFERENCES

1. Alessandro Biessek, ”Flutter for beginners” An introductory guide to building cross-platform mobile applications with Flutter, Packt publishing Ltd., 2019.
2. Marco L. Napoli, “Beginning Flutter: A Hands On Guide to App Development”, John wiley and sons, Inc., 2020.

19CS24L APPLICATION DEVELOPMENT USING FIREBASE

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand how to simplify a database by using Firebase data modelling (K2)
CO2: Build interactive web applications using firebase. (K3)

LIST OF EXERCISES

1. Setup a new project using the Firebase console
    - Install and use the Firebase SDK
2. Configuring Firebase in a website.
3. Adding firebase functionalities in a website.
4. CRUD your data in Real-time
    - Adding and Retrieving data in the Firestore database.
    - Updating and deleting data in the Firestore database.
5. Build and implement user authentication methods using crashlytics.
6. Controlling the Firebase.
    - Sorting and limiting the data
7. Create a Real-time web application using Firebase

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Sublime Text and Firebase CLI

REFERENCES

1. Houssem Yahiaoui, “Firebase Cookbook: Over 70 recipes to help you create real-time web and mobile applications with Firebase”, Packt publishing, 2017.
2. Andrew Grant, “The Definitive Guide to Firebase: Build Android Apps on Google's Mobile Platform”, Apress, 1st Edition, 2017.
3. https://www.udemy.com/course/learning-firebase/

19CS25L	**LINUX ADMINISTRATION**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment. (K2)

CO2: Evaluate the concept of shell scripting programs.(K3)

LIST OF EXERCISES

1. Installation of Red HAT Linux operating system.
    a. Partitioning drives
    b. Configuring boot loader
    c. Network configuration
    d. Setting time zones
    e. Creating password and user accounts
    f. Shutting down
2. Explore the all Linux Directory Management and File Management commands with syntax and its usages
3. Develop a script to check whether the given input is a number or a string
4. Create a shell script that accepts a numerical value N and displaying the decrementing value of N till it reaches 0
5. Develop a basic math calculator using case statement in Linux
6. Design a Shell script that displays list of all the files in the current directory to which the user has read, write and execute permissions Sorting and limiting the data
7. Create a Linux shell script to find the number of characters, words and lines in a file

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows 7,8,10 / Linux (Ubuntu).
- **Software:** Chrome, Firefox Browsers, Java

REFERENCES

1. N.Matthew, R.Stones, Wrox “Beginning Linux Programming”, Wily India Edition. 4th Edition, 2011.
2. N.B.Venkateswarlu, “Advanced Unix Programming”, BS Publications, 2016.

19CS26L	**SOFTWARE TESTING USING SELENIUM**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of automation testing IDE Selenium K2)

CO2: Design and evaluate the test cases using TestNG Framework. (K3)

LIST OF EXERCISES

1. Access and installation of Selenium IDE for Automated Testing
    a. Understanding the components
    b. Driver requirements
    c. Browser Manipulations and waits
    d. Supported Classes
2. Practicing with Basis Driver Scripts in Selenium
    a. Alerts
    b. Prompts
    c. Confirmations
    d. Proxy Setup
    e. Page Loading
    f. Element Finding
3. Developing the driver scripts to perform operations on GUI Elements
    a. Text Box
    b. Submit Button
    c. Send keys()
    d. Click()
    e. Checkbox
    f. Radio Buttons
    g. Image
    h. Dropdown
4. Build a driver scripts to handle the Events
    a. Mouse and Keyboard Events
    b. File Upload and Download Events
    c. Alert and Popup handling
    d. Web tables and Dynamic tables
5. Access and installation of TESTNG IDE for Automated Testing
    - Add the TestNG Framework in Eclipse
6. Create a TestNG sample project for real time applications
    - Create and code test cases
    - Create TestNG Testfile
    - Running the test
    - Export the report

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** JAVA, Eclipse,Selenium,TestNG

REFERENCES

1. https://www.selenium.dev/documentation/en/getting_started/
2. Dimo Kovalenko, “Selenium Design Patterns and Best Practices”, Packet Publishing Limited, 2014.
3. https://www.guru99.com/selenium-tutorial.html

19CS27L PREDICTIVE ANALYTICS USING MACHINE LEARNING

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basic concepts of machine learning and predictive analytics. (K2)
CO2: Deploy applications using machine learning and predictive analytics (K3)

LIST OF EXERCISES

1. Interpret the data using python libraries-Numpy, pandas, matplot
2. Predicting the home rate using the linear regression technique
3. Predict the weather forecasting using regression technique
4. Speech emotion recognition using CNN
5. Sentimental analysis on Twitter data
6. Credit card Fraud detection using historical transaction data
7. Predicting the yield estimation in a garden using images

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Anaconda, Google colab , Jupiter

REFERENCES

1. John D.Kellehar, “Fundamentals of Machine Learning for Predictive Data Analytics”, 2015.
2. https://www.educba.com/machine-learning-vs-predictive-modelling/
3. https://towardsdatascience.com/top-9-data-science-projects-for-a-beginner-in-2020-26eb7d42b116

19CS28L PYTHON FOR MACHINE LEARNING

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Interpret the dataset with virtualization techniques.(K2)
CO2: Apply machine algorithms for classification and prediction.(K3)

LIST OF EXERCISES

1. Interpret the Numpy operations using python
2. Creating data frames and reading data from CSV/JSON using python pandas
3. Data visualization using python matplot
4. Classify the data using classification algorithms (KNN/SVM) in python
5. Weather forecasting using k-means clustering algorithm
6. Image classification using decision tree/random forest using python
7. Face recognition using Neural network in python

P:30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- **Operating System**: Windows / Linux
- **Software:** Anaconda, Google colab , Jupiter

REFERENCES

1. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education, 1st Edition, 2017.
2. Ethem Alpayd, “Introduction to machine learning”, MIT press, 2nd Edition, 2015.

19CS29L FULL STACK DEVELOPMENT

		L	T	P	C
19CS29L	**FULL STACK DEVELOPMENT**	**0**	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Build the Data base tables with proper user authentications (K3)

CO2: Develop simple interactive static and dynamic web applications (K3)

LIST OF EXERCISES

1. Create Database and entities with different user access privileges
2. Create a table with necessary attributes, key and Domain constraints. Perform CRUD operations.
3. Create a simple spring boot web service to get and post user data.
4. Create a web service to fetch the information from DB and display the data as JSON.
5. Create the simple static web pages and apply the necessary CSS Layouts and styles.
6. Create an enriched static webpage design by applying Bootstrap 5 and Perform essential DOM Event handlings.
7. Create a dynamic Single page web application to get and post user form data from DB.
8. **MINI PROJECT**: Develop an enriched dynamic website for handling student’s personal and performance data.

SOFTWARE REQUIREMENTS

- Operating Systems: Windows 8 or above / Ubuntu 14 or above
- Software’s: VS Code, PostgreSQL 12, Java 8, Spring Boot 2.6, React JS / Angular, Bootstrap 5

PREREQUISITES

Basic Knowledge in HTML, CSS, Java Script, Java, DBMS

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Julie C. Meloni, Jennifer Kyrnin “Sams Teach Yourself HTML, CSS, and JavaScript All in One,” 3’d Edition, 2020.
2. Juha Hinkula ,” Hands-On Full Stack Development with Spring Boot 2 and React: Build modern and scalable full stack applications using Spring Framework 5 and React with Hooks, 2nd Edition 2nd Edition, Kindle Edition”, Packt Publishing,2021.

3. https://www.udemy.com/course/full-stack-project-spring-boot-20-react-redux/
4. https://www.udemy.com/course/full-stack-angular-spring-boot-tutorial/
5. https://www.coursera.org/learn/front-end-react.

19CS30L	**MICROPROCESSOR AND MICROCONTROLLER**	**L**	**T**	**P**	**C**	**QP**
		1	**0**	**0**	**1**	**C**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the working principles of internal organizational units of microprocessor and microcontroller (K2)

UNIT I 8085 PROCESSOR 8

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts – Timing Diagram – Interrupts- I/O interfacing – Serial & Parallel communication interface – D/A and A/D Interface - Case studies: Traffic Light control, LED display, LCD display

UNIT II 8051 MICROCONTROLLER 7

Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming - Timer/Counter and Serial Communication, Programming Timer Interrupts, Programming External H/W interrupts-Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections

L:15; TOTAL:15 PERIODS

TEXT BOOKS

1. Muhammed Ali Mazidi, Janice Gillisple Maidi, Rolin.D. McKinlay, "The 8051 Microcontroller and Embedded Systems, Using Assembly and C", Pearson Prentice Hall, 2nd Edition, 2015.
2. K.Uma Rao, Andhe Pallav, The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 3 rd Edition, 2014.

REFERENCES

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, 5th Edition, Penram International Publishing, 2002.
2. Kenneth J Ayala, "The 8051 Microcontroller", Cengage Learning, Reprint, 3rd Edition 2014.
3. A.K.Ray and K.M. Bhurchandi, "Advanced Microprocessor and Peripherals", Tata McGraw Hill, 3rd Edition, 2013.
4. Andrew N. Sloss, Dominic Symes, Chris Wright and John Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software", Elsevier, 2009.

19CS31L	**GOLANG PROGRAMMING**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Implement the basic concepts of Golang (K3)
CO2: Build a basic framework for blockchain using Golang (K3)

LIST OF EXPERIMENTS

1. Write a program to calculate the year given the date of birth and age.
2. Write a program to get a number from the console and check if it's between 1 and 10.
3. Write a program that divides x by 2 if it's greater than 0.
4. Write a program to create a new file containing names and read it into an array.
5. Write a program to take the string 'hello world' and slice it in two.
6. Write a program that rolls a dice (1 to 6).
7. Write a program to create a struct house with variables noRooms, price and city.
8. Write a program to create a variadic function that prints the names of students.
9. Write a program to create a method that calls another method.
10. Write a program to generate Fibonacci series using recursive functions.
11. Build the basic framework for a blockchain using Golang module system.

P: 30; TOTAL:30 PERIODS

SOFTWARE REQUIREMENTS

- Operating System: Linux/ Windows
- Software: LiteIDE /GoLand 2021.2.4

REFERENCES

1. Shubhangi Agarwal , "Learning Go Programming : Build Scalable Next -Gen Web Application using Golang", BPB Publications; 1st edition, 2021.
2. Prithvipal Singh and Sachchidanand Singh, "Hands-on Go Programming: Learn Google Golang Programming, Data Structures, Error Handling and Concurrency", BPB Publications; 1st edition, 2021.
3. https://www.udemy.com/topic/go-programming-language/

19CS32L	**KOTLIN PROGRAMMING**	**L T P C**
		0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Implement the basic concepts of Kotlin (K3)
CO2: Build a simple block chain using Kotlin (K3)

LIST OF EXERCISES

1. Write a program to find the roots of a quadratic equation using conditional statement
2. Write a program to check whether the given number is a positive or a negative number using conditional statement
3. Write a program to display Fibonacci series using for loop statement.
4. Write a program to check Palindrome number using loop
5. Write a program to display Armstrong numbers between two integers using functions.

6. Write a program to display prime numbers between intervals using functions.
7. Write a program to find GCD of two numbers using recursive functions.
8. Write a program to find sum of natural numbers using recursive functions.
9. Write a program to find transpose of a matrix using arrays.
10. Write a program to add two matrices using multi-dimensional arrays.
11. Write a program to create a genesis block of a blockchain.
12. Write a program to build a simple blockchain for an application (Supply Chain Management / Medical Systems Management / Land Registration).

P: 30; TOTAL: 30 PERIODS

SOFTWARE REQUIREMENTS

- Operating System: Linux / Windows
- Software: JDK, IntelliJ IDEA 2021.2.3

REFERENCES

1. Aleksei Sedunov, "Kotlin In-Depth: A Comprehensive Guide To Modern Multi-Paradigm Language", BPB Publications, 2020.
2. https://www.geeksforgeeks.org/kotlin-programming-language/
3. https://www.udemy.com/course/kotlin-course/
4. https://www.coursera.org/projects/learn-kotlin-1
5. https://amarszalek.net/blog/2018/03/20/simple-blockchain-in-kotlin/

19CS33L	ETHICAL HACKING	L T P C
		0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basics of ethical hacking and installation of hacking tool (K3)
CO2: Build the simple experiments using the hacking tool (K3)

LIST OF EXERCISES

1. Study Kali Linux tool, types, installation and configuration procedure of VMware/Kali linux.
2. Analysis your network to track resources, mapping visualization and security auditing using Information Gathering Tool
3. Simulate login cracker process using Jhonny/ Hydra/ John
4. How to use Wi-Fi cracking tools in wireless attacks
5. Implement program for scanning, fingerprinting, and exploitation of router using Cisco torch
6. Scan and test the security of web applications.

P: 30; TOTAL: 30 PERIODS

SOFTWARE REQUIREMENTS

- Operating System: Linux
- Software: VMWare,Kali linux Tool

REFERENCES

1. Raphael Hertzog , Mati Aharoni, Jim O'Gorman, “Kali Linux Revealed: Mastering the Penetration Testing Distribution”, Offsec Press, ISBN-13-978-0997615609, 2017.
2. Vivek Ramachandran & Cameron Buchanan, “Kali Linux Wireless Penetration Testing: Master wireless testing techniques to survey and attack” ,
3. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3rd Edition, Prentice Hall, 2020.
4. Mary Manjikian, Cybersecurity Ethics - An Introduction, Routledge - Taylor & Francis Group, 2018.
5. Markus Christen, Bert Gordijn, Michele Loi, ―The Ethics of Cybersecurity‖, Springer, 2020.

19CS34L	AUGMENTED REALITY FOR DEVELOPERS	L	T	P	C
		0	0	2	1

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Articulate the basic terminologies involved in Augmented Reality. (K2)
CO2: Create and deploy Augmented Reality mobile applications to solve real world problems. (K3)

LIST OF EXPERIMENTS

1. Create Marker based Augmented Reality mobile application.
2. Create Markerless Augmented Reality mobile application.
3. Create Cylinder Target Augmented Reality mobile application.
4. Create Multi Target Augmented Reality mobile application.
5. Create UI, Virtual Buttons, Animation and Interaction with 3D game objects.
6. Create an Augmented Reality Mobile application for any one of the real-world use cases. The application must include at least 2 scenes which can be changed dynamically, a good UI, Animation and Interaction with 3D game objects.

P:30; TOTAL:30 PERIODS

HARDWARE REQUIREMENTS - Mobile/Tablet – Web Camera - Desktop PC / Laptop (i5 Processor – 8 GB RAM) Equivalent or above.

SOFTWARE REQUIREMENTS - Unity 3D, Vuforia, AR Foundation, Visual Studio, C# .NET, Blender.

REFERENCES

1. Jonathan Linowes, “Augmented Reality with Unity AR Foundation: A Practical guide to cross-platform AR development with Unity 2020 and later versions”, Packt Publishing, 2021.
2. Jonathan Linowes, Krystian Banilinski, “Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit and Vuforia”, Packt Publishing, 2017.
3. Ashley Godbold, “Mastering UI Development with Unity”, Packt Publishing, 2018.

4. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles and Practice”, Pearson Education India, 2016.
5. Augmented Reality in Tourism, Museums and Heritage: A New Technology to Inform and Entertain (Springer series on Cultural Computing) 1st Ed. 2021.
6. Brinis Hamza, Abderrahmen Brinis, “Udemy Course - Build your First AR application using Unity C# and Vuforia: Learn how to make AR Book or magazine for Kids with Vuforia and Unity”, 2021.
7. https://library.vuforia.com/getting-started/getting-started-vuforia-engine-unity
8. https://learn.unity.com/tutorial/setting-up-ar-foundation
9. https://www.coursera.org/learn/ar
10. https://www.udemy.com/course/develop-augmented-reality-book-ar-business-card-with-unity

R-2019 B.E – CSE

OPEN ELECTIVE COURSES

19CS01N	COMPUTER GRAPHICS AND VIRTUAL REALITY	L	T	P	C	QP
		2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Apply different view of projections on objects (K3)
CO 2: Apply 2D and 3D transformations (K3)
CO 3: Apply lighting and shading effects on objects (K2)
CO 4: Explore 3D interaction techniques (K2)
CO 5: Work on virtual reality tools (K3)

UNIT I INTRODUCTION TO COMPUTER GRAPHICS 12

Graphics system and models: Applications of Computer Graphics, Graphics System, Physical and Synthetic Images, Imaging Systems, Graphics Architectures- Primitives and Attributes, Color, Control functions, Adding Interaction. Viewing: Positioning of the Camera, Parallel Projections, Perspective Projections, OpenGL Projection Matrices.

UNIT II GEOMETRIC OBJECTS AND TRANSFORMATIONS 12

Scalars, Points and Vectors, Three-Dimensional Primitives, Coordinate Systems and Frames, Frames in OpenGL, Matrix and Vector Classes, Modeling a Colored Cube, Affine Transformations - Translation, Rotation and Scaling, Transformations in Homogeneous Coordinates, Concatenation of Transformations, Transformation Matrices in OpenGL, Interfaces to Three-Dimensional Applications, Quaternion- 2D transformations: Translation, Scaling, Rotation, and Shearing - 3D transformations: Translation, Scaling, and Rotation.

UNIT III FRAGMENTATION, LIGHTING AND SHADING 12

Vertices to Fragments: Basic Implementation Strategies, Four Major Tasks, Clipping - Line Clipping, Polygon Clipping, Clipping of Other Primitives, Clipping in Three Dimensions, Polygon Rasterization, Hidden-Surface Removal, Antialiasing, Display Considerations. Lighting and Shading: Light and Matter, Light Sources, Polygonal Shading, Specifying Lighting Parameters, Global Illumination.

UNIT IV 3D INTERACTION TECHNIQUES 12

3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines - 3D Travel Tasks, Travel Techniques. Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Multimodal System Control Techniques, Design Guidelines - Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques.

UNIT V ADVANCES IN 3D USER INTERFACES 12

3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces- Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, 3D Interaction Techniques- 3D UI Design and Development-3D UI Evaluation and Other Issues.

L:30;P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Edward Angel, “Interactive Computer Graphics: A Top-Down Approach Using OpenGL”, Addison-Wesley, 7th Edition, 2015.

2. Hearn Baker Carithers, “Computer Graphics with Open GL”, Pearson Education Limited, 4th Edition 2014.
3. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.

REFERENCES

1. Abdulmotaleb El Saddik , Mauricio Orozco, Mohamad Eid, Jongeun Cha, “Haptics Technologies: Bringing Touch to Multimedia”, Springer; 2011.
2. https://booksite.elsevier.com/samplechapters/9780123749437/01~Front_Matter.pdf
3. http://cmp.felk.cvut.cz/cmp/courses/XE33PVR/WS20072008/Lectures/Technical/intro-print.pdf
4. https://virsabi.com/everything-about-haptic-technology
5. http://staff.fhhagenberg.at/burger/publications/pdf/ifip-portugal94.pdf

19CS02N	**MOBILE APPLICATION DEVELOPMENT**	**L**	**T**	**P**	**C**	**QP**
		2	**0**	**2**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Work in the mobile application development framework and understand the lifecycle of mobile application (K2).
CO2: understand the Android platform and its components(K2)
CO3: work on mobile application tools to create simple applications (K3)
CO4: understand Android views, view Groups and layouts. (K2)
CO5: Understand about intents and services in android application development (K2).

UNIT I INTRODUCTION 12

Mobile Applications – Characteristics and Benefits –Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Frameworks and Tools – Mobile devices Profiles.

UNIT II INTRODUCING ANDROID 12

The Android platform - Understanding the Android market - The layers of Android - Four kinds of Android components - Understanding the AndroidManifest.xml file - Mapping applications to processes.

UNIT III TOOLS 12

Android Platform – Eclipse Emulator – Android Application Architecture – Event based programming – iOS Platform – UI tool kit interfaces – Event handling and Graphics services – Layer Animation.

UNIT IV ANDROID STUDIO DEVELOPMENT ENVIRONMENT 12

Setting up an Android Studio Development Environment - Creating an Example Android App in Android Studio - Creating an Android Virtual Device (AVD) in Android Studio - The Basics of the Android Studio Code Editor - Saving and Restoring the State of an Android Activity - Understanding Android Views, View Groups and Layouts.

UNIT V APPLICATION DEVELOPMENT 12

Intents and Services – Storing and Retrieving data – Communication via the Web – Notification and Alarms – Graphics and Multimedia – Location based services – Packaging and Deployment – Security and Hacking.

L:30;P:30; TOTAL:60 PERIODS

REFERENCES

1. W. Frank Ableson, Robisen, Chris King, C. Enrique Ortiz, “Android in Action”, Manning Shelter Island, 3rd Edition, 2012.
2. Zigurd Mednieks, Laird Dornin, G.BlakeMeike and Masumi Nakamura, “Programming Android”, O Reilly, 2011.
3. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley, 2010.
4. Alasdair Allan, “iPhone Programming”, O‟Reilly, 2010.
5. Wei-Meng Lee, “Beginning iPhone SDK Progrmming with Objective-C”, Wrox Wiley, 2010.
6. Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley, 2009.

19CS03N	**OBJECT ORIENTED PROGRAMMING**	**L**	**T**	**P**	**C**	**QP**
		2	**0**	**2**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the differences of structured and object oriented programming features.(K3)
CO2: develop programs using overloading and appropriate constructors. (K3)
CO3: develop the applications using appropriate inheritance and polymorphism mechanisms (K3)
CO4: use advance features like templates and exception to make programs supporting reusability and sophistication. (K3)
CO5: Implement rich data handling through files and STL. (K3)

UNIT I BASIC CONCEPTS 12

Introduction to OOPs - Applications of OOP - Structure of C++ - Program - C++ Basics: Keywords – Constants - Data Types - Dynamic Initialization of Variables - Reference Variables - Operators in C++ - C++ Class Overview: Class Definition Objects - Class Members - Access Control – Scope Resolution operator - Friend Functions - static class members.

UNIT II CONSTRUCTORS AND OVERLOADING 12

Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors - Function Overloading - Operator overloading, Rules for Operator overloading - overloading of binary and unary operators.

UNIT III INHERITANCE AND POLYMORPHISM 12

Introduction to inheritance - Defining Derived Classes - Single Inheritance - Multiple Inheritance - Multi-Level Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes - Abstract Classes - Constructors in Derived Classes - Introduction to pointers - Pointers to Objects - Virtual Functions - Pure Virtual Functions - Virtual Destructors.

UNIT IV TEMPLATES AND EXCEPTION HANDLING 12

Introduction - Class Templates - Class Templates with Multiple Parameters - Function Templates, Function Templates with Multiple Parameters -Member Function Templates - Basics of Exception Handling, Types of exceptions - Exception Handing Mechanism - Throwing and Catching Mechanism.

UNIT V FILE HANDLING AND STL 12

Files in C++: File handling in C++ - File I/O - Formatted and Unformatted I/O – STL.

L:30;P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Herbert Schildt, “C++: The Complete Reference”, 5th Edition, Tata McGraw – Hill Publishers, 2014.
2. Paul Deitel, Harvey Deitel, “C++ How to Program”, 8th Edition, Prentice Hall Publisher, 2016.
3. Trivedi, Bhushan “Programming with ANSI C++”, 2nd Edition, Oxford University Press - NASW Press, 2013.

REFERENCES

1. Ira Pohl, “Object Oriented Programming using C++”, Pearson Education, 2nd Edition, Reprint 2004.
2. S. B. Lippman, Josee Lajoie, Barbara E. Moo, “C++ Primer”, Pearson Education, 4th Edition, 2012.
3. Bjarne Stroustrup, “The C++ Programming language”, Pearson Education, 4th Edition, 2013.

19CS04N	PROGRAMMING IN PYTHON	L	T	P	C	QP
		2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: develop simple Python programs. (K3)

CO2: structure simple Python programs for solving problems and decompose a Python program into functions. (K3)

CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)

CO4: understand file management concepts and develop packages in Python Programs. (K3)

CO5: design and Develop GUI Programming. (K5)

UNIT I DATA, EXPRESSIONS, STATEMENTS 12

Python interpreter and interactive mode - values and data types: Variables - expressions - statements – Operators - precedence of operators – Input and Output - comments – Errors: Syntax Errors - Runtime errors – Logical Errors.

UNIT II CONTROL FLOW, FUNCTIONS 12

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) – chained conditional (if-elif-else) - Iteration: state – while – for – break – continue - pass - Fruitful functions: Function argument and its types - return values – parameters – local and global scope - function composition – recursion.

UNIT III LISTS,TUPLES,DICTIONARIES 12

Strings: string slices – immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists – list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods.

UNIT IV FILES, MODULES, INTERPRETERS &PACKAGES 12

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – Computer Numerical Controller (CNC) implementation using python – CNC G codes to stepper Motor - Python control of Linux CNC for prototyping machine- packages - Name space.

UNIT V GRAPHICAL USERINTERFACEPROGRAMMING 12

Event driven programming - TkInterintroduction - Introducing callbacks - User input - Simple case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score.

L:30;P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, O'Reilly Media, Inc., 2016.
2. Brian Heinold, “A Practical Introduction to Python Programming”,Mount St. Mary’s University, 2012.
3. Richard L. Halterman, “Learning to Program with Python”, 2019.
4. Mark Pilgrim, “Dive into Python”, Apress, 2012.

REFERENCES

1. Timothy A.Budd, “Exploring Python”,, Mc-Graw Hill Education (India) Limited, 2015.
2. PaulGries, Jennifer Campbell and Jason Montojo, “Practical Programming: An

Introduction to Computer Science using Python 3.6", Pragmatic Programmers, LLC, 2018.

3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd, 2016.
4. http://ce.sharif.edu/courses/96-97/2/ce153-6/resources/root/Learn-to-Program-with-Python.pdf.

19CS05N	**FUNDAMENTALS OF JAVA PROGRAMMING**	**L**	**T**	**P**	**C**	**QP**
		2	**0**	**2**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply object oriented concepts to solve real world problems (K3)
CO 2: explain the principles of packages and strings in java. (K2)
CO 3: develop multi-thread applications with exception handling (K3)
CO 4: create user interfaces for java application and applets using GUI (K3)
CO 5: build real time applications with JDBC and Collections (K3)

UNIT I JAVA BASICS 12

OOPS Concepts-Java Programming Constructs - Objects and Classes - Methods - Constructors -Access Specifiers - Data Types – Variables – Operators - Control Statements – Arrays - Inheritance – Method Overriding - Abstract Class – Interfaces.

UNIT II PACKAGES AND STRING 12

Packages - Importing Packages- Access Protection –Wrapper Classes - String Handling - Character extraction - string comparison – Methods for Modifying and Searching String.

UNIT III EXCEPTION HANDLING AND THREADS 12

Exception Handling: Try, Catch, Finally Blocks – Throw – Throws - Class Throwable-Multithreaded Programming: Creating Threads – Creating Multiple Threads – Thread Priorities –Synchronization - Inter Thread Communication - Suspending, Resuming and Stopping of Threads.

UNIT IV APPLETS AND EVENT HANDLING 12

Applet Basics - Applet Architecture - Applet Class and Methods – Passing parameters to Applets - Event Handling - Delegation Event Model - Event Classes - Event Listener Interfaces – Adapter Classes.

UNIT V JDBC AND COLLECTIONS 12

The Design of JDBC - The Structured Query Language - JDBC Configuration - Executing SQL- –Collections: Wrapper classes – Collection framework.

L:30;P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Hortsmann & Cornell, “CORE JAVA 2 Advanced Features – VOL-II”, Pearson Education, 10th Edition, 2017.
2. Deitel H M and Deitel P I, —Java - How to Program, Pearson Education, New Delhi, 11th Edition 2017.
3. Herbert Schildt, Java: The Complete Reference, 11th Edition, 2018.

REFERENCES

1. Anita Seth,B.L.Juneja, “JAVA one step ahead”, Oxford University Press Publication, 2nd Edition, 2018.
2. Sachin Malhotra and Saurabh Choudhary, Programming in Java Oxford University, New Delhi, 2018.
3. Herbert Schildt, “Java: A Beginner's Guide”, Tata McGraw Hill, 2007.

19CS06N	PROGRAMMING FOR ROBOTICS	L	T	P	C	QP
		2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: interpret the basic concepts of Robot programming. (K2)
CO 2: enrich the robot programming through VAL. (K3)
CO 3: develop robot with movement and motion instructions. (K3)
CO4: understand the importance of operating and data processing. (K3)
CO 5: explore the interfacing tools and testing of robot. (K3)

UNIT I INTRODUCTION TO ROBOT PROGRAMMING 12

Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation-Interlock commands Operating mode of robot, Jogging-Types, Robot specifications-Motion commands, end effectors and sensors commands.

UNIT II ROBOT PROGRAMMING LANGUAGES 12

Robot Languages-Classifications, Structures, Variable Assembly Language (VAL) - VAL language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications.

UNIT III RAPID LANGUAGE 12

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Move master command language-Introduction, syntax, simple problems.

UNIT IV AML LANGUAGE 12

ARC Macro Language (AML): AML Language-General description, elements and functions, Statements, constants and variables-Program control statements-Operating systems, Motion, Sensor commands-Data processing.

UNIT V PRACTICAL STUDY OF VIRTUAL ROBOT 12

Robot cycle time analysis-Multiple robot and machine Interference-Process Chart-Simple Problems-Virtual robotics, Robot studio online software- Introduction, Jogging, components, work planning, program modules, input and output signals-Singularities-Collision Detection-Repeatability measurement of robot-Robot economics.

L:30;P:30; TOTAL:60 PERIODS

REFERENCES

1. S. R. Deb, “Robotics technology and flexible automation”, Tata McGraw Hill publishing company limited, 2010.
2. Mikell. P. Groover, “Industrial Robotics Technology, Programming and Applications”, McGraw Hill Co, 2008.
3. RobotIcs Lab manual, 2007.
4. Klafter. R. D, Chmielewski. T. A. and Noggin’s., “Robot Engineering: An Integrated Approach”, Prentice Hall of India Pvt. Ltd., 2011.
5. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 2008.
6. Craig. J. J. “Introduction to Robotics mechanics and control”, Addison-Wesley, 2018.

19CS07N FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C	QP
2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand intelligent agents for search and games (K2)
CO2: Solve AI problems through programming with Python. (K3)
CO3: Learning optimization and inference algorithms for model learning. (K2)
CO4: Design and develop programs for an agent to learn and act in a structured environment. (K3)
CO5: Design some of the applications that use Artificial Intelligence (K3)

UNIT I INTRODUCTION 12

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Basic terminologies of tree and graph structures, State space representation, Search graph and Search tree.

UNIT II SEARCH ALGORITHMS 12

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

UNIT III PROBABILISTIC REASONING 12

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

UNIT IV MARKOV DESIGN PROCESS 12

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT V LEARNING 12

Supervised and Unsupervised learning, Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

L:30;P:30; TOTAL:60 PERIODS

LIST OF PRACTICALS (Should be given as Assignments)

1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3. Write a programme to construct a Bayesian network from given data.
4. Write a programme to infer from the Bayesian network.
5. Write a programme to run value and policy iteration in a grid world.
6. Write a programme to do reinforcement learning in a grid world.
7. Mini Project work

TEXT BOOK

1. S.Russel, P.Norvig, “Artificial Intelligence - A Modern Approach”, Pearson Education, 3rd Edition, 2015.

REFERENCES

1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, 3rd Edition Tata McGraw-Hill Education Pvt. Ltd, 2008.
2. Trivedi, M.C., “A Classical Approach to Artifical Intelligence”, Khanna Publishing House, 2018.
3. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011

19CS08N	SIMULATION AND MODELING	L	T	P	C	QP
		2	0	2	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: understand the basics of simulation and modelling.(K2)
CO2: generate random numbers and random variates using different techniques.(K3)
CO3: develop simulation model using heuristic methods.(K3)
CO4: identify the relevant input and output analyzer, verification and validation models and simulation software. (K3)
CO5: simulate the models for the purpose of optimum control by using software. (K3)

UNIT I INTRODUCTION 12

Introduction to Simulation: Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System.

UNIT II RANDOM NUMBERSGENERATION 12

General Principles: Concepts in discrete -event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. Random Numbers: Properties, Generations methods, Tests for Random Number-Frequency test, Runs test, Autocorrelation test.

UNIT III SIMULATION MODEL USING HEURISTIC METHODS 12

Random Variate Generation:Inverse Transform Technique-Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods-Erlang distribution.

UNIT IV SIMULATION MODELS USING INPUT AND OUTPUT ANALYZER 12

Analysis of Simulation Data Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model –Model Building, Verification, Calibration and Validation of Models.

UNIT V FUZZY AND GA 12

Modeling Based on Expert Knowledge - Fuzzy sets, Membership functions, Fuzzy Inference systems, Expert Knowledge and Fuzzy Models, Design of Fuzzy Controllers. Simulation of Engineering Systems: Monte-Carlo simulation.Genetic Algorithm - operations – elitism.

L:30;P:30; TOTAL:60 PERIODS

TEXT BOOKS

1. Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation",. Academic press, 2nd Edition, 2000.

REFERENCES

1. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, Discrete Event system Simulation, Pearson Education, Asia, 4thEdition, 2007.
2. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978.
3. Ogata K ," Modern control Engineering" , Prentice hall of India , 3rd Edition ,2001.

4. Jang J.S.R. sun C.T and Mizutani E, "Neuro-Fuzzy and soft Computing", Prentice hall of India, 3rd Edition, 2002.
5. Shannon, R. E., “System Simulation: The Art and Science”, Prentice Hall Inc. 1990.
6. Pratab.R "Getting started with MATLAB" Oxford university Press 2009.
7. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions –Industrial Engineering series, 4thEdition, 1991.
8. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004.

19CS09N	**COMPUTER ARCHITECTURE**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Realize the role of functional units and various architectural features (K2)
CO 2: Examine data representation and execution procedure of an ALU (K2)
CO 3: Identify the factors that degrade the pipeline performance and its counter measures (K4)
CO 4: Evaluate and analyze the performance of memory. (K4)
CO 5: To learn the different ways of communication with I/O devices and interfaces. (K2)

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional units – Basic operational concepts – Bus structures – Performance – Memory locations and addresses- Memory operations - Instructions and instruction sequencing – Instruction set architecture – Addressing modes- I/O Operations

UNIT II BASIC PROCESSING UNIT 9

Fixed point arithmetic- Addition and subtraction of signed numbers –multiplication of positive Numbers- signed operand multiplication and fast multiplication –restoring and non-restoring division algorithm. Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control.

UNIT III PIPELINING 9

A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – virtual memory, Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors.

UNIT V I/O SYSTEMS 9

Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – USB.Input/output system, programmed I/O, DMA and interrupts, I/O processors

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann / Elsevier, 5th Edition, 2014.
2. Carl Hamacher, Zvonko Vranesic, SafwatZaky and Naraig Manjikian, Computer Organization and Embedded Systems, Tata McGraw Hill, 6th Edition, 2012.
3. William Stallings, Computer Organization and Architecture – Designing for Performance, Pearson Education, 8th Edition, 2010.

REFERENCES

1. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, 3rd Edition, 2012.
2. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, 5th Edition, 2012.

19CS10N	DEEP LEARNING	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the basis of Machine Learning (K2)
CO2: Explore various Deep feed forward Networks (K2)
CO3: Implement and analyse Convolutional Neural Algorithms (K3)
CO4: Build Recurrent Neural networks for various applications (K3)
CO5: Understand optimization and generalization techniques in deep learning (K2)

UNIT I MACHINE LEARNING BASICS 9

Introduction to machine learning - Linear models (SVMs and Perceptrons, logistic regression). Learning Algorithms – Capacity, Overfitting and underfitting – Hyperparameters and Validation Sets – Estimators, Bias and Variance – Maximum Likelihood Estimation – Bayesian Statistics – Supervised Learning Algorithms – Unsupervised Learning Algorithms – Stochastic Gradient Descent – Building a Machine Learning Algorithm – Challenges Motivating deep learning.

UNIT II DEEP FEED FORWARD NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets

UNIT III DEEP CONVOLUTIONAL NEURAL NETWORKS 9

Convolutional Neural Networks**:** The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression

UNIT IV RECURRENT NEURAL NETWORKS 9

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing.

UNIT V OPTIMIZATION AND GENERALIZATION 9

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. 2nd Edition, 2016.
2. Dr.AdrianRosebrock, “Deep Learning for Computer Vision with Python: Starter Bundle”, PyImage Search, 1st Edition, 2017.

REFERENCES

1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 1st Edition, 2013.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 1st Edition, 2015.

19CS11N	**FUNDAMENTALS OF MACHINE LEARNING**	**L**	**T**	**P**	**C**	**QP**
		3	**0**	**0**	**3**	**A**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: To study the basics of machine learning (K1)
CO 2: To learn linear models(K2)
CO 3: To understand distance based clustering techniques(K2)
CO 4: To know about tree and rule-based models (K2)
CO 5: To understand ensemble learning (K2)

UNIT I INTRODUCTION 9

Machine learning - Task : problems solved with machine learning, Looking for structure, performance evaluation - Models: Geometric models, Probabilistic models, Logical models, Grouping and grading –Features - Binary Classification -Handling more than two classes – Regression-Movie genre identification and rating system

UNIT II LINEAR MODELS 9

Concepts: Supervised, Unsupervised and Descriptive learning - Hypothesis space - Linear classification – univariate linear regression – multivariate linear regression – logistic regression – perceptron – multilayer neural networks – learning neural networks structures – support vector machines- Credit card approval system.

UNIT III DISTANCE-BASED MODELS 9

Distance and measure - Neighbours and exemplars - Nearest neighbour classification - Distance based clustering: K-means algorithm, clustering around medoids –Document clustering.

UNIT IV TREE AND RULE MODELS 9

Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees - spam filtering

UNIT V MODEL ENSEMBLES 9

Features : Kinds of feature, Feature transformation , Feature Construction and Selection - Ensemble learning: bagging and random forests – Boosting: Boosted rule learning - Meta learning –Diabetes diagnosis system.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 1st Edition 2012.
2. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2nd Edition 2012.

REFERENCES

1. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
2. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012
3. https://www.coursera.org/learn/machine-learning/
4. http://archive.ics.uci.edu/ml/

19CS12N	BLOCKCHAIN TECHNOLOGY	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Identify blockchain, transactions, blocks, proof-of- work.(K1)
CO2: Recognize the basic security mechanism with Cryptographic technique (K2)
CO3: Recognize the significance of Bitcoin in BlockChain.(K2)
CO4: Implement consensus protocol mechanisms and hyper ledger tools.(K3)
CO5: Identify the important issues in blockchain technology.(K3)

UNIT I INTRODUCTION 9

History: Digital Money to Distributed Ledgers- Design Primitives: Protocols, Security, Consensus, Permissions, Privacy - Blockchain Architecture and Design- History of centralized services- Transactions-Trusted third party for transactions-Making a case for a trustless system - Decentralized transactions- Verifying and Confirming transactions.

UNIT II BASICS OF CRYPTOGRAPHY AND BITCOIN 9

Cryptography Hash Function – Properties of Hash Function – Hash pointer and Merkle tree – Digital Signature – Symmetric and Asymmetric Key Cryptography. Creation of Coins – Payments and Double Spending.

UNIT III BIT COIN TRANSACTION 9

Transaction in Bitcoin Network – Block Mining – Block propagation and Block relay- Proof of Work (PoW) – HashcashPoW – Attacks on PoW– Proof of Stack – Proof of Burn – Proof of Elapsed Time.

UNIT IV CONSENSUS AND HYPERLEDGER 9

Consensus: Basic consensus mechanisms-Requirements for the consensus protocols-Scalability aspects of Blockchain consensus protocols. Permissioned Blockchains: Design goals -Consensus protocols for Permissioned Blockchains. Hyperledger Fabric I: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation -Hyperledger composer tool

UNIT V CHALLENGES AND SECURITY ISSUES 9

Security and Safeguards- Protection from attackers - Hacks on exchanges - stopping adoption- Scalability problems - Bitcoin creation and economy - Network attacks to destroy bitcoin- Limited Supply and Deflation.

L:45; TOTAL:45 PERIODS

TEXT BOOK

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press- 1st Edition, 2016.

REFERENCES

1. Roger Wattenhofer, “Distributed Ledger Technology: The Science of the Blockchain”, 2nd Edition, 2017.
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Crypto currencies”, 2nd Edition, 2015.

19CS13N	DATABASE MANAGEMENT SYSTEMS	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Interpret the basic concepts and functions of DBMS and design E-R models for simple database application scenarios. (K2)
CO2: Apply the relational algebra operations in a database design. (K3)
CO3: Create database with appropriate constraints and query the database. (K3)
CO4:Understand the Importance of logical database design.(K2)
CO5: Analyze the database schema and apply the normalization rules and techniques to optimize the database. (K3)

UNIT I INTRODUCTION 9

Purpose of Database System – Views of data – Data Models – Database Languages – Database System Architecture – Database users and Administrator – Entity – Relationship (E-R) model – Constraints - Keys - E-R Diagrams – Weak Entity Sets – Extended E-R features - Design of E-R database schema – E-R schema to tables.

UNIT II RELATIONAL DATABASE MODEL 9

Structure of Relational Databases – Database Schema – Schema Diagrams – Relational Query Languages - Relational Algebra – Tuple Relational Calculus -– Domain Relational Calculus.

UNIT III STRUCTURED QUERY LANGUAGE (SQL) 9

Overview of SQL query language – SQL Data definition – Basic Structure of SQL Queries – Additional Basic Operations – Set Operations – Null values – Aggregate Operations – Nested Subqueries – Joins – Views – Integrity Constraints – Authorization. Introduction to Advanced SQL: Functions and Procedures – Triggers.

UNIT IV LOGICAL DATABASE DESIGN 9

Need for good database design – Functional Dependencies and Keys – Closure of Functional Dependencies Set – Closure of attributes - Dependency Preservation - Decomposition using functional dependencies – Canonical Cover - Atomic domains.

UNIT V NORMALIZATION 9

Normal Forms:First Normal Form – Second Normal Form – Third Normal Form – Boyce Codd Normal Form – Multivalued Dependencies - Decomposition using Multivalued dependencies – Fourth Normal Form – Join Dependencies – Fifth Normal Form.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts‖, Sixth Edition, Tata McGraw Hill, 2013.
2. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education / Addison Wesley, Sixth Edition, 2010.
3. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖,

8th Edition, Pearson Education, 2006

REFERENCES

1. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Pearson Education, Fifth Edition, 2009.
2. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition, 2004.
3. Raghu Ramakrishnan, ―Database Management Systems‖, 3rd Edition, Tata McGraw-Hill, 2003.
4. S.K.Singh, ―Database Systems Concepts, Design and Applications‖, 1st Edition, Pearson Education, 2006.
5. Jeffrey Stanton, ―An Introduction to Data Science‖, an interactive eBook from iTunes.

19CS14N	STRUCTURED QUERY LANGUAGE	L	T	P	C	QP
		3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the fundamental DDL statements in SQL (K2)
CO2: Understand the fundamental DML statements in SQL(K2)
CO3: Exemplifying the advanced Query structures in SQL (K2)
CO4: Application of Basic and Advanced SQL statement on real time cases using joins (K3)
CO5: Integrating the advanced tools to construct real time application using SQL Procedures and all necessary SQL Statements (K3)

UNIT I DATA DEFINITION LANGUAGE 9

Introduction –SQL Syntax – Data types – Operators - Databases: Create – Drop – Rename- Select - Tables: Create – Rename – Alter –Truncate – Delete – Drop – Copy – Temp table –SQL Keys : Primary Key –Foreign Key – Composite key – Unique Key – Alternate Key.

UNIT II DATA MANIPULATION LANGUAGE 9

DML Statements – Select Statement –Insert Statement – Where clause –Sql Aliases – Operators - In – Between- Like -And – Or –Not -Union - Any- All –Exist – Some – Update Statement – Delete Statement: Data Base - Table –Rows–SQL Aggregate Functions.

UNIT III ADVANCED QUERY STRUCTURES 9

SQL Clauses: Order by- Asc – Desc-Random - Limit - Group By – Having - Sub Query – Nested Sub Query –Data Control Language: Privileges – Grant –Revoke – SQL Case statements -Null Functions –Indexes - Sequences – Auto Increment /Decrement – Clone tables –SQL Injections.

UNIT IV SQL JOINS 9

SQL Joins – Basics -Types: Self Join -Inner Join - Outer Join - Left Join – Right Join-Full outer Join – views – Case studies: Student Library Scenario –Customer Sale Scenario – Employee Pay Scenario.

UNIT V SQL PROCEDURES 9

PL/SQL- Stored Procedures – Syntax – Functionalities – Control statements –Functions – Cursor -Triggers – Exceptions – Case Study: Banking Transactions (Front End : Html5 /Php/Asp/Jsp Back End : WAMPP / SQL Server).

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, Tata McGraw Hill, 2013.
2. James groff ,PaulWeinberg, Andy Oppel – SQL The complete reference, Third Edition -Paper Back Illustrated , 2009
3. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education / Addison Wesley, Sixth Edition, 2010.

REFERENCES

1. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education, Fifth Edition, 2009.
2. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, 8th Edition, Pearson Education, 2006
3. https://docs.microsoft.com/en-us/sql/?view=sql-server-ver15
4. https://www.w3schools.com/sql/
5. https://www.geeksforgeeks.org/sql-tutorial/

NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai & Accredited by NAAC)

K.R.NAGAR, KOVILPATTI – 628 503
www.nec.edu.in

REGULATIONS – 2019

CURRICULUM & SYLLABUS

B. E. – CIVIL ENGINEERING

B. E. – CIVIL ENGINEERING

CURRICULUM AND SYLLABUS

DEPARTMENT OF CIVIL ENGINEERING

VISION

Producing outstanding Civil Engineering Professionals with human values to face future challenges.

MISSION

- To provide with excellent teaching and research ambience.
- To prepare student for leadership roles in civil engineering.
- To facilitate student with lifetime skills and human values.
- To collaborate with industries to meet the ever challenging environment.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

1. Will have a successful career in civil engineering.
2. Pursue advanced degrees in support of their chosen profession.

PROGRAMMEOUTCOMES (POs)

At the time of graduation graduates of our CIVIL programme are expected to have

1. An ability to apply fundamental knowledge of mathematics, science and civil engineering in real-world problems.

2. An ability to identify, formulate and provide solution for engineering problems.
3. An ability to design and evaluate the desired needs.
4. An ability to conduct test and interpret the results.
5. An ability to use the skills, modern tools and techniques.
6. An ability to analyze the local and global impact of civil engineering.
7. Awareness of environment, innovations and sustainable development.
8. An ability to display their professional responsibilities meeting ethical standards.
9. An ability to have an idea of contemporary issues and an ability to function on multidisciplinary teams.
10. An ability to communicate effectively both in written and oral.
11. Recognition of the need for and an ability to engage in professional development and life-long learning.
12. An ability to lead a project team for the successful completion.

PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **Civil Engineering programme** is designed with total number of credits ***166 (125*** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table - I.

TABLE – 1 CATEGORY OF COURSES

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	06
2.	Basic Science courses	21.5
3.	Engineering Science courses	22.5
4.	Programme Core courses	76
5.	Programme Elective courses relevant to chosen specialization / branch;	21
6.	Open Elective courses from other technical and /or emerging subject areas;	06
7.	Skill Development Courses	13
8.	Mandatory courses	(non – credit)
	TOTAL	**166**

i. **Humanities and Social Sciences(HSMC)**include English, Communication Skill laboratory and Management courses

ii. **Basic ScienceCourses**(**BSC)** include Chemistry, Physics, Biology and Mathematics

iii. **Engineering Science Courses(ESC)**include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering

iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.

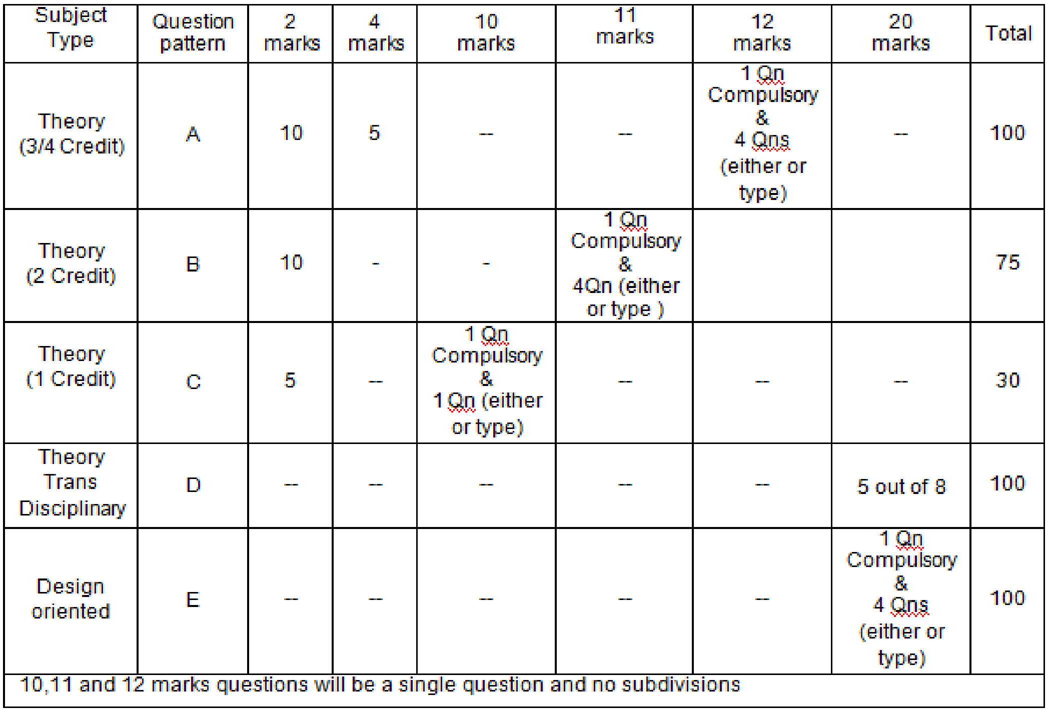
vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.

vii. **Skill Development Courses (SDC)** includethe courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.

viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

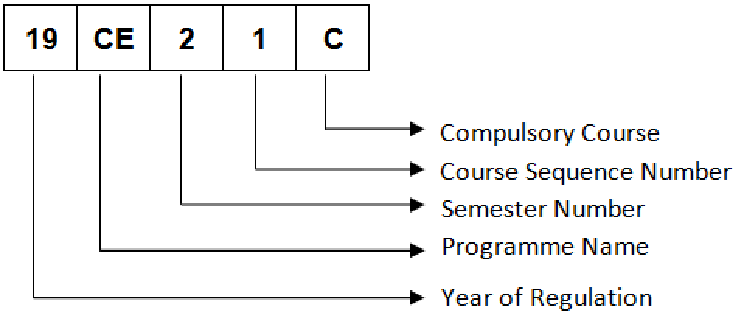
Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

TABLE – 2 QP – QUESTION PATTERN



Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE


19
CE
2
1
C
Compulsory Course
Course Sequence Number
Semester Number
Programme Name
Year of Regulation

REGULATIONS – 2019 CURRICULUM AND SYLLABUS

B. E. – CIVIL ENGINEERING

SEMESTER – I

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
PRACTICAL COURSES								
6.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	
7.	ESC	19SH17C	Engineering Practice Laboratory Part A – Mechanical Laboratory Part B – Electrical and Electronics Laboratory	0	0	4	2	
			TOTAL	**11**	**1**	**11**	**17.5**	

SEMESTER – II

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1	BSC	19CE21C	Applied mathematics	3	1	0	4	A
2	BSC	19CE22C	Physics for Civil Engineering	2	0	0	2	B
3	BSC	19CE23C	Life Science	2	0	0	2	B
4	ESC	19CE24C	Problem Solving Techniques	3	0	0	3	A
5	ESC	19CE25C	Engineering Mechanics	3	1	0	4	A
6	ESC	19CE26C	Basic Electrical and Electronics Engineering	3	0	0	3	A
PRACTICAL COURSES								
7.	ESC	19CE27C	Problem Solving Techniques Laboratory	0	0	4	2	
8.	ESC	19CE28C	Basic Electrical and Electronics Engineering Laboratory	0	0	3	1.5	
9.	HSMC	19CE29C	Communication Skills laboratory	0	0	2	1	
10.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
			TOTAL	**17**	**2**	**11**	**24.5**	

SEMESTER – III

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	BSC	19CE31C	Transforms, Probability and Statistics	3	1	0	4	A
2.	PCC	19CE32C	Solid Mechanics	3	1	0	4	A
3.	PCC	19CE33C	Fluid Mechanics	3	0	0	3	A
4.	PCC	19CE34C	Engineering Survey– I	3	0	0	3	A
5.	PCC	19CE35C	Construction Materials, Equipment's and Practices	3	0	0	3	A
6.	ESC	19CE36C	Basic Mechanical Engineering and Energy Sciences	3	0	0	3	A
PRACTICAL COURSES								
7.	PCC	19CE37C	Strength of Materials Laboratory	0	0	2	1	-
8.	PCC	19CE38C	Engineering Survey Practical–I	0	0	2	1	-
			TOTAL	18	2	4	**22**	

SEMESTER – IV

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19CE41C	Strength of Materials	3	1	0	4	A
2.	PCC	19CE42C	Applied Hydraulics and Hydraulic Machines	3	0	0	3	A
3.	PCC	19CE43C	Water Supply Treatment and Management	3	1	0	4	A
4.	PCC	19CE44C	Engineering Survey - II	3	0	0	3	A
5.	PCC	19CE45C	Soil Mechanics	3	1	0	4	A
6.	PCC	19CE46C	Concrete Technology	3	0	0	3	A
PRACTICAL COURSES								
7.	PCC	19CE47C	Engineering Survey Practical - II	0	0	2	1	-
8.	PCC	19CE48C	Hydraulic Engineering Laboratory	0	0	2	1	-
			TOTAL	**18**	**3**	**4**	**23**	

SEMESTER – V

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19CE51C	Basic Structural Analysis	3	1	0	4	A
2.	PCC	19CE52C	Design of Reinforced Concrete Elements	3	1	0	4	A
3.	PCC	19CE53C	Waste Water Treatment and Management	3	1	0	4	A
4.	PCC	19CE54C	Foundation Engineering	3	0	0	3	A
5.	PCC	19CE55C	Highway Engineering	3	0	0	3	A
6.	HSMC	19CE56C	Professional Ethics and Human Values	3	0	0	3	A
7.	MAC	19MC02C	CONSTITUTION OF INDIA	3	0	0	0	D
PRACTICAL COURSES								
8.	PCC	19CE57C	Concrete and Highway Engineering Laboratory	0	0	2	1	-
9.	PCC	19CE58C	Soil Mechanics Laboratory	0	0	2	1	-
			TOTAL	**21**	**3**	**4**	**23**	

SEMESTER – VI

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
THEORY COURSES								
1.	PCC	19CE61C	Estimation and Costing	2	1	0	3	A
2.	PCC	19CE62C	Construction Engineering and Management	3	0	0	3	A
3.	PCC	19CE63C	Solid Waste Management, Air and Noise Pollution Control	4	0	0	4	A
4.	PCC	19CE64C	Design of Steel Structures	3	0	0	3	A
5.	PEC	E1	Elective I	3	0	0	3	-
6.	PEC	E2	Elective II	3	0	0	3	-
PRACTICAL COURSES								
7.	PCC	19CE65C	Structural Design and Drawing	0	0	4	2	-
8.	PCC	19CE66C	Environmental Engineering Laboratory	0	0	2	1	-
			TOTAL	18	1	6	**22**	

SEMESTER – VII

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	*PEC*	E3	Elective III	3	0	0	3	-
2.	*PEC*	E4	Elective IV	3	0	0	3	-
3.	*PEC*	E5	Elective V	3	0	0	3	-
4.	*PEC*	E6	Elective VI	3	0	0	3	-
5.	*OEC*	E7	Elective VII	3	0	0	3	-
6.	*OEC*	E8	Elective VIII	3	0	0	3	-
7.	HSMC	19CE71C	Project management and Finance	3	0	0	0	A
PRACTICAL COURSES								
8.	SDC	19CE72C	Project Work – I	0	0	6	3	-
9.	PCC	19CE73C	Comprehension	0	0	4	2	-
			TOTAL	21	0	10	**23**	

SEMESTER – VIII

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	*PEC*	E9	Elective IX	3	0	0	3	-
PRACTICAL COURSES								
2.	SDC	19CE81C	Project Work – II	0	0	12	6	-
3.	SDC	19CE82C	Internship /In plant Training	0	0	4	2	-
			TOTAL	**3**	**0**	**16**	**11**	

TOTAL CREDITS TO BEEARNED FOR THE AWARD OF THE DEGREE - 166

PROGRAMME ELECTIVE COURSES (PEC)

S.No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
STRUCTURAL ENGINEERING DOMAIN								
1.	PEC	19CE01E	Advanced Structural Analysis	3	0	0	3	A
2.	PEC	19CE02E	Bridge Structures	3	0	0	3	A
3.	PEC	19CE03E	Storage Structures	3	0	0	3	A
4.	PEC	19CE04E	Theory of plates and Shells	3	0	0	3	A
5.	PEC	19CE05E	Tall Buildings	3	0	0	3	A
6.	PEC	19CE06E	Prefabricated Structures	3	0	0	3	A
7.	PEC	19CE07E	Computer Aided Design of Structures	3	0	0	3	A
8.	PEC	19CE08E	Industrial Structures	3	0	0	3	A
9.	PEC	19CE09E	Smart Materials and Smart Structures	3	0	0	3	A
10.	PEC	19CE10E	Repair and Rehabilitation of Structures	3	0	0	3	A
11.	PEC	19CE11E	Finite Element Techniques	3	0	0	3	A
12.	PEC	19CE12E	Design of Reinforced Concrete and Brick Masonry Structures	3	0	0	3	A
13.	PEC	19CE13E	Prestressed Concrete Structures	3	0	0	3	A
14.	PEC	19CE14E	Basics of Dynamics and Aseismic Design	3	0	0	3	A
15.	PEC	19CE15E	Design of steel concrete composite structures	3	0	0	3	A
16.	PEC	19CE16E	Advanced Steel Structures	3	0	0	3	A
17.	PEC	19CE18E	Experimental Stress Analysis	3	0	0	3	A
18.	PEC	19CE19E	Non Destructive Testing	3	0	0	3	A
GEOTECHNICAL ENGINEERING DOMAIN								
19.	PEC	19CE24E	Engineering Geology	3	0	0	3	A
20.	PEC	19CE25E	Rock Engineering	3	0	0	3	A
21.	PEC	19CE26E	Ground Improvement Techniques	3	0	0	3	A
22.	PEC	19CE27E	Introduction to Soil Dynamics and Machine Foundations	3	0	0	3	A
23.	PEC	19CE28E	Geotechnical Earthquake Engineering	3	0	0	3	A
SURVEY AND TRANSPORTATION ENGINEERING DOMAIN								
24.	PEC	19CE31E	Remote Sensing Techniques and Geographic Information System	3	0	0	3	A

S.No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
25.	PEC	19CE32E	Pavement Engineering	3	0	0	3	A
26.	PEC	19CE33E	Traffic Engineering and Management	3	0	0	3	A
27.	PEC	19CE34E	Railways, Airports and Harbour Engineering	3	0	0	3	A
28.	PEC	19CE35E	Advanced Surveying	3	0	0	3	A
ENVIRONMENTAL ENGINEERING DOMAIN								
29.	PEC	19CE38E	Environmental Impact Assessment	3	0	0	3	A
30.	PEC	19CE39E	Industrial Waste Management	3	0	0	3	A
31.	PEC	19CE40E	Ecological Engineering	3	0	0	3	A
32.	PEC	19CE41E	Environmental Instrumentation	3	0	0	3	A
IRRIGATION AND WATER RESOURCES ENGINEERING DOMAIN								
33.	PEC	19CE45E	Hydrology	3	0	0	3	A
34.	PEC	19CE46E	Ground Water Engineering	3	0	0	3	A
35.	PEC	19CE47E	Coastal Zone Management	3	0	0	3	A
36.	PEC	19CE48E	Water Resources Engineering	3	0	0	3	A
37.	PEC	19CE49E	Irrigation Engineering	3	0	0	3	A
CIVIL ENGINEERING MANAGEMENT DOMAIN								
38.	PEC	19CE52E	Housing Planning and Management	3	0	0	3	A
39.	PEC	19CE53E	Architecture and Town Planning	3	0	0	3	A
40.	PEC	19CE54E	Total Quality Management	3	0	0	3	A
41.	PEC	19CE55E	Engineering Economics and Cost Analysis	3	0	0	3	A
42.	PEC	19CE56E	Intellectual Property Rights (IPR)	3	0	0	3	A
43.	PEC	19CE57E	Management of Irrigation Systems	3	0	0	3	A
44.	PEC	19CE58E	Product Development Laboratory	1	0	2	2	-
REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM DOMAIN								
45.	PEC	19CE61E	Remote Sensing and GIS for Engineering Applications	3	0	0	3	A
46.	PEC	19CE62E	UAV Photogrammetry	4	0	0	4	A
47.	PEC	19CE63E	Total Station and GPS Surveying	4	0	0	4	A
48.	PEC	19CE64E	Terrestrial, Mobile and Aerial LIDAR	3	0	0	3	A

S.No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
49.	PEC	19CE65E	UAV Photogrammetry Laboratory	1	0	2	2	-
50.	PEC	19CE66E	Total Station and GPS Surveying Laboratory	1	0	2	2	-

ONE CREDIT ELECTIVE COURSES (PEC)

S.No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern$^{\oplus}$
STRUCTURAL ENGINEERING DOMAIN								
1.	*PEC*	19CE01L	Recent Advancements in Special Concrete	1	0	0	1	C
2.	*PEC*	19CE02L	Design of Foundation Elements	1	0	0	1	C
3.	*PEC*	19CE03L	Earth Retaining Structures	1	0	0	1	C
4.	*PEC*	19CE04L	Traffic Engineering and safety	1	0	0	1	C
5.	*PEC*	19CE05L	Bridge construction techniques	1	0	0	1	C
6.	*PEC*	19CE06L	Decentralized Waste WaterTreatment System (DEWATS)	1	0	0	1	C
7.	*PEC*	19CE07L	Building marking	1	0	0	1	C
8.	*PEC*	19CE08L	Introduction to Geographic Information System (GIS)	1	0	0	1	C
9.	*PEC*	19CE09L	Timber structures	1	0	0	1	C
10.	*PEC*	19CE10L	Earthquake Resistant Design	1	0	0	1	C
11.	*PEC*	19CE11L	Seismic evaluation and retrofitting of structures	1	0	0	1	C
12.	*PEC*	19CE12L	Tunneling Techniques	1	0	0	1	C
13.	*PEC*	19CE13L	Soil contamination and remediation	1	0	0	1	C
14.	*PEC*	19CE14L	Environmental noise Pollution	1	0	0	1	C
15.	*PEC*	19CE15L	Safety In Construction	1	0	0	1	C
16.	*PEC*	19CE16L	Design of Industrial Roofing System	1	0	0	1	C
17.	*PEC*	19CE17L	Advanced Engineering Materials in Construction	1	0	0	1	C
18.	*PEC*	19CE18L	Environmental Clearance (EC)	1	0	0	1	C
19.	*PEC*	19CE19L	Environmental Legislations	1	0	0	1	C
20.	*PEC*	19CE20L	Environmental Engineering Drawing	1	0	0	1	C
21.	*PEC*	19CE21L	Analytical Instrumentation	1	0	0	1	C

S.No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
22.	*PEC*	19CE22L	Coating Technology	1	0	0	1	C
23.	*PEC*	19CE23L	Acoustics	1	0	0	1	C
24.	*PEC*	19CE24L	Computer Aided Building Layout Drawing	0	0	2	1	-
25.	*PEC*	19CE25L	C Programming applications for Civil Engineering-I	0	0	2	1	-
26.	*PEC*	19CE26L	C Programming applications for Civil Engineering-II	0	0	2	1	-
27.	*PEC*	19CE27L	C Programming applications for Civil Engineering-III	0	0	2	1	-

Open Elective Course (OEC)

Group – I (Inter-disciplinary courses)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following course is compulsory								
1.	OEC	19ID01E	Product Design and Development	3	0	0	3	E
2.	OEC	19ID02E	Disaster Management	3	0	0	3	E
3.	OEC	19ID03E	Energy Engineering	3	0	0	3	E
4.	OEC	--	Other Programme Courses	3	0	0	3	As specified for the Chosen Course

Group-II (Trans-disciplinary courses) - Self Study Course

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	QP
Any one of the following course is compulsory								
1.	OEC	19TD01E	Soft Skills and Interpersonal Communication	0	0	0	3	D
2.	OEC	19TD02E	Impact of social media on society	0	0	0	3	D
3.	OEC	19TD03E	International Business Management	0	0	0	3	D
4.	OEC	19TD04E	Basics of Marketing	0	0	0	3	D
5.	OEC	19TD05E	Indian Economy	0	0	0	3	D
6.	OEC	19TD06E	International Trade	0	0	0	3	D
7.	OEC	19TD07E	Global Challenges and issues	0	0	0	3	D
8.	OEC	19TD08E	Indian Culture and Heritage	0	0	0	3	D

9.	OEC	19TD09E	Indian History	0	0	0	3	D
10.	OEC	19TD10E	Sustainable Development and Practices	0	0	0	3	D
11.	OEC	19TD11E	Women in Indian Society	0	0	0	3	D
12.	OEC	19TD12E	Bio Mechanics in Sports	0	0	0	3	D

19SH11C	**TECHNICAL ENGLISH**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: apply the basic language skills to understand various aspects of communication skills (K3)
- CO2: express their thoughts with correct usage of language in formal writings (K3)
- CO3: understand various language components and develop the pronunciation skill. (K2)
- CO4: make effective technical writings and interpret any pictorial representation. (K3)
- CO5: frame sentences and write effective reports. (K3)

UNIT I 6

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, Letter to Friend / Parent / Siblings - Greetings and Self Introduction – Situational Phrases - Tense (Present)

UNIT II 6

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) –Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

UNIT III 6

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

UNIT IV 6

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

UNIT V 6

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

Suggested Activity: Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Anderson, Paul V. “Technical Communication: A Reader - Centered Approach”, 9th Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. “A Comprehensive Grammar of the English Language”, Longman Inc., Newyork, 2014.

REFERENCES

1. Murphy Raymond, “Basic Grammar Practice on Tense”, Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., “Engineering English”, Orient Blackswan, Hyderabad, 2015.

19SH12C MATHEMATICAL FOUNDATIONS FOR ENGINEERS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make use of orthogonal transformation. (K3)
CO2: find the evolutes of various curves.(K2)
CO3: maxima and minima of real valued functions.(K3)
CO4: solve ordinary differential equations.(K2)
CO5: solve partial differential equations.(K2)

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivative – Total derivative – Euler’s theorem on homogeneous functions – Taylor’s Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange’s multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Solutions of first order ordinary differential equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2014.

REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9th Edition, Dorling Kindersley Private Limited, 2010.

19SH13C	**ENGINEERING PHYSICS**	**L T P C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2 0 0 2**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)
CO2: understand the principle and propagation of different types of waves (K2)
CO3: choose the appropriate Laser technique for industrial and medical applications (K2)
CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)
CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

UNIT I CRYSTALLOGRAPHY 6

Lattice, Unit cell, Bravais lattice, Lattice planes - Crystal system - Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

UNIT II WAVES 6

Simple harmonic oscillators - Damped harmonic oscillator - Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

UNIT III LASER 6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO_2), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

UNIT IV FIBRE OPTICS 6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

UNIT V QUANTUM PHYSICS 6

Black Body Radiation - Matter Waves - Heisenberg's uncertainty principle - Schrodinger's wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 11th Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", 7th Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D. J. Griffiths, "Quantum mechanics", 2nd Edition, Cambridge University Press, 2014.

REFERENCES

1. Renk, Karl.F "Basics of laser physics", 2nd Edition, Springer international publishing, 2017.
2. H. J. Pain,Patricia Rankin "Introduction to vibration and waves", 1st Edition, Wiley, 2015
3. K.S.Mathur, "Fundamentals of Fiber Optics",1st Edition, Zorba books, 2018.

19SH14C ENGINEERING CHEMISTRY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) 2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)
CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)
CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)
CO4: familiar with the various novel organic material used in electronics industry. (K2)
CO5: understand the principle, components and working of various analytical instruments. (K2)

UNIT I WATER TREATMENT 6

Hardness - Estimation of hardness of water – Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

UNIT II SURFACE CHEMISTRY AND CATALYSIS 6

Adsorption – Types - Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – Kinetics of surface reactions - Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications - Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

UNIT III ELECTROCHEMISTRY AND CORROSION 6

Electrode potential-Nernst Equation-reference electrode - glass electrode - measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)

Corrosion: Types of corrosion - Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

UNIT IV ELECTRONIC MATERIALS 6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidene fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, biosensor - chemical sensors

UNIT V ANALYTICAL TECHNIQUES 6

Spectroscopy:Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Jain P.C. and Jain. M., “Engineering Chemistry”, Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20th Edition, 2018.

REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6th Edition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, “Organic Electronics: Materials, manufacturing and applications”, Wiley - VCH, 2016

19SH15C ENGINEERING GRAPHICS

(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
2	0	4	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
CO2: construct the orthographic projections of points, straight lines and lamina (K2)
CO3: draw the projections of simple solids in different positions. (K3)
CO4: visualize the sectional views and surface areas of various solids. (K3)
CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

INTRODUCTION 5

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

UNIT I ENGINEERING CURVES 17

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

UNIT II ORTHOGRAPHIC PROJECTIONS 17

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

L: 30; P: 60; TOTAL: 90 PERIODS

TEXT BOOKS

1. Bhatt N.D, “Engineering Drawing”, 53rd Edition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, “Engineering Drawing”, Pearson Education, 2nd Edition, 2009.

REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2nd Edition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, “Engineering Drawing”, Subhas Publications, 32nd Edition, 2017.

19SH16C	ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY	L T P C
		0 0 3 1.5

(Common to all B.E. / B.Tech. Degree Programmes)

PART A – ENGINEERING PHYSICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K2)
CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium.(K2)
CO3: illustrate the electrical properties of materials. (K2)

LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster's bridge.

- A minimum of FIVE experiments shall be offered.

REFERENCES

1. David Loyal, " Physics laboratory" 4th Edition, Cengage learning, 2013
2. Sesha Sai Kumar Vemula, "Engineering Physics lab manual" 1st Edition, LAP LAMBERT Academic Publishing, 2017

PART B - ENGINEERING CHEMISTRY LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: determine various water quality parameters. (K2)
CO 2: quantify different ions by different analytical techniques. (K2)
CO3: determine the rate of corrosion of mild steel plate. (K2)
CO4: verify the freundlich adsorption isotherm. (K2)

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron (Fe^{2+}) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.

6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron (Fe^{2+}) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

P: 45; TOTAL: 45 PERIODS

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

REFERENCES

1. D.C. Harris "Quantitative Chemical Analysis: International Edition", W.H.Freeman, 9th Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford , P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8th Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

19SH17C ENGINEERING PRACTICE LABORATORY L T P C

(Common to all B.E. / B.Tech. Degree Programmes) **0 0 4 2**

PART A - MECHANICAL LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: prepare different carpentry joints. (K3)
CO2: prepare pipe connections with different joints for domestic applications. (K3)
CO3: make simple components using sheet metal (K3)
CO4: make components using machining operations (K3)
CO5: explain the types of welding processes (K2)
CO6: discuss the applications of 3D printing and injection moulding processes (K2)

LIST OF EXPERIMENTS

I. CARPENTRY PRACTICES 5

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands on exercise with application

II. PLUMBING PRACTICES 5

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands on exercise with application

III. SHEET METAL PRACTICES 5

1. Forming and Bending
2. Model making: Tray, Conical Funnel etc.

IV. MACHINING PRACTICES **5**

1. Simple Turning
2. Drilling Practice
3. Model making: Shaft, stiffener plate, square flange, etc.
4. Demonstration of machining process in Vertical Machining Centre (VMC)

V. METAL JOINING PROCESS **5**

1. Demonstration of Gas, Arc and TIG Welding

VI. ADDITIVE MANUFACTURING AND INJECTION MOULDING PROCESSES **5**

1. Demonstration of 3D Scanning and Printing
2. Demonstration of Injection Moulding process

P: 30; TOTAL: 30 PERIODS

TEXT BOOK

1. Bawa H.S, “Workshop Practice”, Tata McGraw Hill Publishing Company Limited, 2007

REFERENCES

1. Ramesh Babu V, “Engineering Practices Laboratory Manual”, Revised Edition, VRB Publishers Private Limited, Chennai, 2014.
2. Jeyachandran K, Natarajan S. and Balasubramanian S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
3. Jeyapoovan T, Saravanapandian M. and Pranitha S, “Engineering Practices Lab Manual”, Vikas Publishing House Private Limited, 2006.
4. Rajendra Prasad A and Sarma PMMS, “Workshop Practice”, Sree Sai Publication, 2002
5. Kannaiah P and Narayana KL, “Manual on Workshop Practice”, Scitech Publications, 1999.

PART B – ELECTRICAL AND ELECTRONICS LABORATORY

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: perform residential house wiring (K2)
CO2: identify faults in any electrical appliances (K2)
CO3: measure energy and resistance to earth of electrical equipment (K2)
CO4: measure AC signal parameters using CRO (K2)
CO5: apply soldering for electronic circuit formation in PCB (K2)

LIST OF EXPERIMENTS

ELECTRICAL

1. Residential House Wiring using Switches, Fuse, Indicator, Lamp and Energy Meter.
2. Stair Case Wiring Connections
3. Measurement of Energy using Energy Meter for Single Phase System.
4. Measurement of Earth Resistance using Electrical Equipment.

5. Study of Emergency Lamp, Choke, Starter, Fan and Iron Box
6. Coil Rewinding for Transformer and Fan using Rewinding Machine.
7. Connection of protective devices

ELECTRONICS

8. Study of Resistor, capacitor and inductor
9. Study and Operation of Digital Multimeter, Function/Signal Generator and Regulated Power Supply.
10. Measurement of AC signal parameter (Peak-Peak, RMS, Period and Frequency) using CRO and DSO.
11. Soldering Practice
12. Study of logic gates AND, OR, NOT, NAND, NOR and EXOR.
13. Half Wave Rectifier and Full Wave Rectifier.

P: 30; TOTAL: 30PERIODS

REFERENCES

1. Jeyachandran K, Natarajan S and Balasubramanian S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, 2007.
2. Jeyapoovan T, Saravanapandian M and Pranitha S, “Engineering Practices Lab Manual”, Vikas Publishing House Pvt. Ltd, 2006.
3. Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, 2007.
4. Rajendra Prasad A and Sarma P.M.M.S., “Workshop Practice”, Sree Sai Publication, 2002.
5. Kannaiah P and Narayana K.L., “Manual on Workshop Practice”, Scitech Publications, 1999.

19CE21C APPLIED MATHEMATICS L T P C

3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: calculate the Fourier series solution of Wave and Heat equations. (K3)
CO2: evaluate area and volume using double and triple integrals. (K3)
CO3: analyze the concepts related to vector calculus. (K3)
CO4: grasp Analytic functions and their properties. (K2)
CO5: evaluate complex integration over contour.(K3)

UNIT I BOUNDARY VALUE PROBLEMS 12

Fundamentals of Fourier series - Half range sine and cosine series, Parseval’s theorem - Fourier series solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two dimensional heat equation.

UNIT II INTEGRAL CALCULUS 12

Evaluation of double and triple integrals- Change of order of integration - Change of variables - Cartesian to polar coordinates- Area and volume - Beta and Gamma integrals - Definite integrals in terms of Beta and Gamma functions.

UNIT III VECTOR CALCULUS 12

Gradient, Divergence and Curl –Directional derivatives – Irrotational and solenoidal vector fields -Vector integration–Line, Surface and Volume Integrals –Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem–Simple applications involving cubes and rectangular parallelopipeds.

UNIT IV ANALYTIC FUNCTIONS 12

Analytic functions - Necessary and Sufficient conditions - Harmonic and orthogonal properties of analytic functions - Harmonic conjugate - Construction of analytic functions - Conformal mapping: w= z+c, cz, 1/z and bilinear transformation.

UNIT V COMPLEX INTEGRATION 12

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's expansions - Singular points - Residues - Residue theorem - application of residue theorem to evaluate real integrals - unit circle and semi-circular contour

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S. "Higher Engineering Mathematics", Khanna Publications, New Delhi, 44th Edition, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition, 2011.

REFERENCES

1. Bali NP and Manish Goyal, "Text book of Engineering Mathematics", Laxmi Publications (P) Ltd., 9th Edition, 2017.
2. Ramana BV, "Higher Engineering Mathematics", Tata McGraw Hill Publishing company, 6th Edition, New Delhi, 2008.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publishing House Private Limited, 5th Edition, 2016.

19CE22C PHYSICS FOR CIVIL ENGINEERING

L	T	P	C
2	0	0	2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the basics of mechanics and principle of turbines. (K2)
CO 2: summarize the working principles of vacuum pumps and gauges.(K2)
CO 3: express the acoustic properties of buildings. (K2)
CO 4: gain knowledge on various lighting designs for buildings and colours. (K2)
CO 5: explain the properties and performance of advanced materials. (K2)

UNIT I MECHANICS 6

Newton's laws – force, momentum and impulse – Work and Energy equations and applications - Turbines – working principle and applications.

UNIT II PUMPS AND GAUGES 6

Vacuum pumps – Working principle – Rotary pumps and diffusion pumps - Centrifugal pumps and reciprocating pumps - Vacuum gauges - Working principle – Pirani gauge and penning gauge - Manometer.

UNIT III ACOUSTICS 6

Classification of sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method.– Factors affecting acoustics of buildings and their remedies. Methods of sound absorptions – absorbing materials - Absorption Coefficient and its determination.

UNIT IV LIGHTING DESIGNS 6

Radiation quantities – spectral quantities – relationship between luminescence and radiant quantities – hemispherical reflectance and transmittance – Photometry: Cosines law, Inverse square law - Colour theory.

UNIT V ADVANCED ENGINEERING MATERIALS 6

Nano phase materials - Shape memory alloys - Metallic glasses – Fibre reinforce plastics - Advanced ceramics materials - MEMS.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. Daniel Kleppner and Robert Kolankow, "An Introduction to Mechanics", Tata McGraw-Hill Pubishing Company, 1st Edition, 2017.
2. Budinski, K.G. & Budinski, M.K. "Engineering Materials Properties and Selection", Prentice Hall, 2015
3. Stevens, W.R., "Building Physics: Lighting: Seeing in the Artificial Environment, Pergaman Press, 2013

REFERENCES

1. Gaur R.K. and Gupta S.L., "Engineering Physics" Dhanpat Rai publishers, 2012
2. Patti Mollica, "Color Theory: An essential guide to color-from basic principles to practical applications" Walter Foster Publishers, 2013
3. Dr. RK Bansal "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, Revised 9th Edition, 2010.

19CE23C LIFE SCIENCE L T P C

2 0 0 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe and comprehend the fundamental concepts of cell biology. (K2)

CO2: understand the components and functions of ecosystem. (K2)

CO3: familiar with the importance and toxicity of some transition elements in biological systems. (K2)

CO4: describe the various types of bioremediation process. (K2)

CO5: recognize the various environmental monitors and waste treatment techniques. (K2)

UNIT I CELL BIOLOGY 6

Cell as a basic unit of life-Cell organization of prokaryotic and eukaryotic cells-Structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus - Cell cycle - cell division: mitosis and meiosis.

UNIT II ECOLOGY 6

Ecosystems: Components, types, flow of matter and energy in an ecosystem- Community ecology: Characteristics, frequency, life forms, and biological spectrum- Ecosystem structure: Biotic and abiotic factors, food chain, food web and ecological pyramids.

UNIT III METALS IN BIOLOGICAL SYSTEMS 6

Introduction - Importance of Mg, Mn, Fe, Co, Ni, Cu and Zn in biological systems - Metal toxicity.

UNIT IV BIOREMEDIATION 6

Introduction - Advantages and applications -Types of bioremediation-Natural (attenuation)-Ex-situ and In-situ.

UNIT V ENVIRONMENTAL MONITORING AND WASTE TREATMENT 6

Introduction – Bio-indicators - Biomarkers - Biosensors-Biotechnological processes – Waste treatment – Equalization – Neutralization - Removal of suspended and dissolved organic solids - Chemical oxidation, Adsorption – Removal of dissolved inorganic solids.

L: 30; TOTAL: 30 PERIODS

TEXT BOOKS

1. A.K.Chatterji, Introduction to Environmental biotechnology, PHI Learning Private Limited, New Delhi, 2011.
2. R.M Maier, I.L. Pepper and C.P.Gerba, Environmental Microbiology, Academic Press, 2000.

REFERENCES

1. G.Karp, Cell and Molecular Biology: Concepts and Experiments, John Wiley, 6th Edition, 2009.
2. Dieter Rehder, Bioinorganic Chemistry, Oxford University Press, 1st Edition, 2014.
3. S. Manahan, Environmental Chemistry, CRC Press, 10th Edition, 2017.

19CE24C PROBLEM SOLVING TECHNIQUES L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: develop algorithmic solutions to simple computational problems. (K3)
CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
CO 3: solve problems using array and functions. (K3)
CO 4: implement various sorting techniques. (K3)
CO 5: implement various searching techniques. (K3)

UNIT I BASICS OF PROBLEM SOLVING 9

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

UNIT II BASIC TECHNIQUES 9

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

UNIT III ARRAYS AND FUNCTIONS 9

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

UNIT IV SORTING TECHNIQUES 9

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

UNIT V SEARCHING TECHNIQUES 9

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Maureen Sprankle and Jim Hubbard, “Problem Solving and Programming Concepts”, Prentice Hall, 9th Edition, 2012.
2. Harsha Priya, R. Ranjeet, — Programming and Problem Solving Through C Language, Firewall / Laxmi Publications (P) Ltd., New Delhi, 2015.

REFERENCES

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, 2nd Edition, Oxford University Press, 2013.
2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner‘s Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

19CE25C ENGINEERING MECHANICS L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: use the basic concept of force systems and solve problems. (K2)
CO2: implement the knowledge acquired in supports, reactions, equilibrium of rigid bodies for solving problems. (K2)

CO3: predict centre of gravity, moment and product moment of inertia of simple configurations. (K2)
CO4: solve practical problems on Projectiles, Newton‟s laws, work-energy, impulse momentum and impact on elastic bodies. (K2)
CO5: apply the principles of friction and rigid body dynamics to analyze and solve problems (K2)

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lame’s theorem, Parallelogram and triangular Law of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force – Vectorial representation of forces.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram - Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis, Vectorial representation of moments and couples – Scalar components of a moment – Varignon‟s theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes– First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section – Angle section, Hollow section by using standard formula - second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem. Principal moment of inertia of plane areas – principal axes of inertia – Mass moment of inertia – mass moment of inertia for prismatic, cylindrical and spherical solids from first principal – relation to area moments of bodies.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Projectile motion – Newton‟s law – Work Energy Equation of particles – Impulse and Momentum. Definition – time of compression, restitution, collision – laws of conservation of momentum – coefficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – loss of kinetic energy.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coulomb friction – Simple contact friction – Rolling resistance – Belt friction – Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Beer, F.P. and Johnson Jr. E.R., “Vector Mechanics for Engineers”, Vol.1 Statics and Vol.2 Dynamics, McGraw Hill International, 9th Edition, 2010.
2. Vela Murali, “Engineering Mechanics” Oxford University, 2010.

REFERENCES

1. Rajasekaran S and Sankarasubramanian G, “Fundamentals of Engineering Mechanics”, Vikas Publishing House Private Limited, 3rd Edition, 2010.
2. Hibbeller R.C., “Engineering Mechanics”, Vol.1 Statics, Vol.2 Dynamics, 12th Edition, Pearson Education Asia Private Limited, 2010.
3. Irving H Shames, “Engineering Mechanics – Statics and Dynamics”, Pearson Education Asia Private Limited, 4th Edition, 2009.

19CE26C BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the concepts of basic electrical circuits (K2)
CO2: describe the working principles of electrical machines and instruments (K2)
CO3: outline the functions of the component of low voltage electrical installations (K2)
CO4: explain the characteristics and applications of semiconductor devices (K2)
CO5: recall the different logic principles used in digital circuits(K2)

UNIT I CONCEPTS OF DC AND AC ELECTRICAL CIRCUITS 9

Electrical Circuit Elements – Ideal and Practical Sources – Electrical Quantities: Voltage, Current, Power and Energy – Ohms Law – Kirchoffs Laws – analysis of simple circuit with DC excitation- AC Circuits Fundamentals – Single Phase Circuits and Three Phase Circuits – Power and Power Factor.

UNIT II ELECTRICAL MACHINES 9

DC Machines: Types – Construction – Working Principles – Need for Starters - Speed control of DC motors.

AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Starting and Speed Control of Induction Motors.

AC Synchronous Generators: Construction – Working Principle.

Transformers: Single Phase and Three Phase Transformers – Auto Transformers - Construction – Working Principle.

UNIT III INSTRUMENTS AND ELECTRICAL INSTALLATION 9

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.

Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Operation, Characteristics and Applications: PN Junction Diode - Rectifiers - Zener Diode – Regulators - Bipolar Junction Transistor –CE Amplifier - FET – Opto-Electronic Devices – LEDs – Photo Diodes.

UNIT V DIGITAL ELECTRONICS 9

Binary Number System – Logic Gates – Boolean Algebra – Adders - Flip Flops– Shift Registers – Counters – ADC and DAC.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. D.P. Kothari and I.J. Kothari, "Basic Electrical and Electronics Engineering", 1st Edition, Tata McGraw Hill, 2014.
2. P.S. Bimbhra, "Electrical Machinery", Khanna Publishes, 7th Edition, 2011.
3. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, New Delhi, 2009.
4. A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2004.

REFERENCES

1. D.C. Kulshreshtha, "Basic Electrical Engineering", Revised 1st Edition, Tata McGraw Hill, 2011.
2. L.S.Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill, 2003.
6. David Bell, "Electronic Devices and Circuits", Prentice Hall Private Limited, 2007.
7. M. Morris Mano, "Digital Design", 4th Edition, Pearson Education, 2007.

19CE27C PROBLEM SOLVING TECHNIQUES LABORATORY L T P C

0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: solve simple and Complex problems. (K3)
CO 2: solve sorting and searching problems. (K3)

LIST OF EXERCISES

Programs using simple logics and switch cases

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

Programs using Control Structures

5. Perform the following operations:
    a. Generate Pascal's triangle.
    b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.

7. Compute Sine series and Cosine series.
8. Find the 2‘s complement of a binary number.

Programs using Arrays

9. Perform the following operations:
   a. Matrix addition.
   b. Transpose of a matrix.
   c. Matrix multiplication by checking compatibility

Programs to manipulate Strings

10. Perform the following operations on a string:
    a. Insert a sub-string into main string at a given position.
    b. Delete n characters from a given position in a string.
    c. Check whether the given string is palindrome or not.
    d. Replace a character of string either from beginning or ending or at a specified location.

Programs using Functions

11. Perform the following operations: (Use recursive functions)
    a. Find the factorial of a given integer.
    b. Find the GCD (Greatest Common Divisor) of two given integers.
    c. Solve the Towers of Hanoi problem.

Programs using sorting and searching techniques

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

P: 60; TOTAL: 60 PERIODS

Software Requirement: Turbo C / Python

19CE28C	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**	**L T P C** **0 0 3 1.5**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the common components with different rating and use the instruments (K2)
CO2: analyze the basic electrical circuits (K2)
CO3: infer the characteristics of electrical machines (K2)
CO4: demonstrate the functionality and characteristics of electronics devices. (K2)

LIST OF EXPERIMENTS

1. Basic Safety Precautions, Practical Circuit Elements and Measuring Instruments – Voltmeter, Ammeter, Wattmeter and Energy Meter
2. Verification of Ohms Law and Kirchoff Laws
3. Load test of Single Phase Transformer

4. Load test on DC Shunt Motor
5. Load test on DC Series Motor
6. Load test on Single Phase Induction Motor
7. Load test on Three Phase Induction Motor
8. Experimental Verification of PN Junction diode Characteristics.
9. Experimental Verification of Zener Diode Characteristics and Zener Diode as Voltage Regulator
10. Input and Output Characteristics of BJT in CE Configuration
11. Truth Tables and Functionality of Flip Flops

P: 45; TOTAL: 45 PERIODS

19CE29C COMMUNICATION SKILLS LABORATORY L T P C

(Common to all B.E. / B.Tech., Degree Programmes) **0 0 2 1**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO 1: Listen and respond effectively to interact at different situations fluently (K2)

CO2: Excel appropriately in professional contexts. (K3)

CO3: Acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3)

UNIT I 10

Lab session: Listening and responding to audio files

Practice session: Mini Presentation related to Business English & Picture description.

UNIT II 10

Lab session: Role Play – News Reader

Practice session: Resume Preparation

UNIT III 10

Lab session: Listening to audio files related to soft skills.

Practice session: Practicing Power point presentation, Group discussion.

P: 30; TOTAL: 30 PERIODS

REFERENCES

1. Dutt P. Kiranmai and Rajeevan Geeta, “Basic Communication Skills”, Foundation Books, 2013.
2. Comfort, Jeremy, et al. “Speaking Effectively, Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge: Reprint 2011.
3. Rizvi.M.Ashraf, “Effective Technical Communication”, The MC-Graw Hill Education Private Limited, Companies, New Delhi, 2010.

19GN01C INNOVATION THROUGH DESIGN THINKING

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)
CO2: Practice design thinking process through a multidisciplinary task. (K3)

UNIT I BASICS OF DESIGN THINKING PROCESS 15

Design thinking process basics-Ideation tools-case studies.

UNIT II PRACTICING DESIGN THINKING PROCESS 30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, “Design Thinking: The Handbook”, WS Professional, 2020
2. Pavan Soni, “Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving”, Penguin Random House, 2020
3. D.M. Arvind Mallik, “Design Thinking for Educators”, Notion Press, 2019
4. Michael Lewrick, “The Design Thinking Playbook”, Wiley, 2019
5. Kathryn Christopher, “Design Thinking in Engineering”, Kendall Hunt Publishing Company, 2019
6. Robert Curedale, “Design Thinking Process & Methods” 5th Edition, Design Community College Inc, 2019
7. David Lee, “Design Thinking in the Classroom”, Ulysses Press, 2018
8. Jimmy Jain, “Design Thinking for Startups”, Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, “The Little Booklet on Design Thinking: An Introduction”, 2nd Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, “Design Thinking: New Product Development Essentials”, Wiley-Blackwell, 2016
11. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009

MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and empathy map through case studies - presentation	10 Hours
Forming multidisciplinary batches among the students- Guide the batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions	20 Hours
Evaluating the students‘ activities through their presentations	

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19CE31C TRANSFORMS, PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: compute the Fourier transforms of various functions. (K2)
CO2: apply Laplace Transform techniques to solve ordinary differential equations. (K2)
CO3: solve difference equations using Z–Transforms. (K2)
CO4: grasp basic probability concepts and standard distributions. (K2)
CO5: calculate the various measures of dispersion and testing of Hypothesis. (K3)

UNIT I FOURIER TRANSFORM 12

Fourier Integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT II LAPLACE TRANSFORM 12

Existence conditions -– Transforms of elementary functions – Properties – Transforms of periodic functions – Initial and final value theorems – Convolution theorem - Inverse transforms - Transform of Derivatives and Integrals - Solutions of linear ordinary differential equations of second order with constant coefficients.

UNIT III Z – TRANSFORM 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solutions of difference equations using Z-transform.

UNIT IV RANDOM VARIABLES 12

Discrete and continuous random variables – Moments -Moment generating function and their properties.Binomial, Poisson, Uniform, Exponential and Normal distributions.

UNIT V STATISTICS 12

Mean, median, mode and standard deviation - Sampling distributions - Tests for single mean, Proportion, Difference of means (for large samples) – Tests for single variance and equality of variances – t-test, F-Test and Chi-square test for goodness of fit – Independence of attributes.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S., “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2011.

REFERENCES

1. OliverC.Ibe, “Fundamentals of Applied Probability and Random processes”, Elsevier, First Indian Reprint, 2007.
2. Peebles Jr.P.Z., “Probability R and om Variables and Random Signal Principles”, 4th Edition, Tata McGraw-Hill Publishers, New Delhi, 2002.
3. Bali N.P. and Manish Goyal, “A Text book of Engineering Mathematics”, 8th Edition, Laxmi Publications Private Limited, 2011.
4. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, 5th Edition, Narosa Publishing House Private Limited, 2016.

19CE32C SOLID MECHANICS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the basic properties of solids. (K3)
CO2: analyze the plane truss. (K3)
CO3: analyze the transverse loading on beams (K3)
CO4: calculate the deflection in beams and shear stresses (K3)
CO5: determine Torsion in shafts and springs (K3)

UNIT I STRESS STRAIN AND DEFORMATION OF SOLIDS, STATES OF STRESS 12

Rigid bodies and deformable solids – Stability, strength, stiffness – Tension, compression and shear stresses – Strain, elasticity, Hooke’s law, limit of proportionality, modulus of elasticity, stress -strain curve, lateral strain – Temperature stresses – Deformation of simple and compound bars – Shear modulus, bulk modulus, relationship between elastic constants – Biaxial state of stress – Stress at a point – Stress on inclined plane – Principal stresses and principal planes – Mohr’s circle of stresses.

UNIT II ANALYSIS OF PLANE TRUSS 12

Stability and equilibrium of plane frames – Types of trusses – Analysis of forces in truss member’s method of joints, method of sections, method of tension coefficients – Graphical Method.

UNIT III TRANSVERSE LOADING ON BEAMS 12

Beams – Types of supports – Simple and fixed, types of load – Concentrated, uniformly distributed, varying distributed load, combination of above loading – Relationship between bending moment and shear force – Bending moment, shear force diagram for simply supported, cantilever and over hanging beams – Theory of simple bending-Bending stress.

UNIT IV DEFLECTION OF BEAMS AND SHEAR STRESS 12

Deflection of beams – Double integration method – Macaulay's method – Slope and deflection using moment area method, Conjugate Beam method – Variation of shear stress – Shear stress distribution in rectangular, I sections, solid circular sections, hollow circular sections, angle and channel sections.

UNIT V TORSION AND SPRINGS 12

Stresses and deformation in circular (solid and hollow shafts) – Stepped shafts – Shafts fixed at both ends – Leaf springs – Stresses in helical springs – Deflection of springs**.**

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2015.
2. Bansal R.K. "Strength of materials", Laxmi Publications, New Delhi, 6th Edition, 2018.

REFERENCES

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", Van Nos Reinbhold, New Delhi 1999.
2. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited, New Delhi, 2009.
3. Rattan. S.S, "Strength of Materials", Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS–I Strength materials, Laxmi publications, New Delhi, 2015
5. Srinath, L.S. "Advanced mechanics and solids", Tata-McGraw Hill Publishing Company Limited, 3rd Edition 2009.

19CE33C FLUID MECHANICS

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: illustrate the basic fluid properties. (K2)
CO2: estimate the pressure, hydrostatic forces and concepts of continuity equation acting in the fluid (K3)
CO3: extend the knowledge of Bernoulli"s equation and the condition of flow in a circular pipe. (K3)
CO4: enumerate the concepts of boundary layer and losses computed in a pipe flow (K2)
CO5: paraphrase the idea of dimensional and model analysis with other model / prototype problems. (K2)

UNIT I DEFINITIONS AND FLUID PROPERTIES 7

Definitions – Fluid and fluid mechanics – Dimensions and units – Fluid properties – Continuum Concept of system and control volume.

UNIT II FLUID STATICS AND KINEMATICS 10

Pascal's Law and Hydrostatic equation – Forces on plane and curved surfaces – Buoyancy – Meta centre – Pressure measurement –Fluid Kinematics -Stream, streak and path lines – Classification of flows – Continuity equation (one, two and three dimensional forms) – Stream and potential functions – flow nets – Velocity measurement (Pitot tube, current meter, Hot wire and hot film anemometer, float technique, Laser Doppler velocimetry).

UNIT III FLUID DYNAMICS 10

Euler and Bernoulli's equations – Application of Bernoulli's equation – Discharge measurement – Laminar flows through pipes and between plates – Hagen Poiseuille equation – Turbulent flow – Darcy – Weisbach formula – Moody diagram – Momentum Principle.

UNIT IV BOUNDARY LAYER AND FLOW THROUGH PIPES 9

Definition of boundary layer – Thickness and classification – Displacement and momentum thickness– Development of laminar and turbulent flows in circular pipes – Major and minor losses of flow in pipes – Pipes in series and in parallel – Pipe network.

UNIT V SIMILITUDE AND MODEL STUDY 9

Dimensional Analysis – Rayleigh's method, Buckingham's Pi-theorem – Similitude and models studies – Scale effect and distorted models.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jain.A.K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, 12th Edition, 2016.
2. Modi, P.N. & Seth, S.M "Hydraulics and fluid Mechanics", Standard book house, New Delhi, 2015.

REFERENCES

1. Streeter, Victor, L. and Wylie, Benjamin E., "Fluid Mechanics", McGraw-Hill Limited, 1998.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2013.
3. Subramanya.K "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

19CE34C ENGINEERING SURVEY- I

L T P C
3 0 0 3

COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

CO1: explain the basic principle of chain surveying. (K2)
CO2: interpret the working principle of compass and plane table surveying. (K2)
CO3: demonstrate the application of leveling in the field surveying. (K2)
CO4: demonstrate the application of theodolite in the field surveying. (K2)

CO5: outline engineering surveys and usage of modern surveying instruments. (K2)

UNIT I INTRODUCTION AND CHAIN SURVEYING 9

Definition - Principles - Classification - Field and office work - Scales - Conventional signs - Survey instruments, their care and adjustment - Ranging and chaining - Reciprocal ranging - Setting perpendiculars - well conditioned triangles - Traversing - Plotting - Enlarging and reducing figures.

UNIT II COMPASS SURVEYING AND PLANE TABLE SURVEYING 9

Prismatic compass – Surveyor's compass - Bearing - Systems and conversions - Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors - Plane table instruments and accessories - Merits and demerits - Methods - Radiation - Intersection - Resection - Traversing.

UNIT III LEVELLING AND APPLICATIONS 9

Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check levelling - Booking - Reduction - Curvature and refraction - Reciprocal levelling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs.

UNIT IV THEODOLITE SURVEYING 9

Theodolite - Vernier and microptic - Description and uses - Temporary and permanent adjustments of vernier transit - Horizontal angles - Vertical angles - Heights and distances - Traversing - Closing error and distribution - Gale‟s tables - Omitted measurements.

UNIT V ENGINEERING SURVEYS AND MODERN INSTRUMENTS 9

Reconnaissance, preliminary and location surveys for engineering projects - Lay out - Setting out works - Route Surveys for highways, railways and waterways - Mine Surveying - instruments - Tunnels - Correlation of underground and surface surveys - Shafts – Adits - Electromagnetic distance measurement - Carrier waves - Principles – Instruments –Total Station –GPS.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I ,Lakshmi Publications Private Limited, New Delhi, 2005
2. Kanetkar T.P., "Surveying and Levelling", Vols.I, United Book Corporation, Pune, 2006.

REFERENCES

1. Clark D., "Plane and Geodetic Surveying", Vols. I, C.B.S. Publishers and Distributors, Delhi, 6th Edition, 2004.
2. James M.Anderson and Edward M.Mikhail, "Introduction to Surveying", McGraw-Hill Book Company, 7th Edition 2012.
3. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.

19CE35C CONSTRUCTION MATERIALS, EQUIPMENT'S AND PRACTICES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the Primary Construction materials and their properties. (K2)
CO2: describe the Secondary Construction materials and their properties. (K2)
CO3: illustrate the Construction Practices. (K2)
CO4: identify the Construction techniques. (K3)
CO5: utilize the construction equipments. (K3)

UNIT I PRIMARY CONSTRUCTION MATERIALS 9

Stones – Types – characteristics – uses - BIS tests - Tiles-types, selection, suitability, uses and maintenance – Bricks – composition – manufacture – types - BIS tests. Hollow concrete blocks, Burnt clay hollow Blocks, Stabilized mud blocks – Selection of Building Blocks – Cement – Manufacturing – Different types - hydration- setting and hardening – Initial & Final Setting Time-Cement mortar.

UNIT II SECONDARY CONSTRUCTION MATERIALS 9

Timber- defects-causes of decay - seasoning – preservation - fire proofing - Laminated wood products - types – properties – uses of fiber boards, particle boards, hard boards and A.C boards - Paints – types – wall paints – wood paints – metal paints. Steel Properties – types- Aluminum products - UPVC – crack fillers – Asbestos –GI Sheets– Glass – water proofing compounds – fiber reinforced plastic – smart concrete and smart bricks.

UNIT III CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry – concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements– temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames .

UNIT IV SPECIAL FORMS OF CONSTRUCTION 9

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - driving diaphragm walls, sheet piles - shoring for deep cutting - well points - Dewatering and stand by Plant equipment for underground open excavation. Launching girders, bridge decks, off shore platforms.

UNIT V CONSTRUCTION EQUIPMENT 9

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. S.C. Rangawala, “Engineering materials”, Charotar Publishing House, New Delhi, 2014.
2. Arora S.P. and Bindra S.P., “Building Construction, Planning Techniques and Method of Construction”, Dhanpat Rai and Sons, 2010.

REFERENCES

1. Santhakumar. A.R, “Conrete Technology”, Oxford University Press, 2007.
2. P.C Varghese “Building Materials”, PHI Learning Private Limited, 2nd Edition, 2015.
3. Neville A.M., “Properties of Concrete”, Pearson Education, 2008

19CE36C BASIC MECHANICAL ENGINEERING AND ENERGY SCIENCES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

CO1: describe the thermodynamic systems and apply first law of thermodynamics to various systems. (K2)

CO2: explain second law of thermodynamics and study the feasibility of a process based on first and second law of thermodynamics. (K2)

CO3: determine the change in properties of atmospheric air subjected to psychrometric processes (K3)

CO4: familiarize with the basic concepts of various forms of renewable energy sources. (K2)

CO5: realize the present energy scenario and the need for energy conservation and various energy conservation measures. (K2)

UNIT I BASICS AND FIRST LAW OF THERMODYNAMICS 9

Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of thermodynamics - concept of temperature and heat.Concept of ideal and real gases.First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady - Flow Engineering Devices.

UNIT II SECOND LAW OF THERMODYNAMICS 9

Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin’s and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy.

UNIT III PSYCHROMETRY 9

Psychrometry and psychrometric charts, Dalton’s law of partial pressure - property calculations of air vapour mixtures. Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing - evaporative cooling.

UNIT IV ALTERNATIVE ENERGY SOURCES 9

Introduction to energy systems and resources, sustainability & the environment. Fossil fuels - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, wave, tidal and hydrogen energy; possibilities for energy storage or regeneration - Pumped storage hydro power.

UNIT V ENERGY CONSERVATION 9

Energy efficiency and conservation; Introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, Concept of Green Buildings and Green Architecture; LEED ratings; Embodied energy analysis. Energy Audit of Facilities and optimization of energy consumption.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Yunus A Cengel and Michael A Boles, “Thermodynamics - An Engineering Approach”, 7th Edition Tata McGraw-Hill Education, 2014.
2. Boyle, Godfrey, “Renewable Energy”, 3rd Edition, Oxford University Press, 2012.

REFERENCES

1. Nag PK, “Engineering Thermodynamics”, 5th Edition, the Mc-Graw Hill Book Company, 2013.
2. Sonntag, Borgnakke and Van Wylen, “Fundamentals of Thermodynamics”, 1st Edition, Wiley India Private Limited, 2010.
3. Holman JP, “Thermodynamics”, McGraw-Hill Education, 1988.
4. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.), “Energy Systems and Sustainability: Power for a Sustainable Future”, Oxford University Press, 2004.
5. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., “Energy and the Environment”, 2nd Edition, John Wiley, 2006.

19CE37C STRENGTH OF MATERIALS LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Successful completion of this course, the students will able to

CO1: demonstrate the fundamental modes of loading the structures (K2)
CO2: perform experiments making measurements of loads, displacements and Strains (K3)
CO3: compute the strength of the material and stiffness properties of Structural elements (K3)

LIST OF EXPERIMENTS

1. Test involving axial compression on concrete cylinder to obtain the stress – strain curve
2. Test involving axial tension to obtain the stress – strain curve and the strength

3. Test involving torsion to obtain modulus of rigidity value of the specimen
4. Test involving flexure to obtain the load deflection curve and hence the stiffness
5. Tests on springs
6. Test to verify Maxwell’s reciprocal theorem
7. Test on wooden specimen (Compression, Tension and shear)
8. Hardness tests
9. Shear test
10. Test for impact resistance

The student should learn the use of deflectometer, extensometer, compressometer and strain gauges.

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl. No.	Description of Equipments	Quantity
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine for steel rods	1
3.	Izod impact testing machine	1
4.	Hardness test	
	Rockwell	1 each
	Vicker’s	
	Brinnel	
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	Few
9.	CompressionTesting Machine (100 Ton)	1

P: 30; TOTAL 30 PERIODS

19CE38C ENGINEERING SURVEY PRACTICAL - I

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Successful completion of this course, the student will able to

CO1: Experiment with chain, compass and plane table surveying (K2)

CO2: Perform leveling and tachometry survey in the field.(K3)

LIST OF EXPERIMENTS

1. Study of chains and its accessories
2. Aligning, Ranging and Chaining
3. Chain Traversing
4. Compass Traversing
5. Plane table surveying: Radiation

6. Plane table surveying: Intersection
7. Plane table surveying: Resection – Three point problem
8. Plane table surveying: Resection – Two point problem
9. Study of levels and levelling staff
10. Fly levelling using Dumpy level & Tilting level
11. Check levelling
12. Study of theodolite
13. LS and CS
14. Measurement of horizontal angles by reiteration and repetition methods using theodolite
15. Measurement of vertical angles using theodolite

SURVEY PRACTICAL - I & SURVEY PRACTICAL – II
LIST OF EQUIPMENTS
(For a batch of 30 students)

S. No.	Description of Equipments	Quantity
1.	Total Station	2 Nos.
2.	Theodolites	Atleast 1 for every 5 students
3.	Dumpy level	Atleast 1 for every 5 students
4.	Plain table	Atleast 1 for every 5 students
5.	Prismatic compass	6 Nos
6.	Pocket stereoscope	1
7.	Ranging rods	
8.	Levelling staff	
9.	Cross staff	1 for a set of 5 students
10.	Chains	
11.	Tapes	
12.	Arrows	

P: 30; TOTAL: 30 PERIODS

19CE41C STRENGTH OF MATERIALS L T P C

3 1 0 4

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: recognize the concept of Energy principles (K3)
CO2: analyse structures as indeterminate (K3)
CO3: develop Knowledge on Columns and Cylinders (K3)
CO4: develop Knowledge on State of stress (K3)
CO5: develop Knowledge on Unsymmetrical bending, curved beams and Shear centre. (K3)

UNIT I ENERGY PRINCIPLES 12

Strain energy and strain energy density – strain energy in traction, shear in flexure and torsion – castigliano's theorems – principle of virtual work – application of energy theorems for computing deflections in beams and trusses – Maxwell's reciprocal theorems.

UNIT II INDETERMINATE BEAMS 12

Propped cantilever and fixed beams-fixed end moments and reactions for concentrated load (central, non central), uniformly distributed load, triangular load (maximum at centre and maximum at end) – theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams for continuous beams.

UNIT III COLUMNS AND CYLINDERS 12

Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns - Eccentrically loaded short columns – middle third rule – core section – columns of unsymmetrical sections – (angle channel sections) – thin cylinders and shells – under internal pressure – deformation of thin cylinders and shells - thick cylinders – compound cylinders.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 12

Determination of principal stresses and principal planes – volumetric strain – dilatation and distortion – theories of failure – principal stress dilatation – principal strain – shear stress – strain energy and distortion energy theories .

UNIT V ADVANCED TOPICS IN BENDING OF BEAMS 12

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – curved beams – Winkler Bach formula – stress concentration – Shear flow – Shear centre**.**

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Bansal R.K. "Strength of materials", Laxmi Publications, New Delhi, 6th Edition, 2018.
2. Ramamrutham.S, "Strength of Materials", Dhanpat Rai Publishing Company Private Limited, Jan 2008.

REFERENCES

1. Punmia B.C. "Theory of Structures (SMTS)" Vol 1&II, Laxmi Publishing Private Limited, New Delhi, 2004.
2. Rajput R.K. "Strength of Materials", S.Chand& Company Limited, New Delhi, 2006.

19CE42C APPLIED HYDRAULICS AND HYDRAULIC MACHINES L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1:explain concepts of open channel flow, Channel transition and Identify economical Section (K2)
CO2: compute the flow measurement and specific energy (K2)
CO3: explain the rapidly varied channel-flow and dam flow profile characteristics (K2)

CO4: illustrate the performance characteristics of various types of turbines (K2)
CO5: examine the pumps for various engineering applications based on their performance Curves (K4)

UNIT I OPEN CHANNEL FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow in channels - Properties of open channel - Velocity distribution in open channel –– Determination of roughness coefficients – Manning’s and Chezy’s formula -Most economical sections – Wide open channel.

UNIT II UNIFORM FLOW 9

Uniform flow – Flow measurement by notches and weirs – Specific energy– Determination of normal depth and velocity - Critical flow and its computation – Channel Transition -Non-erodible channels.

UNIT III VARIED FLOW 9

Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and back water curves – Profile determination – Graphical integration, direct step and standard step method – Flow through transitions - Hydraulic jump – Types – Energy dissipation – Surges.

UNIT V TURBINES 9

Impact of jets on plane and curved plates - Classification of Turbines - Reaction turbines-Francis turbine,Radial flow turbines,draft tube and Cavitation- Propeller and Kaplan turbines - Impulse turbines - Perfomance of Turbine - Runway Speed - Similarity laws.

UNIT V PUMPS 9

Classification of Pumps - Centrifugal pump - Work done - minimum speed to start the pump – NPSH -multistage Pumps – Characteristics curve - reciprocating pump - negative slip - flow separation conditions - air vessels -indicator diagram and its variation - savings in work done - rotary pumps, Gear pump.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Bansal R.K, Fluid mechanics & Hydraulic machines, Laxmi Publishing Private Limited, New Delhi, 2007.
2. Modi, P.N, and Seth S.M. Hydraulic and Fluid Mechanics Standard Book House, 2011.

REFERENCES

1. Jain A.K., “Fluid Mechanics (including Hydraulic Machines”, Khanna Publishers, 8th Edition, 1995.
2. Ranga Raju, K.G., “Flow through Open Channels”, Tata McGraw-Hill, 1985.
3. Ramamrutham S, Hydraulics Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Company, 2011
4. VenTe Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
5. Mays L.W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2005.

19CE43C WATER SUPPLY TREATMENT AND MANAGEMENT

L T P C
3 1 0 4

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: examine the various sources of water and their characteristics. (K3)
CO2: classify the different types of conveyance system, pipes and pumping system. (K3)
CO3: design the components of a water treatment plant. (K3)
CO4: explain the various processes of advance water treatment. (K3)
CO5: analyse distribution networks and water supply to buildings. (K3)

UNIT I PLANNING FOR WATERSUPPLY SYSTEM 12

Public water supply system - Planning - Objectives - Design period - Population forecasting -Water demand - Sources of water and their characteristics - Surface and Groundwater - Impounding reservoir well hydraulics - Development and selection of source - Water quality - Characterization -Water quality standards.

UNIT II CONVEYANCE SYSTEM 12

Water supply - intake structures - Functions and drawings - Pipes and conduits for water - Pipe materials - Hydraulics of flow in pipes - Transmission main design - Laying, jointing and testing of pipes - Drawings appurtenances - Types and capacity of pumps - Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 12

Objectives - Unit operations and processes - Principles, functions design and drawing of flash mixers, flocculators, sedimentation tanks and sand filters – Filter press – Disinfection - Ozonation and UV - Residue Management – TSDF – Co-processing and co-incineration.

UNIT IV ADVANCED WATER TREATMENT 12

Aerator - Iron and manganese removal- Defluoridation and demineralization - Water softening - Desalination - membrane Systems – Construction, Operation & Maintenance aspects of Water Treatment Plants - Recent advances - Membrane Processes – Arsenic treatment.

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 12

Requirements of water distribution - Components - Service reservoirs - Functions and drawings - Network design - Economics - Computer applications - Analysis of distribution networks - Appurtenances - operation and maintenance - Leak detection, methods-principles of design of water supply in buildings - House service connection - Fixtures and fittings - Systems of plumbing and drawings of types of plumbing.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Garg, S.K., “Environmental Engineering”, Vol.1 Khanna Publishers, New Delhi, 2014.
2. Punmia, B.C., Ashok K Jain and Arun K Jain, “Water Supply Engineering”, Laxmi Publications Private Limited, New Delhi, 2014.

REFERENCES

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Syed R.Qasim and Edward M.Motley Guang Zhu, "Water Works Engineering Planning, Design and Operation", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2010.
4. K.N Duggal, "Elements of Water Resource Engineering" New age publishers, New Delhi, 2005.

19CE44C ENGINEERING SURVEY- II L T P C 3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: utilize the concepts of curve for designing (K3)
CO2: utilize the concepts of tacheometric surveying (K3)
CO3: utilize the concepts of control surveying (K3)
CO4: identify probable error and it adjustments in surveying measurements. (K3)
CO5: outline the concepts of celestial bodies and hydrological measurements by using astronomical and hydrographical surveying (K2)

UNIT I SETTING OUT OF CURVES 9

Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Compound and reverse curves - Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances.

UNIT II TACHEOMETRIC SURVEYING 9

Tachometric systems - Tangential, stadia and subtense methods - Stadia systems - Horizontal and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia constants – Anallatic lens - Subtense bar.

UNIT III CONTROL SURVEYING 9

Working from whole to part - Horizontal and vertical control methods - Triangulation - Signals - Base line - Instruments and accessories - Satellite station - Reduction to centre – Trilateration - Trigonometric leveling - Single and reciprocal observations – Bench marking.

UNIT IV SURVEY ADJUSTMENTS 9

Errors - Sources, precautions and corrections - Classification of errors - True and most probable values - Weighted observations - Method of equal shifts - Principle of least squares - Normal equation - Correlates - Level nets - Adjustment of simple triangulation networks.

UNIT V ASTRONOMICAL AND HYDROGRAPHIC SURVEYING 9

Celestial sphere-Astronomical terms and definitions-Motion of sun and stars-Apparent altitude and corrections–Celestial co-ordinate systems-Nautical almanac-Star constellations -Practical astronomy - Field observations and calculations for azimuth-Hydrographic Surveying-Tides - MSL - Sounding methods - Location of soundings and methods - Three point problem - Strength of fix - Sextants and station pointer .

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Punmia B.C., "Surveying", Vols. II and III, Laxmi Publications, 2005.
2. Kanetkar T.P., "Surveying and Levelling", Vol.II, United Book Corporation, Pune, 2006.

REFERENCES

1. Clark D., "Plane and Geodetic Surveying", Vols. I and II, C.B.S. Publishers and Distributors, Delhi, 6th Edition, 2006.
2. James M.Anderson and Edward M.Mikhail, "Introduction to Surveying", McGraw-Hill Book Company, 2012.
3. Bannister A. and Raymond S., "Surveying", ELBS, 6th Edition, 2006.

19CE45C SOIL MECHANICS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: classify the soil based on Index and Engineering properties (K2)
CO2: explain the principle of soil water movement and its effect on stress distribution (K2)
CO3: explain the stresses in the soil and principle of consolidation (K2)
CO4: determine the shear strength parameters of soil (K2)
CO5: analyse the stability of slopes and slope protection measures (K2)

UNIT I INDEX PROPERTIES AND COMPACTION 12

Nature of Soil - Problems with soil - phase relation -Index properties – clay mineralogy structural arrangement of grains - sieve analysis - sedimentation analysis – Atterberg's limits - Classification for engineering purposes - BIS Classification system - Soil compaction - factors affecting compaction – Field compaction methods.

UNIT II SOIL WATER, PERMEABILITY AND EFFECTIVE STRESS 12

Soil water – Various forms – Capillary rise – Suction - Effective stress concepts in soil – Total, neutral and effective stress distribution in soil - Permeability – Darcy's Law-Permeability measurement in the laboratory – field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils - Quick sand condition - Seepage –Laplace Equation - Introduction to flow nets –Properties and uses - Application to simple problems.

UNIT III STRESS DISTRIBUTION, COMPRESSIBILITY AND SETTLEMENT 12

Stress distribution in soil media – Boussinesque formula – Stress due to line load and Circular and rectangular loaded area - Approximate methods - Use of influence charts - Components of settlement - Immediate and consolidation settlement - Terzaghi's one dimensional consolidation theory - Laboratory consolidation test –Computation of rate of settlement. – √t and log t methods. e-log p relationship consolidation settlement N-C clays – O.C clays - Problems on final and time rate of consolidation.

UNIT IV SHEAR STRENGTH 12

Shear strength of cohesive and cohesionless soils - Mohr - Coulomb failure theory - Measurement of shear strength, direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influences shear strength of soil- Liquefaction of sand.

UNIT V SLOPE STABILITY 12

Slope failure mechanisms - Modes - Infinite slopes - Finite slopes –- Method of slices – Modified Bishop's method - Friction circle method - Stability number – Problems – Slope protection measures.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Private Limited, 16th Edition, 2017.
2. Arora, K.R, "Soil Mechanics and Foundation Engineering", Standard Publishers, 7th Edition, 2017 (Reprint).

REFERENCES

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Limited., New Delhi, 2014.
2. Craig.R.F., "Soil Mechanics", E & FN Spon, London and New York, 2012.
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics", New Age International Publication, 3rd Edition, 2016.
4. Palanikumar.M., "Soil Mechanics", Prentice Hall of India, Learning Private Limited Delhi, 2013.

19CE46C CONCRETE TECHNOLOGY

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the suitability of ingredients of concrete and their testing methods. (K2)
CO2: explain Properties of concrete and testing procedures of concrete in plastic and hardened state. (K2)
CO3: infer quality control and design concrete mixes by various methods. (K2)
CO4: summarize durability of concrete and concreting under special circumstances. (K2)

CO5: outline the properties of special concretes and its applications. (K2)

UNIT I INGREDIENTS OF CONCRETE 9

Cement –constituents –Hydration-Types of cement-Test on cement as per BIS specifications - Aggregates - Properties and tests as per BIS- Quality of water – Admixtures-Chemical admixture and mineral admixture.

UNIT II PROPERTIES OF CONCRETE 9

Workability – Segregation – Bleeding – Strength – Stress - Strain characteristics – Modulus of Elasticity – Shrinkage – Creep – Permeability – Destructive tests - Non-Destructive Tests.

UNIT III CONCRETE MIX DESIGN AND QUALITY CONTROL OF CONCRETE 9

Statistical quality control - Sampling and testing – Acceptance criteria – Factors influencing the design mix – Mix Design by ACI and IS method.

UNIT IV DURABILITY AND CONCRETE UNDER SPECIAL CIRCUMSTANCES 9

Durability – Chemical attack – Corrosion and its preventive measures - Underground Construction –Under water Construction –Extreme weather concreting.

UNIT V SPECIAL CONCRETES 9

High Strength concrete – High Performance Concrete – Reactive powder concrete – Light weight concrete - Mass concrete – Self Compacting Concrete – Polymer Concrete - Geopolymer Concrete – Fibre Reinforced Concrete – Ready Mix Concrete – Ferro cement – Shortcrete – Vacuum concrete.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Shetty M.S., “Concrete Technology”, S.Chand& Company, New Delhi, 2014.
2. Gambhir M.L., “Concrete Technology”, Tata Mc-Graw Hill Company, Noida, 2011.

REFERENCES

1. Orchard D.F., “Concrete Technology”, Vol I &II, 1998
2. Neville A.M., “Properties of Concrete”, Pearson Education, 2008
3. Santhakumar. A.R, “Concrete Technology”, Oxford University Press, 2007.
4. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.

19CE47C ENGINEERING SURVEY PRACTICAL - II L T P C
0 0 2 1

COURSE OUTCOMES

Upon Successful completion of this course, the student will able to

CO1: apply knowledge for setting out of simple and transition curve (K3)

CO2: apply knowledge to find horizontal angle, vertical angle and distance using theodolite. (K3)

CO3: describe the features of total station for field measurements.(K2)

LIST OF EXPERIMENTS

1. Theodolite survey traverse
2. Tacheometry
    - (i) Tangential system
    - (ii) Stadia system
    - (iii) Subtense system
3. Setting out works
    - (i) Foundation marking
    - (ii) Simple curve by Rankine‟s method & Two Theodolite method
    - (iii) Transition curve
4. Triangulation – Single plane method – Double plane method
5. Sun / Star observation to determine azimuth
6. Traversing by total station

P: 30; TOTAL: 30 PERIODS

19CE48C HYDRAULIC ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Successful completion of this course, the student will able to

CO1: apply knowledge on flow measurements in pipes and open channels (K3)
CO2: calculate the performance on hydraulic machineries (K3)
CO3: apply knowledge on pipe layouts and design pumps for residential buildings (K3)
CO4: apply the knowledge of selecting pumps in different conditions. (K3)

LIST OF EXPERIMENTS

1. Determination of co-efficient of discharge for orifice
2. Determination of co-efficient of discharge for notches
3. Determination of co-efficient of discharge for venturimeter
4. Determination of co-efficient of discharge for orifice meter
5. Study of impact of jet on flat plate (normal / inclined)
6. Study of friction losses in pipes
7. Study of minor losses in pipes
8. Study on performance characteristics of Pelton turbine.
9. Study on performance characteristics of Francis turbine
10. Study on performance characteristics of Kaplan turbine
11. Study on performance characteristics of Centrifugal pumps (Constant / variable speed)
12. Study on performance characteristics of reciprocating pump.

LIST OF EQUIPMENTS
(For a batch of 30 students)

- I. Bernoulli’s theorem – Verification Apparatus
- II. Flow Measurement open channel flow

   1. Channel with provision for fixing notches (rectangular, triangular & trapezoidal forms)

III. Flow measurement in pipes
   1. Venturimeter, U tube manometer fixtures like Valves, collecting tank
   2. Orifice meter, with all necessary fittings in pipe lines of different diameters
   3. Calibration of flow through orifice tank with Provisions for fixing orifices, collecting tank
   4. Calibration of flow through mouth piece Tank with provisions for fixing mouth pieces Viz external mouth pieces .

IV. Losses in Pipes
   1. Major loss – Friction loss- Pipe lengths (min. 3m) of different diameters with Valves and pressure rapping & collecting tank
   2. Minor Losses -Pipe line assembly with provisions for having Sudden contractions in diameter, expansions Bends, elbow fitting, etc.

V. Pumps
   1. Centrifugal pump assembly with accessories (single stage)
   2. Centrifugal pump assembly with accessories (multi stage)
   3. Reciprocating pump assembly with accessories
   4. Deep well pump assembly set with accessories

VI. Turbine
   1. Impulse turbine with assembly and fittings
   2. Francis turbine with assembly and fittings
   3. Kaplan turbine with assembly and fittings

P: 30; TOTAL: 30 PERIODS

19CE51C BASIC STRUCTURAL ANALYSIS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Use the strain energy principles in determinate and indeterminate structures (K2)
CO2: Construct influence line diagrams for a structure under moving load. (K2)
CO3: Determine the unknown forces in three hinged two hinged arches. (K2)
CO4: Determine the unknown forces in continuous beams and rigid frames by slope defection method. (K2)
CO5: Determine the unknown forces in continuous beams and rigid frames by moment distribution method. (K2)

UNIT I STRAIN ENERGY METHOD 12

Determination of Static and Kinematic Indeterminacies – Analysis of statically determinate structures- plane frames and plane trusses – Analysis of statically indeterminate structures - continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

UNIT II INFLUENCE LINE METHOD 12

Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam sections - influence lines for member forces in pin jointed plane frames. - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams - Muller Breslau’s principle.

UNIT III ARCHES 12

Arches - Types of arches – Funicular concepts - Analysis of three hinged, two hinged - Parabolic and circular arches – Settlement and temperature effects.

UNIT IV SLOPE DEFLECTION METHOD 12

Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames – Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

UNIT V MOMENT DISTRIBUTION METHOD 12

Stiffness - distribution and carry over factors –- Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement - symmetric frames with symmetric and skew- symmetric loadings.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. R.C.Hibbeler, Structural Analysis in SI units, Pearson India, Ninth Edition, 2017.
2. Bhavikatti,S.S, Structural Analysis, Vol.1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi-4, 2014.

REFERENCES

1. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications, 2004.
2. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. CS Reddy, Basic Structural Analysis, Tata McGraw Hill Publication, 2011.

19CE52C DESIGN OF REINFORCED CONCRETE ELEMENTS

L T P C
3 1 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design the reinforced concrete flexural members by working stress method. (K3)

CO2: Design the reinforced concrete beams, slabs by limit state method. (K3)

CO3: Design and identify the behavior of reinforced concrete subjected to bond, anchorage, shear and torsion by limit state method. (K3)

CO4: Design the different types of reinforced concrete columns by limit state method.(K3)

CO5: Design the reinforced concrete footings by limit state method. (K3)

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 12

Materials for Concrete – Stress-Strain curve for concrete and reinforcing steel – Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of flexural members and slabs by working stress method – Properties of un-cracked section.

UNIT II LIMIT STATE DESIGN OF BEAMS (FLEXURE,SHEAR,TORSION) 12

Design of singly and doubly reinforced rectangular, flanged and continuous beams – Design Requirements for RC members in bond and Anchorage as per current code – Detailing.

UNIT III LIMIT STATE DESIGN OFSLABS, STAIRCASE 12

Design of one way and two way rectangular slabs subjected to uniformly distributed load for various boundary conditions and corner effects – Design of ordinary and dog legged staircases - Detailing.

UNIT IV LIMIT STATE DESIGN OF COLUMNS 12

Types of columns – Short and Long column - Braced and Unbraced columns – Design of short column for circular, rectangular, square under axial, uniaxial and biaxial bending – Detailing.

UNIT V LIMIT STATE DESIGN OF FOOTING 12

Design of wall footing – Design of pad and sloped footing for axially and eccentrically loaded rectangular footing – Design of combined rectangular footing for two columns only – Detailing.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOKS

1. M.L.Gambhir, “Fundamentals of Reinforced Concrete Design”, PHI Learning Publishing Company Pvt. Ltd.,2006.
2. UnnikrishnaPillai.S., DevdasMenon, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd., NewDelhi
3. Jain, A.K., “Limit State Design of RC Structures”, Nemchand Publications,Rourkee
4. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

REFERENCES

1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi 2002.
2. Krishna Raju.N., “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors, New Delhi, 2003.
3. Subramanya.N., “Design of Reinforced Concrete Structures”, Oxford Publications, 2011.

19CE53C WASTE WATER TREATMENT AND MANAGEMENT

L	T	P	C
3	1	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to,

CO1**:** Interpret the composition of sewage, estimate the wastewater generation and design of sewer system (K2)
CO2: Attribute the type of treatment system and to perform basic design of sewage treatment (K2)
CO3: Select the suitable sewage treatment process (K2)
CO4: Perceive the advance sewage treatment technologies (K2)
CO5**:** Describe the concepts of self-purification of streams and sludge disposal methods (K2)

UNIT I PLANNING AND DESIGN OFSEWERAGESYSTEM 12

Sources, Characteristics of sewage and its composition - population equivalent - Estimating quantity of sewage - Storm runoff estimation - Sewerage - separate, combined and partially seperate system - Hydraulic design of flow in sanitary sewers - sewer materials -Laying and testing - sewer appurtenances – sewage pumping - Discharge standards for Effluents

UNIT II PRIMARY TREATMENTOFSEWAGE 11

Objectives – Unit Operations and Processes - Collection system - Selection of treatment processes - Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber - primary sedimentation tanks - Onsite sanitation - Septic tank - Operation and Maintenanceaspects.

UNIT III SECONDARY TREATMENTOF SEWAGE 12

Objectives – Selection of Treatment Methods – Principles, Functions and design - Activated Sludge Process - Natural systems - Ponds and Lagoons - Trickling filters - Rotating biological contactors - Operation and Maintenance aspects.

UNIT IV ADVANCED SEWAGETREATMENT 12

Hybrid system - SBR - MBR - MBBR - FBR (Basics)- Anaerobic systems - Anaerobic filters - UASB - Biogas recovery- Reclamation and Reuse of sewage - Constructed Wetland - Nutrient removal systems - DEWATS (Basics).

UNIT V SEWAGE DISPOSAL ANDSLUDGEMANAGEMENT 13

Dilution – Self purification of surface water bodies - Oxygen sag curve – Streeter Phelps equation - Eutrophication - Land Disposal – Sewage farming – Sewage sickness - Sludge Digestion- characterization - Thickening – Dewatering – Drying - Disposal - Septage Management.

L: 45; T: 15; TOTAL: 60 PERIODS

TEXT BOOK

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.

REFERENCES

1. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
2. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, WashingtonD.C.,2010
3. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.

19CE54C FOUNDATION ENGINEERING L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Plan and execute detailed site investigation program to select type of foundation. (K2)
CO2: Determine bearing capacity of shallow foundation based on the soil conditions. (K2)
CO3: Explain the types of footing and raft based on contact pressure distribution. (K3)
CO4: Interpret the load carrying capacity and settlement of piles and pile group.(K2)
CO5: Illustrate the behavior of soil behind retaining structures. (K2)

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration-Auguring and boring – Wash boring and rotary drilling– Geophysical methods- Depth of boring – Spacing of bore hole – Sampling – Representative and undisturbed sampling – Sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Bore log report – Penetration tests (SPT and SCPT) – Data interpretation (Strength Parameters and Liquefaction potential) – Selection of foundation based on soil condition.

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits–Terzaghi"s formula and BIS formula–factors affecting bearing capacity – Problems - Bearing Capacity from insitu tests (SPT, SCPT and plate load) – Allowable bearing pressure, Determination of settlement of foundations on granular and clay deposits – Total and differential settlement - Allowable settlements – Codal provision – Methods of minimizing settlement, differential settlement.

UNIT III FOOTING SANDRAFTS 9

Types of foundation – Contact pressure distribution and settlement below footings and raft - Isolated and combined footings – Types and proportioning - Mat foundation– Types, applications uses and proportioning-principle of floating foundation- Seismic force considerations-Codal provisions.

UNIT IV PILES 9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil - Static formula - Dynamic formulae (Engineering news and Hiley"s)– Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity – Group capacity by different methods (Feld‟s rule, Converse Labarre formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test – Forces on pile caps – Under reamed piles – Capacity under compression and uplift-Codal provisions

UNIT V RETAINING WALLS 9

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
2. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi.2014.
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.

REFERENCES

1. Das, B.M. "Principles of Foundation Engineering", Thompson Asia Pvt. Ltd., 8th Edition, Singapore, 2013.
2. Joseph E Bowles, "Foundation Analysis and design", McGraw Hill Education, 5th Edition, 28th August 2015.
3. Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.

19CE55C HIGHWAY ENGINEERING

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to

CO1: Illustrate the highway planning, engineering surveys for highway alignment. (K2)
CO2: Design the geometric features of highway elements (K3)
CO3: Design the flexible and rigid pavements (K3)
CO4: Identify the desirable properties of highway materials and its standards & various practices adopted for construction. (K2)
CO5: Evaluate the various defects in pavements and its treatment. (K2)

UNITI HIGHWAY PLANNING AND ALIGNMENT 9

Significance of highway planning – Modal limitations towards sustainability - History of road development in India – factors influencing highway alignment – Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods (Remote Sensing, GIS and GPS techniques) - Classification of highways – Locations and functions – Typical cross sections of Urban and Rural roads

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads - Hairpin bends – Lateral and vertical clearance at underpasses [IRC Standards Only].

UNIT III DESIGN OF FLEXIBLE ANDRIGID PAVEMENT 9

Pavement components and their functions - Design principles of Flexible and Rigid pavement- factors affecting the Design of pavements -Design practice for flexible and rigid Pavements (IRC methods only) – Embankments- Problems in Flexible pavement design.

UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE 9

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Test on Bituminous mixes-Construction practice including modern materials and methods, Water Bound macadam Road, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures - Highway drainage –– Construction machineries.

UNIT V HIGHWAY MAINTENANCE 9

Types of Pavement -Types of defects in Flexible pavements – Surface defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments. -Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs. - Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation, Evaluation of pavement Failure and strengthening - Overlay design by Benkelman Beam Method [Procedure only].

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Veeraragavan. A, Khanna.K and Justo.C.E.G. Highway Engineering, Nem Chand & Bros Publishers,2014
2. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai,2010
3. Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers, 2017.

REFERENCES

1. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 8thEdition2013
2. Indian Road Congress (IRC), Guidelines and Special Publications on Planning and Design ofhighways.
3. Sharma.S.K, Principles, Practices and Design of Highway Engineering, S.Chand and CompanyLtd, 2014

19CE56C PROFESSIONAL ETHICS AND HUMAN VALUES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
CO2: Expose awareness on professional ethics. (K2)
CO3: Analyze the engineering ethical breach from past study. (K2)
CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)
CO5: Discuss about the global issues with regard to ethics. (K2)

UNIT I HUMAN VALUES 9

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike W Martin and Roland Schinzinger, “Ethics in Engineering”, 4th Edition, McGraw-Hill, New York 2017.
2. Govindarajan M, Natarajan S and Senthil Kumar VS, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2013.

REFERENCES

1. John R Boatright, "Ethics and the Conduct of Business", 4th Edition, Pearson Education, New Delhi, 2017.
2. Charles D and Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2012.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Fourth Edition, Wadsworth Thompson Learning, United States, 2005.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001.

19MC02C CONSTITUTION OF INDIA

L	T	P	C
3	0	0	0

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the salient features of the Indian Constitution. (K2)
CO2: discuss the structure and functions of parliament. (K2)
CO3: elaborate the structure and functions of state legislature. (K2)
CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
CO5: discuss the foreign policy of India. (K2)

UNIT I INDIAN CONSTITUTION 9

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM 9

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM 9

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT IV THE JUDICIARY 9

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS 9

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.

2. Gupta D.C, “Indian Government and Politics”, Vikas Publishing House, New Delhi, 2010.

REFERENCES

1. Pylee M.V, “Introduction to the Constitution of India”, Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, “Our Constitution”, National Book Trust, New Delhi, 2010.
3. Shukla V N,“Constitution of India”, Eastern Book Company Ltd., New Delhi, 2011.

19CE57C CONCRETE AND HIGHWAY ENGINEERINGLABORATORY

L	T	P	C
0	0	2	1

COURSE OUTCOMES

Upon Successful completion of the course student will able to

CO1 : Determine the physical properties of constituent materials of concrete (K2)
CO2 : Determine the properties of bricks andblocks (K2)
CO3 : Determine the properties of fresh concrete (K2)
CO4 : Determine the properties of hardened concrete (K2)
CO5 : Determine the properties of highwaymaterials (K2)

LIST OFEXPERIMENTS

I. TEST ONCEMENTS

a Determination of Consistency ofcement
b Determination of Initial & Final Setting time of cement
c Determination of Soundness ofcement
d Determination of Compressive strength ofcement

II. TESTS ON BRICKS AND BLOCKS

a Test for compressive strength of bricks and blocks
b Test for water absorption of bricks andblocks

III. TESTS ON FRESH CONCRETE

a Determination of workability of concrete by slump test and casting ofspecimens
b Determination of flow percent of concrete by Flow tabletest
c Determination of workability of concrete by compaction factor test and casting of specimens
d Determination of consistency of concrete by Vee beetest.

IV. TESTS ON HARDENEDCONCRETE

a Determination of Compressive strength of concrete Cube
b Determination of Splitting tensile strength ofcylinder
c Determination of Modulus of Rupture of concretebeam
d Determination of Modulus Of Elasticity of concretespecimen

V. TESTS ONBITUMEN

a Determination of Penetration value of bitumen
b Determination of Softening Point of bitumen
c Determination of Ductility value ofbitumen
d Determination of Viscosity ofbitumen
e Determination of Elastic Recovery ofbitumen

VI. TESTS ONAGGREGATES

a Determination of Particle size distribution and fineness modulus of Coarse Aggregate
b Determination of Water Absorption & Specific gravity of CoarseAggregate
c Determination of Impact Value of coarseAggregate
d Determination of Crushing value of CoarseAggregate
e Determination of Particle size Distribution of fineAggregate

VII. TESTS ON BITUMINOUSMIXES

a Determination of Binder Content value of bituminousmix
b Determination of Marshall Stability and Flow values of bituminous mix
c Determination of California Bearing Ratio value of subgradesoil.

P: 30; TOTAL: 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No	DESCRIPTION OF EQUIPMENTS	QUANTITY
1.	Concrete cube moulds	6
2.	Concrete cylinder moulds	3
3.	Concrete Prism moulds	3
4.	Sieves	1 set
5.	Concrete Mixer	1
6.	Slump cone	3
7.	Flow table	1
8.	Vibrator	1
9.	Trovels and planers	2 set
10.	Vee Bee Consistometer	1
11.	Aggregate impact testing machine	1
12.	Blains Apparatus	1
13.	Compression Testing Machine 200T capacity	1
14.	Flexure Testing Machine	1

15.	Compressometer	1
16.	Le Chatelier’s apparatus	2
17.	Vicat’s apparatus	2
18.	Mortar Cube moulds	10

19CE58C **SOILMECHANICSLABORATORY** **L T P C**
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Determine the index properties of soil. (K3)
CO2: Determine the engineering properties of soil. (K3)

LIST OF EXPERIMENTS

1. Grain size distribution - Sieveanalysis.
2. Grain size distribution - Hydrometeranalysis.
3. Specific gravity of soilgrains.
4. Relative density ofsoil.
5. Atterberg limitstest.
6. Determination of moisture - Density relationship using standard Proctortest.
7. Field density test (Core cutter and sand replacementmethods).
8. Permeability determination (constant head and falling headmethods).
9. Direct shear test in cohesionlesssoil.
10. Unconfined compression test in cohesivesoil.
11. Laboratory Vane Shear Test in cohesivesoil.
12. Triaxial compression test (Demonstrationonly).
13. One dimensional consolidation test (Demonstrationonly).

P: 30; TOTAL 30 PERIODS

LIST OF EQUIPMENTS

(For a batch of 30 students)

Sl. No.	DESCRIPTION OF EQUIPMENTS	QUANTITY
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor compaction apparatus	1 set
6.	Relative Density apparatus	1
7.	Thermometer	2

8.	Direct shear apparatus	1
9.	Unconfined Compression Testing apparatus	1
10.	Field density measuring devices	2
11.	Triaxial shear apparatus	1
12.	Three gang consolidation test device	1
13.	Vane Shear Apparatus	1

19CE61C ESTIMATION AND COSTING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the basic concept of quantity estimation for engineering and Irrigation structures (K2)
CO2: Determine the quantities for various structures (K2)
CO3: Conduct the rate analysis for different building works and roads. (K2)
CO4: Write the report on estimation of residential building, culverts and roads. (K2)
CO5: Illustrate various types of valuation and its methods involved in land and buildings. (K2)

UNITI QUANTITY ESTIMATION OF BUILDINGS 9

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates –Detailed estimate– Estimation of quantities for framed and load bearing structures.

UNITII QUANTITY ESTIMATION OFOTHER STRUCTURES 9

Estimating of septic tank, soak pit –– Open well – Estimate of bituminous and cement concrete roads – embankments - Estimate of retaining walls – culverts – arches - Estimating of irrigation works – aqueduct, fall.

UNITIII RATE ANALYSISANDCOSTING 9

Standard Data – Observed Data – Schedule of rates – Market rates – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works and Roads– Cost Estimates.

UNITIV SPECIFICATIONS, REPORTSAND TENDERS 9

Specifications – Detailed and general specifications –Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – Tender notices – types – tender procedures.

UNITV INTRODUCTION TOVALUATION 9

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. B.NDutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press,2006
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House,1998

REFERENCES

1. Hand Book of Consolidated Data – 8/2000, Vol.1,TNPWD
2. Tamil Nadu Transparencies in Tenders Act,1998
3. Arbitration and Conciliation Act, 199676
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi,20

19CE62C CONSTRUCTION ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Outline the features of construction industry (K2)
CO2: Develop a network plan for construction project (K3)
CO3: Develop a schedule and manage the resources for construction project (K3)
CO4: Prepare the contract documents based on IBRD/MORTH standards (K2)
CO5: Manage cost, finance, quality and safety in construction project (K2)

UNITI INTRODUCTION TO CONSTRUCTION INDUSTRY 9

Introduction- Construction Industry - Project Participants - Characteristics of projects- Project life cycle - Construction Organization - Work Breakdown Structure.

UNITII PROJECT PLANNING MANAGEMENT 9

Estimating project time and cost planning - Developing a network plan - Bar chart - Activity on Arrow (AOA) - Activity on Node (AON) - Precedence network- Introduction to application software.

UNITIII SCHEDULING AND RESOURCE MANAGEMENT 9

Scheduling - Network analysis- Start and finish time – Floats - Critical path Project Update - Project Controls - Schedule Compression- Cost-Time Trade Off (Network Crashing) - Resource Management - Resource Scheduling - Construction Procurement - Inventory control – Equipment management - Material management.

UNITIV CONTRACTS 9

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

UNITV COST CONTROL MANAGEMENT 9

Cost Management – Introduction to financial management - Quality management - safety - Site Management & Administration.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Verma L.C., Standardisation - A New Discipline Peurifoy R.L.,& Ledbetter W.B., Construction Planning Equipment & Methods.
2. K.K.Chitkara, "Construction Project Management", Tata McGraw-Hill Education,2009

REFERENCES

1. Vazirani V.N. &Chandola S.P., "Heavy Construction", KhannaPublications.
2. Jha J. & Sinha S.K., "Construction & Foundation Engineering", KhannaPublications.

19CE63C SOLID WASTE MANAGEMENT, AIR AND NOISE POLLUTION CONTROL

L	T	P	C
4	0	0	4

COURSE OUTCOMES

Upon completion of this course, the students will be able to,

CO1: Identify the sources of municipal solid wastes and methods to reduce solid wastes. (K2)
CO2: Conceptualize the collection and transfer methods of solid waste from source (K2)
CO3: Handle and disposal of municipal solid waste.(K2)
CO4: Identify the sources of air pollution, their impacts and air quality management (K2)
CO5: Select the appropriate control method for particulate and gaseous pollutants.(K2)

UNITI SOURCES, CHARACTERISTICS, ON-SITE STORAGE AND PROCESSING 11

Sources and types of municipal solid wastes - waste generation rates - factors affecting generation - composition - methods of sampling and characterization - Onsite storage methods - Handling and segregation at source - source reduction of waste and 3R Concept.

UNITII COLLECTION, TRANSFER AND PROCESSING OF SOLID WASTE 13

Methods of collection – Collection vehicles – Manpower – Collection routes and their optimization - Analysis of collection systems - Transfer stations - operation & maintenance - Objectives of waste processing – Physical Processing techniques and Equipment - Thermal processing options - Resource recovery from solid waste

UNITIII DISPOSAL OF MUNICIPAL SOLID WASTE 9

Land disposal of solid waste - Sanitary landfills - site selection, design and operation of sanitary landfills– Landfill liners - Leachate management and treatment.

UNITIV SOURCES, IMPACTS OF AIR POLLUTION AND AIRQUALITY MODELING 14

Structure and composition of Atmosphere – Definition and scope of Air Pollution - Sources and classification of air pollutants - effects on human health, vegetation, animals - Effects of meteorology on Air Pollution - Atmospheric stability, Inversion, Wind -profiles and stack plume patterns - Ambient air and stack sampling - Mechanism of dispersion of air pollutants - Dispersion models - Ambient Air Quality and Emission standards -Sources, types and control of indoor air pollutants.

UNITV CONTROL OF PARTICULATE AND GASEOUS POLLUTANTS 13

Gas Particle Interaction - Factors affecting Selection of Control Equipment – Particulates - Working principle, Performance evaluation of Gravity Separators, Centrifugal separators, Particulate Scrubbers, Electrostatic Precipitators - Gaseous pollutants - Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters. - Noise Pollution - Sources and Effects– Measurement – Standards – Control and Preventive measures.

L: 60; TOTAL: 60 PERIODS

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill India, 1stEdition, 2015
2. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.

REFERENCES

1. William A. Worrell, P. AarneVesilind, Christian Ludwig, Solid Waste Engineering - A Global Perspective, 3rdEdition, Cengage Learning,2017.
2. David H.F. Liu, Bela G. Liptak , "Air Pollution" , Lweis Publishers,2000
3. MN RAO and HVN RAO air pollution, Tata Mc-Graw Hill publishing company limited2007.
4. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.

19CE64C DESIGN OFSTEELSTRUCTURES L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Design of simple and eccentric connections. (K3)
CO2: Design tension members by appropriate identification of structural steel. (K3)
CO3: Design compression members by appropriate identification of structural steel. (K3)
CO4: Design the members subjected to bending and Lateral torsional buckling. (K3)
CO5: Design the components of Industrial roofing. (K3)

UNITI INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS 9

Properties of steel – Structural steel sections –Section classifications - Limit State Design Concepts– Loads on Structures – Design of bolted, welded connections – Eccentric connections –Types of failure – Efficiency of connections – prying action – HSFG bolts

UNITII TENSION MEMBERS 9

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

UNITIII COMPRESSION MEMBERS 9

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base

UNITIV BEAMS 9

Types of simple beam connections –Plastic analysis of beams - Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders riveted and welded – Intermediate and bearing stiffeners – Web splices

UNITV ROOF TRUSSES ANDINDUSTRIAL STRUCTURES 9

Roof trusses – Roof and side coverings – Design loads – design of purlin and elements of truss for simple trusses– end bearing – Design of gantry girder and gantry columns – Introduction to Pre- engineered building.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi,2016
2. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010.
3. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

REFERENCES

1. “Teaching Resources for Structural Steel Design – Vol. I & II”, INSDAG,Kolkatta.
2. Ramachandra.S and VirendraGehlot, “Design of Steel Structures – Vol. I & II”, Standard Publication, New Delhi,2007
3. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Private Limited,2013

19CE65C STRUCTURAL DESIGN AND DRAWING L T P C
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design various elements of Retaining wall / Water tanks / Truss / Framed Structures. (K3)
CO2: Sketch the structural drawings of a various elements of Retaining wall / Water tanks /Truss / Framed Structures using AutoCAD. (K3)
CO3: Analyze truss/framed structures using STAAD Pro software (K3)

LIST OF EXPERIMENTS

1. Analysis and design of multi storied framed structure using analyzing software.
2. Analysis and design of a steel truss system using analyzing software.
3. Design and detailing of Reinforced Cement Concrete cantilever and counter fort type retaining walls with reinforcement details.
4. Design of solid slab and Reinforced Cement Concrete Tee beam bridges for Indian Road Congress loading and reinforcement details.
5. Design and detailing of overhead water tank, circular and rectangular watertanks.

P: 60; TOTAL: 60 PERIODS

LIST OF EQUIPMENTS

1. Desktop Systems -30
2. Drafting Software -1
3. Analyzing and design software -1

19CE66C ENVIRONMENTALENGINEERINGLABORATORY

L T P C
0 0 2 1

COURSE OUTCOMES

Upon Successful completion of this course, the students will able to

CO1: Determine the quality parameters of water (K2)
CO2: Determine the quality parameters of wastewater (K2)

LIST OF EXPERIMENTS

1. Sampling, Preservation methods and Characterization of water and wastewater (Demonstration only)
2. Determination of pH and Electrical Conductivity
3. Determination of Turbidity and Hardness
4. Determination of Iron & Fluoride in water
5. Determination of Residual Chlorine
6. Determination of Chloride
7. Determination of Sulphate
8. Determination of Optimum Coagulant Dosage by jar test apparatus
    i) Alum dozing ii) Lime dozing

9. Determination of available Chlorine in Bleaching powder
10. Determination of Dissolved Oxygen
11. Determination of Solids
12. Estimation of C.O.D.
13. Estimation of B.O.D.
14. Determination of Ammonia Nitrogen
15. Introduction to Bacteriological Analysis (Demonstration only)

LIST OF EQUIPMENTS (For a batch of 30 students)

Sl. No.	Description of Equipments	Quantity
1.	pH meter	1 No.
2.	Turbidity meter	1 No.
3.	Conductivity meter	1 No.
4.	Refrigerator	1 No.
5.	BOD incubator	1 No.
6.	Muffle furnace	1 No.
7.	Hot air oven	1 No.
8.	Desicator	1 No.
9.	Jar test apparatus	1 No.
10.	Water bath	1 No.
11.	Furniture	1 lot
12.	Glass wares / Crucibles	1 lot
13.	COD apparatus	2 Nos.
14.	Kjeldane apparatus	1 No.
15.	Calorimeter	1 No.
16.	Chlorine comparator	1 No.
17.	Beaker	30 Nos.
18.	Magnetic stirrer with hot plates	1 No.
19.	Standard Flask	30 Nos.
20.	Burette with stand	15 Nos.
21.	Pipette	15 Nos.
22.	Crucible	15 Nos.
23.	Filtration assembly	1 No.
24.	Chemicals	1 No.
25.	Chemical balance	1 No.

P: 30; TOTAL: 30 PERIODS

19CE71C PROJECT MANAGEMENT AND FINANCE L T P C
(Common to all Programmes) 3 0 0 0

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the concept of operational and project management. (K2)
CO2: Define the scope of a project and develop the project plan. (K2)
CO3: Evaluate the technical, business and social environment related to the project. (K3)
CO4: Formulate and manage project team successfully. (K5)
CO5: Monitor and control projects using tools and techniques. (K3)

UNITI BASIC CONCEPT 9

Concept and categories of project - Project development cycle - Concept, tools and techniques of project management - Logistics and supply chain management - Forms of project organizations.

UNITII THE VERTICALSTRUCTURE PLANE 9

Project identification, formulation and preparation. Market and demand estimation - Market survey techniques - Demand forecasting. Materials management - Analysis of materials input, technology, production, plant capacity, location and site, civil works, charts, layouts and work schedule. Cost of project - Means of financing, estimates of cost - Financial projections.

UNIT III PROCESS OF PROJECT APPRAISAL 9

Technical, Economic, Financial, Legal and Social appraisal of the Industrial Projects. Problems due to rate of discount, wage-rate, exchange rates, treatment of taxes, social cost-benefits - treatment of risk and uncertainty - sensitivity analysis and probability approach - Single as well as multiple projects - Big data analytics - PLM and SLM.

UNIT IV PROJECT TEAM FORMULATION AND MAXIMIZING PARTICIPATION 9

Project Team frame works - Project Team cultures - Barriers and challenges - Selecting Team Members- Key skills of effective project leaders - Giving / receiving feedback from different members of the project.

UNIT V IMPLEMENTATION, MONITORING AND CONTROL OF PROJECTS 9

Project scheduling, network techniques for resource, cost budgeting and scheduling - project management teams and coordination - Monitoring and post implementation, evaluation of the project - ERP - Project financing.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Gobalakrishnan P and Ramamoorthy VE “Textbook of Project Management”, Macmillan Publications, 2014.
2. Maylor “Project Management”, 3rdEdition, Pearson, 2010.

REFERENCES

1. Gido, “Effective project management”, 3rd Edition, Cengage Learning, 2008.

2. Gray and Larson, "Project Management: The Managerial Process", 3rd Edition, TMH, 2010.
3. Choudhury S, "Project Management", Tata Mc-Graw Hill Publishing Co.1st Edition, 2007.

19CE72C **PROJECT WORK – I** **L T P C**
0 0 6 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify an innovate or creative idea / concept / solution to a problem (K3)
CO2: perform the detailed literature survey related to concept / idea (K2)
CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modeling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

P: 45; TOTAL: 45 PERIODS

19CE73C **COMPREHENSION** **L T P C**
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: recollect the technical knowledge acquired during the course of study. (K2)
CO2: demonstrate the comprehensive knowledge in technical interviews.(K4)

ASSESSMENT PROCEDURE

1. Review of civil engineering course of earlier semesters will be done by conducting objective type tests.
2. Periodically competitive exam level objective type tests will be conducted and evaluated.
3. Comprehensive viva will be conducted at the end of the semester for the revised courses.

P: 60; TOTAL: 60 PERIODS

19CE81C PROJECTWORK - II

L T P C
0 0 12 6

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: design and develop the working model (K3)
CO2: work independently to complete the project along with team members (K2)
CO3: demonstrate the results and documents the report (K4)

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

P: 180; TOTAL:180 PERIODS

19CE82C INTERNSHIP / IN-PLANT TRAINING

L T P C
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: acquire the knowledge of different industrial / organizational activities (K2)
CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department
2. A report should be submitted after the successful completion of internship / in-plant training.

P: 60; TOTAL: 60 PERIODS

B.E. CIVIL ENGINEERING

PROGRAMME ELECTIVE COURSES

19CE01E ADVANCEDSTRUCTURALANALYSIS L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

- CO1: Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method. (K3)
- CO2: Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames. (K3)
- CO3: Make use of the fundamental theory of FEA method. (K2)
- CO4: Analyse the structure using plastic mechanism. (K3)
- CO5: Analyse the suspension bridges with stiffening girders.(K3)

UNIT I FLEXIBLITY METHOD 9

Primary structures - Compatibility conditions – Formation of flexibility matrices - Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT II STIFFNESS METHOD 9

Restrained structure –Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

UNIT III FINITE ELEMENT METHOD 9

Introduction – Discretization of a structure – Displacement functions – Truss element – Beam element– Triangular elements - Plane stress and plane strain.

UNIT IV PLASTIC ANALYSIS 9

Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods – Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

UNIT V CABLES AND SUSPENSION BRIDGES 9

Equilibrium of cable – length of cable - anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. R.C.Hibbeler, Structural Analysis in SI units, Pearson India, Ninth Edition, 2017.
2. Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi, 2014.

REFERENCES

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, 2ndEdition, Delhi,2004
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications, 2004.
3. Vazrani.V.N and Ratwani,M.M, Analysis of Structures, Vol-II, Khanna Publishers, 2015.

19CE02E BRIDGE STRUCTURES L T P C

3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Examine the type of bridge and its basic requirements for particular location (K3)
CO2: Design the simple kind of bridge structures (K3)
CO3: Design the T- beam concrete bridge structures (K3)
CO4: Design the Steel and Steel Concrete Composite Bridge sections (K3)
CO5: Design the Supporting Structures for Bridges (K3)

UNIT I INTRODUCTION 9

Investigations and planning, choice of type, linear water way, economic span length, IRC specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.

UNIT II SIMPLE BRIDGE STRUCTURES 9

Load Calculation and dispersion -Design of Slab Bridges – Box Culvert- Pipe Culvert.

UNIT III T- BEAM CONCRETE BRIDGES 9

Pigaud‟s theory, courbon‟s theory- T-Beam Bridges - Prestressed Concrete Bridges.

UNIT IV STEEL AND STEEL CONCRETE COMPOSITE BRIDGES 9

Design of Truss Bridges - Plate Girder Bridges – Steel Concrete Composite Bridges.

UNIT V SUPPORTING STRUCTURES 9

Abutments – Piers – Importance of Soil-Structure Interaction – Types of Foundations – Bearings and expansion Joints.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Company, New Delhi, 2018.
2. Rajagopalan,N “Bridge Superstructure”, Alpha Science International, 2006

REFERENCES

1. Phatak D.R., “Bridge Engineering”, Satya Prakashan, New Delhi, 1990.
2. Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi, 2017
3. Jagadeesh. T.R. and Jayaram.M.A., “Design of Bridge Structures”, Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013

19CE03E STORAGE STRUCTURES L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design steel water storage structures. (K3)
CO2: Design concrete water storage structures. (K3)

CO3: Design steel industrial storage structures. (K3)
CO4: Design concrete industrial storage structures. (K3)
CO5: Design prestressed concrete water storage structures. (K3)

UNIT I STEEL WATER TANKS 12

Design of rectangular riveted steel water tank structures – Design of pressed steel water tank structures - Design of hemispherical bottom water tank structures – Design of oil storage structures.

UNIT II CONCRETE WATER TANKS 12

Design of Circular tanks – Design of Intz tank – Design of rectangular tanks.

UNIT III STEEL BINS 7

Design of square bunker – Jansen‟s and Airy‟s theories – IS Codal provisions –Design of cylindrical silo.

UNIT IV CONCRETE BINS 7

Design of square bunker– Design of cylindrical silo..

UNIT V PRESTRESSED CONCRETE WATER TANKS 7

Principles of circular prestressing – Design of prestressed concrete circular water tanks.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Rajagopalan K., “Storage Structures”, Tata McGraw-Hill, New Delhi, 1998.
2. Krishna Raju N., “Advanced Reinforced Concrete Design”, CBS Publishers and Distributors, New Delhi, 2010.
3. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, sixth edition, 2018.

REFERENCES

1. Ramaswamy G.S., “Modern prestressed concrete design”, Arnold Heinimen, New Delhi, 1998.
2. Lin T.Y. “Design of prestressed concrete structures, Asia Publishing House”, Bombay 2010.
3. David A.Sheppard, William R. and Philips, “Plant Cast precast and prestressed concrete – A design guide”, McGraw Hill, New Delhi 1992.

19CE04E THEORY OF PLATES AND SHELLS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the Principles of elasticity (K2)
CO2: Familiarize with the behaviour and analysis of Thin plates (K2)
CO3: Analyze the behaviour of rectangular plates and circular plates (K3)

CO4: Understand the fundamentals of shells and its classification (K2)
CO5: Analyze the structural behavior of shells. (K3)

UNIT I INTRODUCTION TO THEORY OF ELASTICITY 9

Analysis of Stress: Definition and notation of stress, Equations of equilibrium in differential form, Stress components on an arbitrary plane, Principal stresses, Planes of maximum shear, Stress transformation, Plane state of stress, Mohr's diagram for 3dimensional state of stress. Analysis of Strain: Displacement field, Strains in term of displacement field. Plane state of strain, Compatibility equations.

UNIT II THIN PLATE THEORY 9

Assumptions – Bending of long rectangular plates to a cylindrical surface – Differential equation – Plates with simply supported edges – Plates with built-in edges – Pure bending of plates – Slope and curvature of slightly bent plates – Relation between bending moment and curvature.

UNIT III CLASSICAL APPROACH AND METHODS 9

Small deflections of laterally loaded plates – Differential equation of the deflection surface – Simply supported rectangular plates using different boundary conditions – Navier‟s solution for simply supported rectangular plates under a load uniformly distributed over the area of a rectangle - Levy‟s method – Advantages over Navier‟s solution – Symmetrical bending of laterally loaded circular plates – Differential equation – Uniformly loaded circular plates.

UNIT IV THIN SHELLS 9

Classification of shell surfaces – Surfaces of revolution - Δ-forms of surfaces – Folded plates – Characteristics of shell surfaces – Surfaces and its related aspects – Curvatures of a surface – Curves and related aspects

UNIT V STRUCTURAL BEHAVIOUR OF SHELLS 9

Structural behaviour and various relations – Equilibrium equations – Stress-strain relationships –Equilibrium equations for thin shell elements in membrane state – Curvilinear coordinate system –Shells of revolution – Strain-displacement relations for cylindrical shells.Design of shells based on beam theory - Design aspects of paraboloid, hyperboloid shells.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. S.Timoshenko and J.N. Goodier "Theory of Elasticity Stephen Timoshenko, McGraw Hill Book Company,New York, 2017. Third Edition
2. J.N. Reddy, "Theory and Analysis of Elastic Plates and Shells", Second Edition ,CRC Press, Taylor and Francis Group, Boca Raton ,London , New York ,2016.
3. Prof. K. Bhaskar and Prof. T.K. Varadan (Retd.) Plates: Theories and Applications: Print ISBN:9781118893876 |Online ISBN:9781118894705,Copyright © 2014 John Wiley & Sons, Ltd.
4. Binoy. K. Chatterji, Theory and Design of Concrete Shells , Publisher : Spon Press; Revised edition (1 November 1988)

REFERENCE

1. Rudolph Szilard, “Theories and Applications of Plate Analysis”, Wiley India Pvt. Ltd.
2. Bairagi, K .A Text Book of Plate Analysis –, Khanna Publisher, New Delhi.
3. Thin Shell Structures by Bandopadhyay J.N. New Age International Publishers, New Delhi, 2007

19CE05E TALL BUILDINGS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Describe the various loads acting on a tall building. (K2)
CO2: Describe the forces and frames of tall building. (K2)
CO3: Outline the common high rise structures. (K2)
CO4: Analyse a tall structure. (K3)
CO5: Explain the techniques used in high-rise buildings. (K2)

UNIT I INTRODUCTION AND LOADING 9

The Tall Building in the Urban Context - The tall building and its support structure - development of high rise building structures - General Planning Considerations. Dead Loads - Live Loads-Construction Loads -Snow, Rain, and Ice Loads - Wind Loads-Seismic Loading – Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes of Material - Impact and Dynamic Loads - Blast Loads -Combination of Loads.

UNIT II THE VERTICAL STRUCTURE PLANE 10

Dispersion of Vertical Forces- Dispersion of Lateral Forces - Optimum Ground Level Space - Shear Wall Arrangement - Behaviour of Shear Walls under Lateral Loading. The Floor Structure or Horizontal Building Plane Floor Framing Systems-Horizontal Bracing-Composite Floor Systems the High – Rise Building as related to assemblage Kits Skeleton Frame Systems - Load Bearing Wall Panel Systems - Panel – Frame Systems - Multistory Box Systems.

UNIT III BEHAVIOUR OF HIGH RISE STRUCTURES 10

The Bearing Wall Structure- The Shear Core Structure - Rigid Frame Systems- The Wall - Beam Structure: Interspatial and Staggered Truss Systems - Frame - Shear Wall Building Systems - Flat Slab Building Structures - Shear Truss - Frame Interaction System with Rigid - Belt Trusses - Tubular Systems-Composite Buildings - Comparison of High - Rise Structural Systems Other Design Approaches Controlling Building Drift Efficient Building Forms - Dynamic Response.

UNIT IV ANALYSIS AND DESIGN 9

Approximate Analysis of Bearing Wall Buildings The Cross Wall Structure - The Long Wall Structure The Rigid Frame Structure Approximate Analysis for Vertical Loading - Approximate Analysis for Lateral Loading - Approximate Design of Rigid Frame Buildings-Lateral Deformation of Rigid Frame Buildings - Shear Wall Structure - Composite Structure - The Hollow Tube Structure.

UNIT V OTHER HIGH-RISE BUILDING STRUCTURE 7

Deep - Beam Systems – High rise suspension systems - Pneumatic High rise buildings - Space Frame Applied to High rise Buildings - Capsule Architecture.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 2011.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, McGraw Hill, 2011.

REFERENCES

1. Coull, A. and Smith, Stafford, B, “Tall Buildings ", Pergamon Press, London, 1997.
2. LinT.Y. and Burry D.Stotes, “Structural Concepts and Systems for Architects and Engineers", John Wiley, 1994.
3. Wolfgang Schueller, High-rise building structures, Publisher: Wiley (January 1, 1977).

19CE06E PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Outline the basic concepts in Prefabrication. (K2)
CO2: Infer the different prefabricated components in Structures. (K2)
CO3: Explain the design the principles of Prefabricated Components. (K2)
CO4: Design the joints in prefabricated components. (K3)
CO5: Examine the loading conditions on components. (K2)

UNIT I INTRODUCTION 9

Need for prefabrication – Principles – Materials – Modular coordination – Standarization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS 9

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs– Wall panels – Columns – Shear walls.

UNIT III DESIGN PRINCIPLES 9

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 9

Types of Joints– Jointing materials – Dimensions and detailing – Design of expansion joints – Types of structural connections – Beam to Beam, Column to Column, Column to Foundation, Connection between wall panels, and Connection between floor panels.

UNIT V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Hubert Bachmann and Alfred Steinle , Precast Concrete Structures, 2012.
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., “Knowledge based process planning for construction and manufacturing”, Academic Press Inc., 1994.

REFERENCES

1. Koncz T., “Manual of precast concrete construction, Vols. I, II and III”, Bauverlag, GMBH, 1971.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.

19CE07E COMPUTER AIDED DESIGN OF STRUCTURES L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1**:** Formulate algorithm for solving equations by matrix method and construct algorithm for Computer aided design of truss problems. (K3)
- CO2: Construct algorithm for computer aided design of reinforced concrete members. (K3)
- CO3: Construct algorithm for computer aided design of steel members. (K3)
- CO4: Construct algorithm for analysis of prestressed concrete members. (K3)
- CO5: Acquire the knowledge in Artificial Intelligence and Knowledge based expert systems (K3)

UNIT I STRUCTURAL ANALYSIS 9

Banded and semi-banded matrices - element stiffness matrix – structure stiffness matrix – algorithm for solving trusses by matrix stiffness method – simple applications.

UNIT II REINFORCED CONCRETE STRUCTURES 9

Stress-strain relationship in concrete and steel – algorithm for bending moment coefficients in slab – algorithm for developing design tables for beams – rectangular and flanged sections – simple applications.

UNIT III STEEL STRUCTURES 9

Algorithm for finding load carrying capacity of steel columns – algorithm for moment carrying capacity of steel beams – simple applications.

UNIT IV PRESTRESSED CONCRETE STRUCTURES 9

Algorithm for analysis of prestressed rectangular and I sections in flexure – algorithm for finding losses in prestress – simple applications.

UNIT V EXPERT SYSTEMS 9

Introduction to artificial intelligence - Knowledge based expert systems – Rules and decision tables - Inference mechanisms - simple applications.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Groover M.P. and Zimmers E.W. Jr., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Limited, New Delhi, 2014.
2. Krishnamoorthy C.S.Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 2003

REFERENCES

1. Harrison H.B., "Structural Analysis and Design, Part I and II" Pergamon Press, Oxford, 1990.
2. Rao S.S., "Optimisation Theory and Applications", Wiley Eastern Limited, New Delhi, 1977.
3. Richard Forsyth (Ed), "Expert System Principles and Case Studies", Chapman and Hall, London, 1989.

19CE08E INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Construct the planning aspects of the Industrial Buildings. (K2)
CO2: Select functional Requirement of the Industrial Buildings. (K2)
CO3: Analyze and Design Steel Structures for Industries. (K2)
CO4: Analyze & Design Concrete Structures for Industries. (K2)
CO5: Explain the concept of Prefabrications and pre stressingin Industries. (K3)

UNIT I PLANNING 9

Classification of Industries and Industrial structures – General requirements for industrieslike cement, chemical and steel plants – Planning and layout of buildings and components.

UNIT II FUNCTIONAL REQUIREMENTS 9

Lighting – Ventilation – Acoustics – Fire safety – Guidelines from factories act.

UNIT III DESIGN OF STEEL STRUCTURES 9

Industrial roofs – Crane girders – Mill buildings – Design of Bunkers and Silos–Chimney Cooling Towers (Principles)

UNIT IV DESIGN OF R.C. STRUCTURES 9

Corbels, Brackets and Nibs - Silos and bunkers – Chimneys – Principles of folded plates and shell roofs

UNIT V PREFABRICATION 9

Principles of prefabrication – Prestressed precast roof trusses- construction of roof and floor slabs - Wall panels –storage /transportation /handling in yard /site and erection – Joints in precast structures.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Dayaratnam, P., “Design of Steel Structures”, 2nd Edition, S.Chand &Company, 2003.
2. Ramachandra, S. and Virendra Gehlot, “Design of Steel Structures – Vol. I & II”, 2008. Standard Publication, New Delhi, 2007.
3. Ramamurtham.S “Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company 2007.
4. Varghese P.C “Advanced reinforced Concrete Design”, PHI, Eastern Economy, 2nd Edition, 2005.

REFERENCES

1. BhavikattiS.S, “Design of steel structures”, J.K .International Publishing House Pvt Ltd, 2009.
2. Subramanian, N., Design of Steel Structures, Oxford University Press, 2008
3. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 1995.
4. Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990.
5. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982.
6. Clarence W Dunham , Planning industrial structures, McGraw-Hill Book Co; 1st edition (January 1, 1948)
7. National Building codes

19CE09E SMART MATERIALS AND SMART STRUCTURES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Develop knowledge on smart materials and its response on instrumented structures. (K2)
CO2: Explain the concepts of measurement using smart materials (K2)
CO3: Understand the sensing technology in smart structures. (K2)
CO4: Infer the actuator techniques and materials for structural assessment. (K2)
CO5: Apply the data acquisition and data processing techniques for a sensor (K3)

UNIT I INTRODUCTION 9

Introduction to Smart Materials and Structures – Instrumented structures functions andresponse – Sensing systems – Self-diagnosis – Signal processing consideration – Actuation systems and effectors.

UNIT II MEASURING TECHNIQUES 9

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance –

Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT III SENSORS 9

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

UNIT IV ACTUATORS 9

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro rheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials

UNIT V APPLICATIONS IN CIVIL ENGINEERING 9

Signal Processing and Control for Smart Structures – Sensors for Civil Engineering Structures – Damage detection using sensors – Smart Buildings – Smart Building components such as smart windows.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Brain Culshaw, “Smart Structure and Materials” Artech House Borton, London 1996.
2. Sadhu Singh, “Experimental Stress Analysis“, Khanna Publishers, 1st January 1981.

REFERENCES

1. L. S. Srinath, “Experimental Stress Analysis”, Tata McGraw-Hill, 1998.
2. J. W. Dally & W. F. Riley, “Experimental Stress Analysis”, Tata McGraw-Hill, 1998.

19CE10E REPAIR AND REHABILITATION OF STRUCTURES L TPC 3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Understand importance of maintenance and repair strategies (K2)
CO2: Asses the strength and durability properties of concrete structures (K2)
CO3: Summarize the special type of concretes (K2)
CO4: Understand the techniques for repair and protection methods. (K2)
CO5: Outline the Repair, rehabilitation and retrofitting of structures (K2)

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete–Strength, Durability- Cracks, different types, causes–

Effects due to climate, temperature, Sustained elevated temperature, Corrosion.

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9

Non-destructive Testing Techniques, Load Test for Stability-Epoxy injection, Shoring, Underpinning, Corrosion protection techniques–Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection.

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UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake–Structural Health Monitoring- demolition techniques-Engineered demolition methods- Case studies.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Vidivelli.Bl, Rehabilitation of Concrete Structures, Standard Publishes Distribution, 1st Edition, 2009.
2. Dodge Woodson.R, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth- Heinemann, Elsevier, New Delhi, 2012

REFERENCES

1. Varghese.P.C Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd2014.
2. Ravishankar.K. Krishnamoorthy.T.S, Structural Health Monitoring, Repair And Rehabilitation of Concrete Structures, Allied Publishers, 2004.
3. Hand Book on “Repair and Rehabilitation of RCC Buildings”–Director General works CPWD, Govt. of India , New Delhi–2002

19CE11E FINITE ELEMENT TECHNIQUES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Develop knowledge on modeling, node, discretization and formulations. (K2)
CO2: Analyse one dimensional problems using FE techniques (K2)
CO3: Analyse two dimensional problems using FE techniques (K2)
CO4: Develop Knowledge on truss analysis using FE techniques (K2)
CO5: Develop Knowledge on Finite element software (K3)

UNITI INTRODUCTION VARIATIONAL FORMULATION 9

Basic concepts of FEM – Engineering Problems and governing differential equations – Modelling – discretization – Node, Element –different types of elements- Boundary conditions – Strain-displacement relations – Stress strain relations – Potential energy and equilibrium – Weighted integral and weak formulation – Variational approach – Rayleigh Ritz method.

UNITII FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 9

Finite element modeling – Coordinates and shapes functions – Assembly of global stiffness matrix and global load vector – Properties of stiffness matrix and load vector – Finite element equations – Treatment of boundary conditions – Temperature effects.

UNITIII FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 9

Plane stress and Plane strain problems – Local –Global transformation - Stiffness matrix – Stress calculation Triangular and Quadratic Elements- Isoparametric formulations –shape functions –stiffness matrix

UNITIV FINITE ELEMENT ANALYSIS OF TRUSS PROBLEMS 9

Plane trusses – Local –Global transformation - Stiffness matrix – Stress calculations.

UNITV APPLICATIONS OF FEAIN SOFTWARES 9

Introduction to FEA Software – ANSYS, ABAQUS- Modeling- generation of node numbers -Mesh Generation – Post Processing - Analysis.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Chandrupatla, T.R., and Belegundu, A.D., “Introduction to Finite Element in Engineering”, 3rd Edition, Prentice Hall, India, 2003.
2. J.N.Reddy, “An Introduction to Finite Element Method”, McGraw-Hill, Intl. Student Edition, 2005.
3. S.S.Rao, “The Finite Element Method in Engineering”, Pergaman Press, 2003.

REFERENCES

1. Zienkiewics, “The finite element method, Basic formulation and linear problems”, Vol.1, 4th Edition, McGraw-Hill, Book Co1998.
2. C.S.Krishnamoorthy, “Finite element Analysis” Theory and Programming, Tata McGraw Hill, 1995.

19CE12E DESIGN OF REINFORCED CONCRETE AND BRICK MASONRYSTRUCTURES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Design the retaining walls. (K3)
CO2: Design the water tanks. (K3)
CO3: Design staircase, flat slabs, concrete walls. (K3)
CO4: Design slabs using yield line theory. (K3)
CO5: Design brick walls. (K3)

UNITI RETAINING WALLS 9

Retaining wall – Types – Design and detailing of cantilever and counter fort retaining walls.

UNITII WATER TANKS 9

Design – Underground rectangular tanks – Domes – Overhead circular and rectangular tanks– Design of staging and foundations.

UNITIII STAIRCASES, FLAT SLABS, RC WALLS 9

Staircase – Types – Design of staircases (ordinary and doglegged) – Design of flat slabs – Design of Reinforced concrete walls.

UNITIV YIELD LINE THEORY 9

Application of virtual work method to square, rectangular, circular and triangular slabs.

UNITV BRICK MASONRY 9

Introduction - Classification of walls -Lateral supports and stability - Effective height of wall and columns - Effective length of walls - design loads, load dispersion, permissible stresses - Design of axially and eccentrically loaded brick walls..

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Unnikrishna Pillai,S., Devdas Menon, “Reinforced Concrete Design”, Tata Mc Graw Hill Publishing Company Limited, New Delhi, 2009.
2. Dayaratnam, P., “Brick and Reinforced Brick Structures”, Oxford & IBH Publishing House, 2006.
3. Varghese, P.C., “Advanced Reinforced Concrete Structures”, Prentice Hall of India Private Limited, New Delhi, 2007.

REFERENCES

1. Mallick, D.K. and Gupta A.P., “Reinforced Concrete”, Oxford and IBH Publishing Company, 2007
2. Krishna Raju, N., “Design of RC Structures”, CBS Publishers and Distributors, Delhi,2006
3. Ram Chandra.N. and Virendra Gehlot, “Limit State Design”, Standard Book House,2004.

19CE13E PRESTRESSED CONCRETE STRUCTURES L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Examine the basics and behavior of prestressed concrete. (K3)
CO2: Estimate the concepts of Limit state of serviceability. (K3)
CO3: Estimate the Limit state of strength.(K3)
CO4: Design of prestressed circular tanks and pipes. (K3)
CO5: Analyse the prestressed composite structures and continuous beams. (K3)

UNITI ANALYSIS OF STRESSES 9

Basic concepts – Principles of prestressing – Classification and types – Advantages Over ordinary reinforced concrete – Materials required – High strength concrete and high tensile steel – Methods of prestressing – Analysis of sections of stresses by stress concept, strength concept and load balancing concept.

UNIT II LIMIT STATE OF SERVICEABILITY 9

Factors influencing deflections – Calculation of Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Losses in pretensioned and post- tensioned members – Estimation of crack width.

UNITIII LIMIT STATE OF STRENGTH 9

Basic assumptions for calculating flexural stresses – Design of sections of Type 1 and Type II post- tensioned and pretensioned beams – Location of wires in pre-tensioned beams – Design for shear based on IS 1343 Code –Determination of anchorage zone stresses in post-tensioned beams by Magnel'smethod,Guyon's method and IS 1343 code – Design of anchorage zone reinforcement.

UNITIV PSC SPECIAL STRUCTURES 7

Concept of circular prestressing – Design of prestressed concrete pipes and cylindrical water tanks- Design of Poles and Sleepers.

UNITV COMPOSITE BEAM AND CONTINUOUSBEAMS 11

Types of composite construction – Analysis of stresses – Differential shrinkage – Deflections of composite members –Flexural strength of composite members – Design of Composite sections – Methods of achieving continuity in continuous beams – Analysis of secondary moments – Concordant cable.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, Sixth Edition, 2018.
2. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Company Private Limited, 2009.
3. Rajagopalan, N, "Prestressed Concrete", Alpha Science, 2010.

REFERENCES

1. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990.
2. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay2010.
3. David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete – A design guide, McGraw Hill, New Delhi, 1992.
4. Pasala Dayaratnam, Prestressed Concrete Structures, CBS Publishers & distributors Pvt. Ltd, New Delhi, 2018.

19CE14E BASICS OF DYNAMICS AND ASEISMIC DESIGN L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1:Develop knowledge in the simulation and mathematical model development SDOF system (K2)
CO2: Develop knowledge in the simulation and mathematical model development MDOF system (K2)
CO3: to understand the fundamentals of seismology. (K2)
CO4: Identify the various causes and effects of earthquakes on structures (K2)
CO5: analyze and Design the structures subjected to Seismic loading.(K3)

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF system – D' Alemberts Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic forces.

UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multidegree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT III ELEMENTS OF SEISMOLOGY 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE 9

Effect of earthquake on different types of structures – Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT V DESIGN METHODOLOGY 9

Causes of damage – Planning considerations/Architectural concept (IS 4326–1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993).

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 2nd Edition, Pearson Education, 2015.

2. Pankaj Agarwal & Shrikhande, “Earth quake resistant Design of Structures”, PHI Learning, 2009.
3. Paz, M., “Structural Dynamics – Theory & Computation”, CSB Publishers & Distributors, Shahdara, Delhi, 2004.
4. S.R. Damodarasamyand S. Kavitha , Basics of Structural Dynamics and Aseismic Design, Publisher : PHI (1 December 2009).

REFERENCES

1. Biggs, J.M., “Introduction to Structural Dynamics”, McGraw–Hill Book Co., N.Y., 2013
2. Dowrick, D.J., “Earthquake Resistant Design and Risk Reduction”, John Wiley & Sons, London, 2011.
3. NPEEE Publications.
4. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, Elements of Earthquake Engineering, South Asia Publishers, 1994.

19CE15E DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES L T P C

3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Analyse the composite section (K3)
CO2: Design Composite Beams (K3)
CO3: Design Composite floors (K3)
CO4: Design Composite Columns (K3)
CO5: Design Composite Trusses (K3)

UNIT I INTRODUCTION TO STEEL CONCRETE COMPOSITE STRUCTURES 9

Modular ratio – Transformed section – Composite action – No interaction - Full interaction – Slip calculation -Stress block – Ultimate moment capacity. Provisions of IS: 11384 and Euro Code-4-2004.

UNIT II COMPOSITE BEAMS 9

Introduction to Composite beams - Ultimate moment behaviour – Types and load transferring mechanism of Shear connectors - Types, merits and behaviour of profiled decking - Design consideration for simply supported and continuous composite beam (with or without profile deck) - Problems.

UNIT III COMPOSITE FLOORS 9

Introduction of composite floors - Discuss on shear transferring mechanism in profile deck system - Bending resistance of composite slab - Design consideration of composite floor - Design of Composite floor.

UNIT IV COMPOSITE COLUMNS 9

Introduction to composite columns and its applications - Resistance of encased composite column cross section and infilled composite column cross section under compression -

Design consideration of both encased and infilled composite column under - axial compression, uniaxial bending and biaxial bending – Problems.

UNIT V COMPOSITE TRUSSES 9

Behaviour and application of composite truss - Design consideration – stud specifications – Load calculation - Design of composite truss.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Johnson R.P., “Composite Structures of Steel and Concrete”, volume I, Black well scientific publication, U.K.2018.
2. Narayanan R, “Composite steel structures – Advances, design and construction”, Elsevier, Applied science, UK, 2006

REFERENCES

1. Teaching resource for, “Structural Steel Design,” Volume 2 of 3, Institute for Steel Development and Growth (INSDAG), 2002.
2. Owens.G.W and Knowles.P, “Steel Designers Manual”, Seventh Edition, Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 2011.

19CE16E ADVANCED STEEL STRUCTURES

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

- CO1: Design Different kinds of structural steel connection (K3)
- CO2: Design complex roof trusses (K3)
- CO3: Design storage structures (K3)
- CO4: Design cold formed steel beams (K3)
- CO5: Design cold formed steel columns (K3)

UNITI INTRODUCTION TO BEAM COLUMN CONNECTION 9

Beam to beam connection – Beam to column connection – Flexible, Rigid, Semi rigid connection- Shear and Moment Connection

UNIT II ROOFTRUSSES 9

Load Calculation – Introduction to Tubular trusses – Design of Tubular trusses- Design of Fink and complex space trusses – Pre engineering building techniques.

UNITIII STORAGE STRUCTURES 9

DesignofSilo–DesignofBunker– AiryandJansen‟stheory

UNITIV COLD FORMED STEEL BEAMS 9

Introduction – Press brake and cold rolling Methods- I801 procedure – flat width ratio – Typesof cross sections – local buckling and lateral buckling - Design of flexural member

UNITV COLD FORMED STEEL COLUMNS 9

Introduction – Q factor – Column design using IS 801 Procedure – Introduction to Direct Design method- Design of axially compressed column

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Teaching resource for, "Structural Steel Design," Volume 1, 2 & 3, Institute for Steel Development and Growth (INSDAG), 2002.
2. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi,2016
3. Ramachandra.S and Virendra Gehlot, "Design of Steel Structures – Vol. I & II", Standard Publication, New Delhi,2016

REFERENCES

1. Handbooks of INSDAG (periodicals)
2. Teaching resource for "Cold formed Steel" Design IITMadras.
3. Wie Wen Yu, Design of Cold Formed Steel Structures, Mc-Graw Hill Book Company, 1996
4. S.K. Duggal, Limit State Design of Steel Structures, Mc-Graw Hill Book Company, 2017

19CE18E EXPERIMENTAL STRESS ANALYSIS

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Discuss on various strains measurement methods. (K2)
CO2: Classify the various measuring instruments in experimentation. (K2)
CO3: Relate the concept of photo elasticity in calibration of photoelastic materials. (K2)
CO4: Analyze models based on various methods. (K4)
CO5: Describe the advanced techniques in measurements. (K2)

UNIT I STRAIN MEASUREMENT METHODS 9

Strain gauges – basic characteristics – mechanical, optical, acoustic, electrical inductance and capacitance, pneumatic types – description and working principles – factors producing strain sensitivity – Gauge construction – temperature compensation – Gauge sensitivities and gauge factors – Strain rosettes –Calculation of principal strains and principal stresses.

UNIT II MEASURING INSTRUMENTS 9

Linear Variable Differential Transducer – Cathode Ray Oscilloscope – XY Plotter – Digital Data Acquisition System – Hydraulic Jacks – Pressure Jacks – load cells – Proving Rings – Vibration meter – Wind Tunnel – Calibration of Testing Instruments.

UNIT III PHOTO ELASTICITY 9

Two dimensional photo elasticity – Stress optic law – Polariscope – isoclinic and isochromatic fringes – compensators – Separation techniques – Model materials – Calibration of photo elastic materials.

UNIT IV MODEL ANALYSIS 9

Model analysis – Direct and Indirect models – laws of structural similitude – choice of scales – Model materials – Limitations of model studies –Buckingham pi theorem –Design of direct and indirect models – Begg"s Deformeter and its applications.

UNIT V ADVANCED TECHNIQUES 9

Fundamentals of photo elastic coatings – Morie fringe and Brittle coating technique – crack detection techniques – Introduction to stress freezing technique. – Introduction to nondestructive testings – Holography.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Dally and Railey, "Experimental stress analysis", 2003.
2. Richard G Budynas, "Advanced Strength and Applied Stress Analysis", Tata McGraw Hill Publishing company Ltd., New Delhi, 2011

REFERENCES

1. Sadhu Singh, "Experimental stress analysis", Khanna Publishers, New Delhi, 2005.
2. Dove and Adam, "Experimental stress analysis and Motion measurements",1989

19CE19E NON DESTRUCTIVE TESTING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

- CO1: Illustrate the Visual inspection and liquid penetrant testing procedures. (K2)
- CO2: Explain the principles and procedures for ultrasonic and Acoustic emission testing of industrial components. (K2)
- CO3: Compare the principles, procedures and Instrumentation used for non-destructive testing of ferromagnetic materials. (K2)
- CO4: Classify the various sources and detectors used for the thermography and radiography techniques. (K2)
- CO5: Critically appraise the NDT techniques available and select the most appropriate one for a given situation/application.(K3)

UNITI VISUAL INSPECTION AND LIQUID PENETRANT TESTING 9

Introduction: Comparison of Destructive and Non-Destructive Tests -Conditions for Effective Non- Destructive Testing Visual Inspection:-Optical aids used for visual Inspection - Applications Liquid Penetrant Testing: Physical Principles - Procedure for Penetrant Testing - Penetrant Testing Materials– Penetrant Testing Methods - Water washable and Post - Emulsifiable Method.

UNIT II ULTRASONIC AND ACOUSTIC EMISSION TESTING 9

Ultrasonic Testing: Principle - Ultrasonic Transducers - Flaw detection equipment-Modes of display- Variables affecting Ultrasonic Test-Pulse echo, through transmission and Angle

Beam Testing- Applications, Advantages and Limitations. Acoustic Emission Testing: Principle – Instrumentation – Advantages, Limitations and applications - Acoustic Emission testing of metal pressure vessels - Fatigue crack detection in Aerospace structures.

UNITIII MAGNETIC PARTICLE, EDDY CURRENT AND MAGNETIC FLUX LEAKAGE TESTING 9

Magnetic Particle Testing: Principle- magnetizing techniques- Procedure used for testing acomponent– Advantages, Limitations and applications Eddy current Testing: Principles – Instrumentation for Eddy current testing – Inspection of ferromagnetic materials - Pulsed eddy current testing- Applications. Magnetic Flux Leakage (MFL) Testing: Principle-Magnetizing and Demagnetizing methods – MFL sensors – Flaw detection and analysis in ferromagnetic specimen – advantages, Limitations and applications.

UNITIV THERMOGRAPHY AND RADIO GRAPHY TESTING 9

Thermography: Principle - Detectors and Equipments for active thrermography – heating sources – applications - Thermal imaging for condition monitoring of Industrial Components Radiography: Principle - Electromagnetic radiation sources – Radiographic imaging equipments various inspection techniques - Reading and interpretation of radiographs – safety in industrial radiography.

UNITV INDUSTRIAL APPLICATIONS OF NON-DESTRUCTIVE TESTING 9

Industrial Applications of Non Destructive Testing: Railways- Nuclear industry – Concrete structures - aircraft and aerospace industries –automotive industries – Fire damaged building - Selection of NDT methods – Codes, standards, specifications and Procedures.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Baldev Raj, Jeyakumar,T., Thavasimuthu,M., “Practical Non Destructive Testing”, Narosa Publishing House, New Delhi, 2014.

REFERENCES

1. Charles J. Hellier, “Hand Book of Non-Destructive Evaluation”, The McGraw-Hill Companies, New York,2012.
2. Prasad J and C.G.K. Nair, “Non-Destructive Test and Evaluation of Materials”, Tata McGraw- Hill Publishing Company Limited, New Delhi,2008.
3. V.M. Malhotra and N.J. Carino, "Handbook On Nondestructive Testing on Concrete", Second Edition, CRC Press, New York,2004.

19CE24E ENGINEERING GEOLOGY

		L T P C
19CE24E	**ENGINEERING GEOLOGY**	**3 0 0 3**

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Illustrate the concepts of geological formations, weathering and plate tectonics which are the reasons of earthquakes.(K2)

CO2: Interpret the physical, mechanical and engineering properties of minerals along with formation of coal and petroleum. (K2)

CO3: Interpret the physical, mechanical and engineering properties of rocks. (K2)

CO4: Outline the importance of geological structures and geological investigations.(K2)

CO5: Explain the importance of geological considerations in civil engineering and also the geological hazards such as earthquakes, landslides and Tsunami. (K2)

UNIT I GENERAL GEOLOGY 9

Geology in Civil Engineering – Branches of geology – Earth Structures and composition – Elementary knowledge on continental drift and plate technologies. Earth processes – Weathering – Work of rivers, wind and sea and their engineering

UNIT II MINERALOGY 9

Elementary knowledge on symmetry elements of important crystallographic systems – physical properties of minerals – study of the following rock forming minerals – Quartz family. Feldspar family, Augite, Hornblende, Biotite, Muscovite, Calcite, Garnet – properties, behavior and engineering significance of clay minerals – Fundamentals of process of formation of ore minerals – Coal and petroleum – Their origin and occurrence in India.

UNITIII PETROLOGY 9

Classification of rocks – distinction between igneous, sedimentary and metamorphic rocks. Description occurrence, engineering properties and distribution of following rocks. Igneous rocks – Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite and Basalt Sedimentary rocks sandstone, Limestone, shale, Conglomerate and Breccia. Metamorphic rocks Quartzite, Marble, Slate, Gniess and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOLOGICAL INVESTIGATIONS 9

Attitude of beds – Outcrops – study of structures – Folds, faults and joints – Their bearing on engineering construction.Introduction to Geological maps-Seismic and Electrical methods for Civil Engineering investigations. Applications for sub-surface investigation and groundwater exploration- Borehole core logging and interpretation- Remote sensing techniques – Interpretation for Civil Engineering projects.

UNITV GEOLOGICAL CONSIDERATIONS IN CIVIL ENGINEERING AND GEOHAZARDS 9

Geological conditions necessary for construction of Bridges, Dams, Reservoirs, Tunnels, Buildings, Road cuttings- Coastal Protetction-Earthquake – Seismic zones of India, Landslides – causes and mitigation. Tsunami – causes and mitigation.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi,2012.
2. Parbin Singh. A Text book of Engineering and General Geology, Katson publishing house, Ludhiana2009.

REFERENCES

1. F.G.Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad, 2011.
2. N. Chenna Kesavulu. Textbook of Engineering Geology, Macmillan India Ltd., 2009
3. Krynine and Judd, "Engineering Geology and Geotechniques", McGraw-Hill Book Company, 1st Edition 2005.

19CE25E ROCK ENGINEERING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Classify the rock based on Index properties (K2)
CO2: Explain the stress strain behavior in rocks (K2)
CO3: Explain the insitu stresses and their measurements in rocks (K2)
CO4: Apply the mechanism of rocks in construction (K3)
CO5: Explain the methods of improvement in rock masses (K2)

UNITI CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 6

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose-Rock mass rating and Q system.

UNITII ROCK STRENGTH AND FAILURE CRITERIA 12

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength. Stress - stain behaviour of rock under compression and deviator loading– Mohr – Coulomb failure criteria and empirical criteria for failure – Deformability of rock.

UNITIII INITIAL STRESSES AND THEIR MEASUREMENTS 10

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses– Measurements of in-situ stresses-hydraulic fracturing-over coring method—flat jack method.

UNIT IV APPLICATION OF ROCK MECHANICSIN ENGINEERING 10

Simple engineering application – Underground openings – Rock slopes –Foundations and mining subsidence.

UNITV ROCK STABILISATION *7*

Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves - Shotcreting.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Goodman, P.E. "Introduction to Rock Mechanics", John Wiley and Sons,1989.
2. Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications,1996.
3. Ramamurthy. T., "Engineering in Rocks for Slopes, Foundation and Tunnels: (3rdEdition), PHI Learning Private Limited, New Delhi, 2014.

4. Brady, B.H.G. and Brown, E.T., Rock mechanics for underground mining (3rd Edition), Kluwer Academic Publishers, Dordrecht, 2006.

REFERENCES

1. Brown, E.T. “Rock Characterization Testing and Monitoring”, Pergaman Press, 1991.
2. Arogyaswamy, R.N.P., Geotechnical Application in Civil Engineering”, Oxford and IBH, 1991.
3. Hook E.and Bray J., Rock slope Engineering, Institute of Mining and Metallurgy”, U.K.2004

19CE26E GROUND IMPROVEMENT TECHNIQUES L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Identify suitable ground improvement techniques based on soil conditions (K3)
CO2: Demonstrate the various dewatering and drainage systems (K2)
CO3: Summarize various insitu treatment of cohesionless and cohesive soils (K2)
CO4: Explain the concept of reinforcement in ground improvement (K2)
CO5: Explain soil stabilization with grouting techniques (K2)

UNIT I INTRODUCTION 9

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils - Selection of suitable ground improvement techniques based on soil condition.

UNIT II DEWATERING 9

Dewatering Techniques - Well points – Vacuum and electro osmotic methods – Seepage analysis for two dimensional flows for fully and partially penetrated slots in homogeneous deposits – Design for simplecases.

UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVES OILS 10

Insitu densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations.

UNIT IV EARTH REINFORCEMENT 9

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism– Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

UNIT V GROUTING TECHNIQUES 8

Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

L: 45; TOTAL: 45 PERIODS

TEXTBOOKS

1. Bikash Chandra chattopadhyay and Joyanta Maity, “Ground Improvement Techniques”, PHI Learning Pvt. Ltd.,2017
2. Purushothama Raj. P, “Ground Improvement Techniques”, Firewall Media, 2005.

REFERENCES

1. Koerner, R.M. “Construction and Geotechnical Methods in Foundation Engineering”,McGraw Hill,1994.
2. Koerner, R.M., “Designing with Geosynthetics”, 4thEdition, Prentice Hall, Jersey,2012.
3. Moseley, M.P., “Ground Improvement Blockie Academic and Professional”, Chapman and Hall, Glasgow,2004
4. Winterkorn, H.F. and Fang, H.Y. “Foundation Engineering Hand Book”. Van Nostrand Reinhold, 1994.

19CE27E INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Explain the vibratory motion of elementary systems (K3)
CO2: Illustrate the propagation of waves in different mediums (K2)
CO3: Explain the dynamic properties of soil (K2)
CO4: Design foundations under dynamic loading (K2)
CO5: Interpret vibration isolation with engineering considerations (K3)

UNITI THEORY OF VIBRATION 9

Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring –mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads.

UNITII WAVE PROPAGATION 9

Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compression wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typicalvalues – Particle movements and velocity.

UNITIII DYNAMIC PROPERTIES OF SOILS 9

Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.

UNITIV FOUNDATION FOR DIFFERENT TYPES OF MACHINES 9

Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.

UNITV INFLUENCE OF VIBRATION AND REMEDIATION 9

Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT- Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt.Ltd. (Second Edition) 2006, (Reprint 2010), NewDelhi-110002
2. Srinivasulu. P, and Vaidyanathan. C.V, "Handbook of Machine Foundations", Tata McGraw-Hill, 2007

REFERENCES

1. KamaswaraRao., "Vibration Analysis and Foundation Dynamics", Wheeler Publishing,New Delhi, 1998.
2. KameswaraRao., "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003.
3. Moore, P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH,2005
4. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall,2014.

19CE28E EARTHQUAKE GEOTECHNICAL ENGINEERING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Identify the causes and mechanism of earthquakes (K2)
CO2: Discuss basic facts of soil behavior under dynamic loading (K2)
CO3: Outline the role of soil deposits in modifying the seismic ground motion (K2)
CO4: Design foundations, slopes and retaining walls using seismic codes (K2)
CO5: Explain the principles of earthquake hazard mitigation measures (K2)

UNIT I ELEMENTS OF EARTHQUAKE SEISMOLOGY AND DYNAMICS 6

Mechanism of Earthquakes - Causes of earthquake - Earthquake Fault sources - Elastic Rebound theory- Seismic wave in Earthquake shaking - Definition of earthquake terms - Locating an earthquake - Quantification of earthquakes.

UNITII GROUNDMOTION CHARACTERISTICS 10

Strong Motion Records -characteristics of ground motion - Factors influencing ground motion - Estimation of frequency content parameters - Seismic site investigations - Evaluation of Dynamic soil properties.

UNIT III GROUND RESPONSE ANALYSIS AND DESIGN GROUND MOTION 10

Wave propagation Analysis - Site Amplification, Ground Response Analysis - Method of analysis - One Dimensional Analysis - Equivalent linear Analysis – shear beam Analysis - site effects - Design Ground Motion - Developing Design Ground Motion. Application of software package - codal recommendations.

UNIT IV SEISMIC STABILITY ANALYSIS 12

Earthquake Resistant Design of foundation of buildings - Design considerations - Geotechnical - Architectural - Structural - Capacity Design - Seismic analysis. Earthquake Response of slopes - Evaluation of slope stability - Pseudostatic Analysis - Newmark's Study of Block Analysis - Dynamic Analysis - Earth pressure due to ground shaking valuation - Lateral Deformation - codal provisions.

UNIT V EARTHQUAKE HAZARD MITIGATION 7

Seismic risk vulnerability and hazard - Risk mapping - scale – changing percept of risk – vulnerability Atlas of India. Hazard assessment - Maintenance and modifications to improve hazard resistance; Seismic microzonation – methodology – scale of mapping - Different type of foundation and its impact on safety.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. KameswaraRao, N.S.V., “Dynamics soil tests and applications”, Wheeler Publishing – New Delhi, 2000.
2. Krammer S.L., “Geotechnical Earthquake Engineering”, Prentice Hall, International series Pearson Education(Singapore) Pvt. Ltd.,2004.

REFERENCES

1. McGuire, R.K., “Seismic Hazard and Risk Analysis”, Earthquake Engineering Research Institute, MNo – 10, ISBN 0-943198-01-1, 2004.
2. Mahanti, N.C., Samal, S.K., Datta, P., Nag N.K., “Disaster Management”, Narosa Publishing House, New Delhi, India ISBN :81-7319-727X-2006

19CE31E REMOTE SENSING TECHNIQUES AND GEOGRAPHIC INFORMATION SYSTEM

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the basic principles of remote sensing and spectral signatures (K2)
CO2: Classify the types of sensors and image interpretation (K2)
CO3: Illustrate the components of GIS (K2)
CO4: Interpret the data entry, storage and analysis (K2)
CO5: Apply the techniques of Remote Sensing and GIS in Civil Engineering field (K3)

UNITI EMR AND ITS INTERACTION WITH ATMOSPHERE 9

Remote Sensing – Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere– Atmospheric Windows and its Significance – EMR interaction with Earth

Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface.

UNITII SENSORS AND DATA INTERPRETATION 9
Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of Remote Sensing - Visual Interpretation of Satellite Images – Digital Image processing – Characteristics of different platforms: Airborne and space borne TIR and microwave sensors, High Resolution Sensors - LIDAR, SAR, MODIS and AMSRE.

UNIT III GEOGRAPHIC INFORMATION SYSTEM 9
GIS - History of Development - Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Data Input Sources– DBMS – Data Output - Data models - Raster and Vector data structures – Data compression – Raster vs Vector comparison.

UNIT IV GIS DATA INPUT, STORAGE AND ANALYSIS 9
Analysis using Raster and Vector data – Operations – Overlaying - Buffering – Modeling in GIS - Digital Terrain Modeling, Analysis and application – Products of DEMs and their uses – Sources of errors in GIS and their elimination.

UNIT V APPLICATIONS OF REMOTE SENSING AND GIS 9
Applications of Remote Sensing and GIS – Advanced applications of GIS – Disaster management, Water resource, Land use – Land cover – Urban planning - Intelligent Transport Systems - Development of Resources Information Systems.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Thomas Lillesand, Ralph W.Kiefer, Jonathan Chipman, “Remote Sensing and Image Interpretation”, January 2015
2. Anji Reddy, M., “Remote Sensing and Geographical Information System”, BS Publications, Hyderabad, 2005.
3. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication, 2004.

REFERENCES

1. Thomas. M. Lillesand and Ralph.W.Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.
2. Lo. C.P. and A.K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall of India Private Limited, New Delhi, Pp: 492., 2002.
3. Peter A.Burrough, Rachael A. McDonnell, “Principles of GIS”, Oxford University Press, 2000.

19CE32E **PAVEMENT ENGINEERING** **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Identify the type of pavement and distribution of stress (K2)
CO2: Design the flexible pavement (K3)
CO3: Design the rigid pavement (K3)
CO4: Apply type of maintenance and evaluation procedure of the pavement (K2)
CO5: Identify different methods for stabilization of pavement (K2)

UNIT I GENERAL PRINCIPLES OF PAVEMENT DESIGN 9

Introduction - Pavement as layered structure - Pavement types – Pavement stability-Stress and deflections in pavements under repeated loading.

UNIT II DESIGN OF FLEXIBLE PAVEMENT 9

Empirical– Semi empirical and theoretical Methods – Design procedure as per latest IRC guidelines - Design and specification of rural road.

UNIT III DESIGN OFRIGID PAVEMENT 9

Cement concrete pavements - Modified Westergard approach - Design procedure as per latest IRC guidelines - Joints in rigid pavements - Concrete roads and their scope in India.

UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 9

Pavement Evaluation [Condition and evaluation surveys] - Structural Evaluation by Deflection Measurements, Present Serviceability Index] – Strengthening of Pavement - Pavement maintenance. [IRC Recommendations Only]

UNIT V STABILISATION OF PAVEMENTS 9

Stabilisation with special reference to highway pavements - Choice of stabilizers -Testing and field control – Stabilisation for rural roads in India - Geosynthetics (geotextiles & Geogrids) in roads.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Khanna, S.K. and Justo C.E.G. and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition, 2014.
2. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna Tech. Publications, New Delhi, 2005.
3. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi,2001

REFERENCES

1. Yoder R.J and Witczak M.W., “Principles of Pavement Design”, John Wiley, 2000.
2. Guidelines for the Design of Flexible Pavements, IRC: 37 - 2012, The Indian roads Congress, New Delhi.
3. Guideline for the Design of Plain jointed Rigid Pavements for Highways, IRC: 58-2002, the Indian Roads Congress, New Delhi.

19CE33E TRAFFIC ENGINEERING AND MANAGEMENT

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO 1: Explain the fundamental characteristics of road, traffic and land use (K2)
CO 2: Apply appropriate techniques of traffic surveys and analysis (K3)
CO 3: Design various methods of traffic control measures (K2)
CO 4: Design elements of traffic intersections (K2)
CO 5: Summarize various methods of traffic management (K2)

UNIT I TRAFFIC CHARACTERISTICS 9

Significance and scope – Road Characteristics – Road user characteristics – PIEV theory– Vehicle– Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India

UNIT II TRAFFIC SURVEYSANDANALYSIS 9

Traffic Survey and analysis – Traffic Volume Survey – Methods and interpretation, Speed and Delays, Origin and Destination– Methods and Presentation, Parking and Pedestrian studies– Methods and interpretation, Accident studies and safety- level of services.

UNIT III TRAFFIC CONTROL 9

Traffic signs and road markings - design of traffic signals and signal co-ordination - traffic control aids and street furniture – Networking pedestrian facilities & cycletracks.

UNITIV GEOMETRIC DESIGN OF INTERSECTIONS 9

Conflicts at intersections - classification of„at grade‟ intersections - channelized intersections - principles of intersection design - elements of intersection design - rotary design - grade separation and interchanges -design principles.

UNITV TRAFFIC MANAGEMENT 9

Traffic management - transportation system management (TSM) - travel demand management (TDM) - traffic forecasting techniques - one way streets-traffic segregation - traffic calming - exclusive bus lanes - Intelligent Transportation System (ITS).

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2014.
2. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2000.
3. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013

REFERENCES

1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management.

2. Guidelines of Ministry of Road Transport and Highways, Government of India.
3. Subhash C.Saxena, A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi, 1989.
4. Transportation Engineering – An Introduction, C.JotinKhisty, B.KentLall, Prentice Hall of India Pvt. Ltd, 2006.

19CE34E RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING L T P C

3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Explain the components of railways, their functions and its geometric design (K2)
CO2: Explain construction and maintenance of railway track (K2)
CO3: Illustrate the concepts of Airport planning and layout (K2)
CO4: Understand the airport design, visual aids, and air traffic control (K2)
CO5: Summarize various components of harbour, its function and layout (K2)

UNIT I RAILWAY PLANNING AND DESIGN 10

Role of Indian Railways in National Development – LRT & MRTS - Engineering Surveys for Track Alignment – Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments) - Permanent Way, its Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps in rails and defects in Rails -Sleepers – Functions, Materials, Ballast – Functions, Materials, Ballastless Tracks - Geometric Design of Railway – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves.

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 9

Design of Turnouts, Working Principle - Track Drainage and ventilation - Track Modernisation - Construction & Maintenance of tracks, Re-laying of Track, Signalling, Interlocking and Track Circuiting - Lay outs of Railway Stations and Yards, Level crossings.

UNIT III AIRPORT PLANNING 8

Role of Air Transport, airport classification, Airport Planning – Objectives, components, typical airport layout – Apron, Terminal Building, Hangars, Motor Vehicle Parking Area and Circulation Pattern, Case studies of Airport Layouts, Site Selection and Airport Drainage.

UNIT IV AIRPORT DESIGN 9

Runway Design- Orientation, Cross wind Component, Wind rose Diagram (Problems), Geometric Design and Corrections for Gradients (Problems), Taxiway Design – Geometric Design Elements, Minimum Separation Distances, Design Speed, Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings - Air Traffic Control.

UNIT V HARBOUR ENGINEERING 9

Natural phenomena of harbour - Requirements and Classification of Harbour – Ports and its classification – Layout of harbour -Site Selection & Selection Investigation – Dry and Wet Docks, Planning and Layouts – Port Buildings, Warehouse, Transit Sheds, Intermodal Transfer Facilities, Mooring Accessories, Navigational Aids-Coastal Structures - Coastal Shipping, Inland Water Transport and Container Transportation.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi,1998.
2. Khanna S K, Arora M G and Jain S S, Airport Planning and Design, NemchandandBrothers, Roorkee, 2012.
3. S P Bindra, A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, 2013.

REFERENCES

1. Rangwala, Railway Engineering, Charotar Publishing House, 2013.
2. Rangwala, Airport Engineering, Charotar Publishing House, 2013.
3. Oza.H.P. and Oza.G.H., “A course in Docks & Harbour Engineering”, Charotar Publishing Co. 2013.
4. J.S. Mundrey, “A course in Railway Track Engineering”. Tata McGraw Hill, 2007.

19CE35E ADVANCED SURVEYING L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Apply total station and EDM in distance measurement and traversing design (K3)
CO2: Explain the photogrammetric surveying and do the photo interpretation (K2)
CO3: Explain the basic concepts of remote sensing(K2)
CO4: Apply GPS in transportation engineering and land use planning (K3)
CO5: Understand the route surveys and tunnel alignments (K2)

UNIT I EDM AND TOTAL STATION 9

Electromagnetic distance measurement (EDM) – Principle of EDM Carrier waves – Types of EDM instruments – Distomat – Total Station – Principle – procedure & surveying using Total Station – precise leveling - Micro-optic theodolite.

UNITII PHOTO GRAMMETRY 9

Photogrammetry – Terrestrial and Aerial Photogrammetry – Horizontal position of a point from photographic measurement – elevation of a point – Determination of focal length of camera - Geometry and scale of vertical photographs – Ground co-ordinates from vertical photographs - Relief displacement – Planimetric mapping from vertical photos – Stereoscopy– Photo interpretation Drone surveying.

UNITIII REMOTE SENSING 9

Remote sensing – concepts – Idealized remote sensing system – characteristics – Types of remote sensing system – Remote sensing from space – Data interpretation – application of remote sensing - LIDAR – RADAR -SONAR.

UNITIV GPS SURVEYING 9

GPS Basics – system overview – working principle of GPS – Satellite ranging –calculating position – Ranging errors and its correction – GPS surveying Methods – static, Rapid static, DGPS and Kinematic methods – Real time and post processing DGPS – visibility diagram – GAGAN – Geofencing.

UNITV MISCELLANEOUS 9

Reconnaissance – Route surveys for highways, railways and waterways – simple, compound, reverse, transition and vertical curve – setting out methods - hydrographic surveying – tides – MSL – Sounding methods – measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Duggal, S.K. Surveying Vol. II, Tata McGraw Hill, 2004.
2. Punmia, B.C. Surveying Vol.III, Standard Publishers, 2005.
3. Arora, K. R. Surveying Vol. III, Standard Book House,1996.

REFERENCES

1. James M.Anderson and Edward M.Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
2. Bannister and S.Raymond, "Surveying", 7thEdition, Longman, 2004.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.

19CE38E ENVIRONMENTALIMPACTASSESSMENT

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

- CO1: Interpret the fundamentals and need for Environmental Impact Assessment (K2)
- CO2: Carry out screening and scoping of developmental projects and to understand different methodologies of EIA (K2)
- CO3: Plan environmental impact assessments and environmental management plans (K2)
- CO4: Assess socioeconomic investigation of the environment in a project (K3)
- CO5: Acquire knowledge to prepare environmental impact assessment reports (K3)

UNIT I INTRODUCTION TO EIA 8

Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types EIA in project cycle –EIA Notification and Legal Framework in India – components of EIA Stakeholders and their Role in EIA

UNIT II ENVIRONMENTAL ASSESSMENT AND METHODOLOGY 10

Screening and Scoping in EIA – Drafting of Terms of Reference -Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - overlay - Analysis of alternatives

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impacts on various environmental matrices - Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Environmental Clearance – preparation and implementation - Post Project Audit

UNIT IV SOCIO ECONOMIC ASSESSMENT 10

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis- Public Consultation

UNIT V CASE STUDIES 8

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Waste Processing and Disposal facilities Mining Projects.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Canter, R.L. Environmental impact Assessment, 2nd Edition, McGraw Hill Inc., New Delhi, 1995
2. Peter Morris, RikiTherivel, “Methods of Environmental Impact Assessment”, Rout ledge Publisher, 2009

REFERENCES

1. Ministry of Environment and Forests, EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010
2. “Environmental Assessment Source book”, Vol. I, II & III, The World Bank, Washington, D.C., 1991.

19CE39E INDUSTRIAL WASTE MANAGEMENT

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Summarize the types, characteristics and effects of industrial waste in environment (K2)
CO2: Outline the concepts of Pollution prevention (K2)
CO3: Explain the various treatment technologies of waste from major industries (K2)
CO4: Discuss options for wastewater reuse & residue management (K2)
CO5: Identify technologies on management of hazardous waste (K3)

UNIT I INTRODUCTION 9

Types of industries and industrial pollution – Industrial scenario in India – Regulatory requirements for treatment of industrial wastewater, industrial waste survey, industrial wastewater generation rates, characterization and variables, population equivalent, Bioassay studies – effects of industrial effluents on streams, land, sewage treatment plants and human health.

UNIT II INDUSTRIAL POLLUTION PREVENTION 9

Prevention Vs Control of industrial pollution – benefits and barriers. Source reduction techniques – waste audit, evaluation of pollution prevention options, environmental statement as a tool for pollution prevention, waste minimization circles.

UNIT III INDUSTRIAL WASTEWATER TREATMENT 9

Equalization – neutralization, oil separation, flotation, precipitation, Aerobic and anaerobic biological treatment – Advanced Chemical oxidation – Electro chemical oxidation, wet air oxidation, ozonation, photocatalysis – Heavy metal removal, Refractory organics separation by adsorption – Individual and common effluent treatment plants – combined treatment of industrial waste water and municipal wastewater**.**

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9

Evaporation – Evaporators types and classification – Zero Liquid discharge systems – Quality requirements for wastewater reuse, industrial reuse, disposal on water and land – Residuals from industrial wastewater treatment units - quantification and characteristics of sludge – thickening, digestion, conditioning, dewatering and disposal of sludge. Management of RO rejects.

UNIT V CASE STUDIES AND HAZARDOUS WASTE MANAGEMENT 9

Industrial manufacturing process description, waste water characteristics, source reduction options and waste treatment flow sheet for textiles, tanneries, pulp and paper, metal finishing, sugar and distilleries. Hazardous wastes - Physico chemical treatment – solidification – incineration – Secure land fills.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. W.W.Eckenfelder Jr., “Industrial Water Pollution Control”, McGraw-Hill Book Company, New Delhi, 2000
2. M.N.Rao & A.K.Dutta, “Wastewater Treatment”, Oxford - IBH Publication, 1995.

REFERENCES

1. T.T.Shen, “Industrial Pollution Prevention”, Springer, 1999.
2. R.L.Stephenson and J.B.Blackburn, Jr., “Industrial Wastewater Systems Hand book”, Lewis Publisher, New York,1998
3. Paul L. Bishop “Pollution Prevention: - Fundamentals and Practice”, McGraw – Hill International, 2000.

19CE40E **ECOLOGICAL ENGINEERING** **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Explain the concept of ecosystem (K2)
CO2: Infer the function of ecosystem and its biochemical reaction (K2)
CO3: Make use of rehabilitation methods for the treatment of ecosystem (K3)
CO4: Outline the effects due to industrialization and its case studies (K2)
CO5: Understand the need for sustainability (K2)

UNIT I PRINCIPLES AND CONCEPTS 9

Scope and applications of Ecological Engineering – Development and evolution of ecosystems – Principles and concepts pertaining to species, populations and community

UNIT II ECOSYSTEM FUNCTIONS 9

Biological magnification, diversity and stability, immature and mature systems - Primary productivity – Biochemical cycling of nitrogen, phosphorous, sulphur and carbon dioxide – Habitat ecology - Terrestrial, fresh water, estuarine and marine habitats.

UNIT III ECOLOGICAL ENGINEERING METHODS 10

Bio monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles – Step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for wastewater, Reuse of treated wastewater through ecological systems – Green building and Bio mimicry.

UNIT IV ECOLOGICAL EFFECTS OF INDUSTRIALISATION 8

Ecological effects of exploration, production, extraction, processing, manufacture & transport.

UNIT V CASE STUDIES AND ENVIRONMENTAL SUSTAINABILITY 9

Case studies of integrated ecological engineering systems – Planning, Measuring Sustainability – Carrying Capacity and its limits – Concept of Ecological Foot print.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Odum, E.P., "Fundamental of Ecology", W.B.Sauders,1990.
2. Kormondy, E.J., "Concepts of Ecology", Prentice Hall, New Delhi,1996

REFERENCES

1. Mitch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley and Sons, 1996.
2. Colinvaux, P., Ecology, John Wiley and Sons, 1996.
3. Etnier, C &Guterstam, B., "Ecological Engineering for Wastewater Treatment", 2nd Edition, Lewis Publications, London, 1996.

19CE41E	ENVIRONMENTAL INSTRUMENTATION	L T P C
		3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Discuss the fundamental blocks of Measurement system (K2)

CO2: Explain the working and list the types of sensor and transducer (K2)

CO3: Explain the causes and effects of water, air and noise pollution on environment (K2)

CO4: Describe the working principle of instruments for quality of water, air and sound monitoring and measurement (K2)

CO5: Select the appropriate instrument for specific application and environmental monitoring and measurement and control (K2)

UNIT I INTRODUCTION 9

Definition: Measurement and Instrumentation, Block diagram of Measurement system – Types of Sensor and Transducer. Necessity of instrumentation & control for environment, sensor requirement for environment.

UNIT II WATER 9

Definitions, causes and effects of water pollution. Standards of raw & treated water, sources of water & their natural quality, effects of water quality. Water quality measurement: Thermal conductivity detectors, Opacity monitors, pH analyzers & their application, conductivity analyzers & their application.

UNIT III GROUND AND WASTEWATER 9

Level measurement in wells, laboratory analysis of ground water samples, instrumentation in ground water monitoring, instrumentation in assessment of soil & ground water pollution. Automatic waste water sampling, optimum waste water sampling locations. Instrumentation set up for waste water treatment plant. Latest methods of waste water treatment plants. Quality assurance of storage water.

UNIT IV AIR 9

Definitions, causes and effects of air pollution, air pollution from thermal power plant. Air sampling methods &equipment's, analytical methods for air pollution studies. Measurement of ambient air quality. Flow monitoring: Air flow measurement, gas flow, non-open channel flow measurement.

UNIT V SOUND 9

Definitions, causes and effects of Noise Pollution and Its Monitoring. Ambient noise, Noise intrusions, impulsive noise, transient noise, airport noise. Sound level meters. Tape recorders, noise dosimeters, sound level monitors and acoustical calibrators. Field equipment's for noise measurement.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Measurement Systems 6th Edition, E.O.Doebelin, Dhanesh N Manik, TMcGH,2011
2. Environmental Instrumentation and Analysis Handbook, Randy D Down, Jay H Lehr, John Wiley & Sons,2005.

3. Instrumentation for Studying Vegetation Canopies for Remote Sensing in Optical and Thermal Infrared Regions, Narendra S. Goel, John M. Norman, Taylor & Francis,1990.

REFERENCES

1. A course manual: Instrumentation in Environmental Engg. NEERI Publications. Nagpur.
2. Handbook of Analytical Instruments, 2ndEdition, R.S. Khandpur, TMcGH, 2007.

19CE45E **HYDROLOGY** **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Understand the Hydrological process and estimate the rainfall (K2)
CO2: Relate the process of precipitation and evaporation and its measurements (K2)
CO3: Understand the concept of hydrographs (K3)
CO4: Explain the measures of flood control and flood routing (K3)
CO5: Apply the concepts of ground water (K3)

UNIT I INTRODUCTION ABOUT PRECIPITATION 10

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation. Weather and hydrology – General circulation Temperature humidity – Wind – Diurnal and monsonic wind systems.

UNIT II ABSTRACTION FROM PRECIPITATION AND EVAPORATION 9

Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of infiltration – Infiltration indices – Effective rainfall - Infiltration factors affecting evaporation – Measurement of evaporation.

UNIT III HYDROGRAPHS 8

Factors affecting Hydrograph – Base flow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations - Synthetic Unit Hydrograph.

UNIT IV FLOODS AND FLOOD ROUTING 9

Flood frequency studies – Recurrence interval – Gumbel"s method – Flood routing– Reservoir flood routing – Muskingum"s Channel Routing–Floodcontrol–Storm

UNIT V GROUNDWATER HYDROLOGY 9

Origin- Classification and types - properties of aquifers- governing equations –- Recuperation test – Transmissibility – Specific capacity – Pumping test- Steady flow analysis only- artificial recharge.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Subramanya, K., “Engineering Hydrology”, Tata McGraw-Hill Publishing Company, Limited,2000
2. JayaramyReddy.P., “Hydrology”, Tata McGraw-Hill Publications Private Limited, New Delhi, 2003.

REFERENCES

1. Chow, V.T. and Maidment, “Hydrology for Engineers”, McGraw-Hill Inc., Limited,2000
2. Singh, V.P., “Hydrology”, McGraw-Hill Inc., Limited,2000.
3. Santosh Kumar Garg, “Hydrology and Water Resources Engineering”, Khanna Publications Private Limited, New Delhi,2009.

19CE46E	**GROUNDWATER ENGINEERING**	**L T P C**
		3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Classify the various modes of ground water distribution (K2)
CO2: Interpret hydraulics of flow in ground water (K2)
CO3: Estimate the ground water parameter (K3)
CO4: Summarize the various ground water development techniques.(K2)
CO5: Describe various water quality parameters. (K2)

UNIT I FUNDAMENTALS OF GROUND WATER 10

Introduction – Characteristic of Ground water – Distribution of water - ground water column – Permeability - Darcy's Law - Types of aquifers - Hydro geological Cycle – water level fluctuations.

UNIT II HYDRAULICSOF FLOW 9

Storage coefficient - Specific field - Heterogeneity and Anisotropy -Transmissivity - Governing equations of ground water flow - Steady state flow – DupuitForchheimer assumptions - Velocity potential - Flow nets.

UNIT III WELL HYDRAULICS 8

Transmissivity and Storativity – Pumping test - Unsteady state flow - Thiess method - Jacob method - Image well theory – Effect of partial penetrations of wells - Collectors wells.

UNIT IV GROUNDWATER DEVELOPMENT 9

Zoning of water – over exploited, critical, semi critical and safe-Infiltration gallery - Conjunctive use - Artificial recharge Rainwater harvesting - Safe yield - Yield test – Geophysical methods – Selection of pumps.

UNIT V GROUNDWATER QUALITY 9

Ground water chemistry - Origin, movement and quality - Water quality standards - Saltwater intrusion – Environmental concern.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Raghunath H.M., “Ground Water Hydrology”, Wiley Eastern Limited,2000.
2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons,2000.

REFERENCES

1. C Walton, “Ground Water Resource Evaluation”, McGraw-Hill Publications,1998.
2. William C.Walton, “Ground water Engineering”, Lewis Publisher,1991.

19CE47E COASTAL ZONE MANAGEMENT

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Learn various coastal processes and marine ecosystem. (K2)
CO2: Interpret the coastal resources (K2)
CO3: Explain various terms involved in wave dynamics and methods of wave forecasting (K2)
CO4: Summarize effect of tides on structure (K2)
CO5: Understand the coastal regulations, its laws and policies (K2)

UNIT I COASTAL ZONE AND ECOSYSTEM 9

Coastal zone – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Marine ecosystem: Mangroves – Sea grass – seaweeds – coral reef – Large marine ecosystem – Climate effects on living marine resources – Biological monitoring of marine ecosystem – Human impacts on marine ecosystem.

UNIT II COASTAL RESOURCES 8

Types and functions of coastal and marine resources – Renewable and Non-Renewable resources – living marine resources and Non-living marine resources – Marine minerals – placer deposits – hydrocarbon deposits – polymetallicnodules.

UNIT III WAVE DYNAMICS AND FORECASTING 10

Wave classification – Airy’s Linear Wave theory – Deep water waves – Shallow water waves– Wave pressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles. Need for forecasting – SMB and PNJ methods of wave forecasting – Classification of tides – Darwin’s equilibrium theory of tides – Effects on structures – Seiches – Surges and Tsunamis.

UNIT IV COASTAL PROCESSES 9

Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers – Sea water intrusion – Impact of sewage disposal in seas.

UNIT V COASTAL REGULATIONS 9

Introduction – What is ICM – Developing an ICM framework – Principles – Goals – defining boundaries – Coastal regulations for main land India – coastal regulations for Islands – introduction to Environmental Laws and policies.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Richard Sylvester, "Coastal Engineering, Volume I and II",Elseiner Scientific Publishing Co.,1999
2. Quinn, A.D., "Design & Construction of Ports and Marine Structures", McGraw-Hill Book Co.,1999

REFERENCES

1. Ed. A.T. Ippen, "Coastline Hydrodynamics", McGraw-Hill Inc., New York,1993
2. Dwivedi, S.N., Natarajan, R and Ramachandran, S., "Coastal Zone Management in Tamilnadu".

19CE48E WATER RESOURCES ENGINEERING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Outline the water resource planning and water policy (K3)
CO2: Generalize the station network design (K3)
CO3: Infer on water resource needs (K3)
CO4: Discuss on reservoir planning and management (K3)
CO5: Explain about economic analysis (K3)

UNIT I GENERAL 9

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Economics of water resources planning, physical and socio economicdata – National Water Policy – Collection of meteorological and hydrological data for water resources development.

UNIT II NETWORK DESIGN 9

Hydrologic measurements – Analysis of hydrologic data – Hydrologic station network – Station network design – Statistical techniques in network design.

UNIT III WATER RESOURCE NEEDS 9

Consumptive and non-consumptive water use – Estimation of water requirements for irrigation, for drinking and navigation – Water characteristics and quality – Scope and aims of master plan – Concept of basin as a unit for development – Water budget and development plan.

UNIT IV RESERVOIR PLANNING AND MANAGEMENT 9

Reservoir – Single and multipurpose – Multi objective – Fixation of Storage capacity – Strategies for reservoir operation – Sedimentation of reservoirs – Design flood-levees and flood walls – Channel improvement.

UNIT V ECONOMIC ANALYSIS 9

Estimation of cost and Evaluation of Benefits – Discount rate – Discounting factors – Discounting techniques – Computer Applications.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Linsley.R.K. and Franzini.J.B, "Water Resources Engineering", McGraw-Hill Inc,2000.
2. Douglas J.L. and Lee R.R., "Economics of Water Resources Planning", Tata McGraw-Hill Inc. 2000.
3. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers,1998.

REFERENCES

1. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi,1997.
2. Goodman Alvin S., "Principles of Water Resources Planning", Prentice-Hall,1984.

19CE49E IRRIGATION ENGINEERING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

CO1: Compute the water requirement of crops based on soil conditions. (K2)
CO2: Illustrate on different types of irrigation systems and their performances.(K2)
CO3: Demonstrate the behavior of various irrigation structures and their design Principles. (K2)
CO4: Analyze the concept of seepage through appropriate theories. (K2)
CO5: Evaluate the purpose and function of different types of dams. (K2)

UNIT I CROP WATER REQUIREMENT 9

Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop Seasons – consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies –Planning and Development of irrigation projects – Water quality standards for Irrigation.

UNIT II IRRIGATION METHODS AND WATER MANAGEMENT 9

Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits – Sprinkler irrigation – Drip irrigation – Optimum use of water – Need for optimization of water use – Methods for improving canal irrigation management – Water losses – On farm development works

UNIT III CANAL IRRIGATION 9

Alignment of canals – Classification of canals – Canal falls – Types – Design of vertical drop – Cross drainage works – Types – Canal Head works – Canal regulators – River

Training works.

UNIT IV WEIRS AND TANKS 9

Weirs and Barrage – Classification of weirs – Layout of a diversion head work – component parts – Failure of weirs founded on impervious foundation – Bligh's creep theory – Khosla's theory – Tanks – Isolated tanks and tanks in series – Tank weirs – Types of tank weirs – Tank sluices.

UNIT V DAMS 9

Dams – Types of dams – Problems in dam construction – Factors governing the selection of particular type of dam – Selection of dam site – Gravity dam – Typical cross section – Forces acting on gravity dam – Earth dam – Types of Earth dam – Causes of failure – Arch dam –Types – Forces acting on arch dam – Spillways–Types.

L: 45; TOTAL: 45PERIODS

TEXT BOOKS

1. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, 2000.
2. Punima B.C. &PandeB.B.Lal, "Irrigation and Water Power Engineering", Laxmi Publishing, New Delhi,2009.
3. Santosh Kumar Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publications Private Limited, New Delhi, 2009.

REFERENCES

1. Dilip Kumar Majumdar, "Irrigation Water Management (Principles & Practices)", Prentice Hall of India Private Limited, 2008.
2. Basak.N.N, "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 1999.
3. Sharma R.K, "Irrigation Engineering", S.Chand & Co, 2007.

19CE52E HOUSING PLANNING AND MANAGEMENT L T P C

3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Outline the basics involved in housing planning (K2)
CO2: Explain the various programs involved in housing (K2)
CO3: Design a housing project (K2)
CO4: Summarize the construction techniques and cost effective materials (K2)
CO5: understand the housing finance and project appraisal (K2)

UNIT I INTRODUCTION TO HOUSING 9

Definition of Basic terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and

Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES 9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST- EFFECTIVE MATERIALS 9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd.,New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

REFERENCES

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.
3. National Housing Policy, 1994, Government of India.

19CE53E ARCHITECTURE AND TOWN PLANNING

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Infer the basic concepts of architecture (K2)
CO2: Make use of the rules and layout regulations for site (K3)
CO3: Make use of the rules and regulations for various types of building (K3)
CO4: Plan & Orient buildings by considering Indian climatic and environmental condition (K3)
CO5: Explain the concepts and process of town planning (K2)

UNIT I ARCHITECTURAL DESIGN 8

Architectural Design – an analysis – integration of function and aesthetics – Introduction to basic elements and principles of design.

UNIT II SITE PLANNING 9

Surveys – Site analysis – Development Control – Layout regulations- Layout design concepts.

UNIT III BUILDING TYPES 12

Residential, institutional, commercial and Industrial – Application of anthropometry and space standards-Inter relationships of functions – Safety standards – Building rules and regulations – Integration of building services – Interior design.

UNIT IV CLIMATE AND ENVIRONMENTAL RESPONSIVE DESIGN 8

Man and environment interaction - Factors that determine climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls – Green building concept

UNIT V TOWN PLANNING 8

Planning – Definition, concepts and processes - Urban planning standards and zoning regulations - Urban renewal – Conservation – Principles of Landscape design.

L :45; TOTAL : 45 PERIODS

TEXT BOOKS

1. Francis D.K. Ching, “Architecture: Form, Space and Order”, 4th Edition, Wiley, 2014
2. Givoni B., “Man Climate and Architecture”, Applied Science, Barking ESSEX, 1982.
3. Edward D.Mills, “Planning and Architects Handbook”, Butterworth London, 1995.

REFERENCES

1. Gallian B.Arthur and Simon Eisner, “The Urban Pattern – City Planning and Design”, CBS Publication, New Delhi, 2003.
2. Margaret Robert, “An Introduction to Town Planning Techniques”, Hutchinso London, 1990.

19CE54E TOTAL QUALITY MANAGEMENT

L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Recognize the need for total quality management and areas of application of this Management concept (K2)
CO2: Predict the need for customer expectations and employee involvement. (K2)
CO3: Estimate six – sigma and perform benchmarking. (K3)
CO4: Devise methods to use Quality FuctionDevolpment (QFD), failure Mode Effect Analysis (FMEA) and Taguchi‟s loss functions. (K2)

CO5: Describe ISO 9000 and Environmental Management System (EMS) standards. (K2)

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM –- Contributions of Deming, Juran and Crosby – Cost of Quality, Analysis Techniques for Quality Costs - Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, - Business Excellence Model-Rajiv Gandhi National Quality Award

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking– Reason to bench mark, Bench marking process – FMEA – Stages, Types

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing - QS9000 – ISO14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, 3rd Edition, Indian Reprint 2010.
2. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western Thomson Learning, 2005.

REFERENCE

1. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.

19CE55E ENGINEERING ECONOMICS AND COST ANALYSIS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explain the basics of economics (K2)
CO2: Compare Demand and Schedule (K2)
CO3: Explain the basic terms in organization (K2)
CO4: Explain the basic terms in Financing (K2)
CO5: Explain the basic terms in Analysis of cost (K3)

UNIT I BASIC ECONOMICS 9

Definition of economics - Nature and scope of economic science - Nature and scope of managerial economics - Basic terms and concepts - Goods - Economies of large and small scale - Consumption -Wants characteristics and classification - Law of diminishing marginal utility - relation between economic decision and technical decision.

UNIT II DEMAND AND SCHEDULE 9

Demand - Demand schedule - Demand curve - Law of demand - Elasticity of demand - Types of elasticity - Factors determining elasticity - Measurement - Its significance - Supply - Supply schedule - Supply curve - Law of supply - Elasticity of supply - Time element in the determination of value - Market price and normal price - Perfect competition - Monopoly - Monopolistic competition.

UNIT III ORGANISATION 9

Forms of business - Proprietorship - Partnership - Joint stock company - Cooperative organisation - State enterprise - Mixed economy - Money and banking - Banking - Kinds - Commercial banks -Central banking functions - Control of credit - Monetary policy - Credit instrument.

UNIT IV FINANCING 9

Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds -External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement.

UNIT V COST AND BREAK EVEN ANALYSES 7

Types of costing – Traditional costing approach - Activity base costing - Fixed Cost – Variable cost – Marginal cost – Cost Output Relationship In The Short Run And In Long Run – Pricing Practice – Full Cost Pricing – Marginal Cost Pricing – Going Rate Pricing – Bid Pricing – Pricing For A Rate Of Return – Appraising Project Profitability – Internal Rate Of Return – Pay Back Period – Net Present Value – Cost Benefit Analysis – Feasibility Reports – Appraisal Process – Technical Feasibility Economic Feasibility – Financial Feasibility. Break Even Analysis - Basic Assumptions – Break Even Chart – Managerial Uses of Break Even Analysis.

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Dewett K.K. &Varma J.D., Elementary Economic Theory, S Chand & Co., 2006
2. Sharma JC, "Construction Management and Accounts", Satya Prakashan, New Delhi.

REFERENCES

1. Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age
2. Jhingan, M.L., "Micro Economic Theory", Konark Pvt.Ltd.
3. Khan, M.Y. and Jain, P.K., "Financial Management", McGraw-Hill Publishing Co., Ltd.

19CE56E	**INTELLECTUAL PROPERTY RIGHTS**	**L T P C**
		3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Create awareness on intellectual property rights (IPR). (K2)
CO2: Explain patents and copyrights. (K2)
CO3: Explain application procedures of IPR. (K2)
CO4: Explain the legislations and policy of IPR. (K2)
CO5: Understand the case studies on IPR (K2)

UNIT I TYPES OF PROPERTY 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property (ii.) Immovable Propertyand (iii.) Intellectual Property.

UNIT II PATENTS AND APPLICATION PROCEDURES 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark Registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III INTERNATIONAL PRACTICES 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV LEGISLATIONS AND POLICY 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trademarks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

L: 45; TOTAL: 45 PERIODS

TEXT BOOK

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice", S.Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1974.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.

19CE57E MANAGEMENT OF IRRIGATION SYSTEMS

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Generalise on suitable irrigation system requirements (K2)
CO2: Explain on irrigation scheduling (K2)
CO3: Summarise on irrigation management system (K2)
CO4: Review the operation of irrigation management (K2)
CO5: Infer the involvement of stake holders in irrigation management systems (K2)

UNIT I IRRIGATION SYSTEM REQUIREMENTS 9

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

UNIT II IRRIGATION SCHEDULING 9

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation.

UNIT III MANAGEMENT 9

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

UNIT IV OPERATION 9

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study.

UNIT V INVOLVEMENT OF STAKE HOLDERS 9

Farmer's participation in System operation – Water users associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management.

L 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Dilip Kumar Majumdar, "Irrigation Water Management – Principles and Practice", Prentice Hall of India Pvt. Ltd., New Delhi,2014
2. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al.,Water Management Division Department of Agriculture, Ministry of Agriculture, New Delhi

REFERENCES

1. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project, Technical report No.33, CWC, New Delhi, 1990
2. Maloney, C. and Raju, K.V., "Managing Irrigation Together", Practice and Policy in India, Stage Publication, New Delhi, India, 1994.

19CE58E PRODUCT DEVELOPMENT LABORATORY

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)

CO2: verify the functionality of the concept through prototyping (K4)

UNIT I NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION 20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

UNIT II PROTOTYPING AND DEMONSTRATION 25

Prototype development and demonstration - cost estimation - product documentation

L: 15; P: 30; TOTAL: 45 PERIODS

REFERENCES

1. Michael G Luchs, Scott Swan, Abbie Griffin, "Design Thinking: New Product Development Essentials from the PDMA", Willey, 2015
2. Christian Muller-Roterberg, "Design Thinking", Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development", Tata Mc Graw Hill Education, 4th Edition, 2011.
4. George E Dieter, Linda C Schmidt, "Engineering Design", Mc-Graw Hill International Edition, 5th Edition, 2013.
5. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Education, 2013

Mentor Activities

- Forming multidisciplinary/interdisciplinary batches among the students
- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students' activities through demonstration and presentations

End semester Assessments can be made through

- Product demonstration and presentation

Other points

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four
- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

19CE61E REMOTE SENSING AND GIS FOR ENGINEERING APPLICATIONS

L T P C
3 0 0 3

COURSEOUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: characterize electromagnetic radiation and its interaction with earth features (K2)
CO2: classify platforms and sensors (K2)
CO3: conceptualize the processes in digital image formation and interpretation. (K2)
CO4: understand the cartographic principles of Map preparation. (K2)
CO5: understand GIS components, standards and data formats. (K2)

UNIT I PRINCIPLES OF REMOTE SENSING 9

EMR-wave theory- particle theory-Radiation principles-plank, Stefan,Boltzman, Kirchoff, Wein's law- spectrum for remote sensing-EMR interaction with atmosphere –Rayleigh, mie, non-selective scattering, absorption, refraction-atmospheric windows-EMR interaction with earth's surface-reflection, transmission -spectral signature vegetation, water, soil- Factors affecting spectral reflectance of vegetation, soil and water body-Active & Passive remote sensing- Multispectral & hyperspectral remote sensing - Case study –wavelength identification for applications

UNIT II PLATFORMS & SENSOR 9

Spaceborne platforms-Airborne platforms –UAV-Principle of photography- camera, sensor-types - Optics-Lenses, mirrors, prisms-Radiative transfer function -sensitivity, aperture, shutter speed-filters- Detectors-noise-types Sensitivity, time, and frequency response - hybrid photo detectors - Imaging detectors - CCD –CMOS-TIR- RADAR-SAR-LIDAR-High resolution sensors-S/N Ratio-Case study-sensor selection

UNIT III DIGITAL IMAGE PROCESSING 9

Digital Image fundamentals -processing system- data products-formats-sensor model -spectral & spatial response-IFOV,GIFOV,GSI-sampling & quantization - Resolution, Image representation -geometry, radiometry and color concepts-image degradation-atmospheric, radiometric, geometric correction-image restoration-interpolation & resampling - filters-image segmentation-elements of interpretation-image histogramscattergram - statistics-elements of interpretation – segmentation - classification: supervised, unsupervised-accuracy assessment-case study-steps involved in a satellite image processing

UNIT IV DIGITAL CARTOGRAPHY 9

Definition of Cartography - Maps - functions - uses – Types of Maps – Map Scales and Contents – Map projections – shape, distance, area, and direction properties – perspective and mathematical projections – UTM and UPS references -Indian maps and projections – Map co-ordinate systems- element of map-Map Reproduction-Map Generalization-geometric & coordinate transformations-bilinear and affine transformation - case study-length and area calculation

UNIT V GIS 9

Introduction-components: hardware, software, data, people, method-data quality-aspects and assessment-metadata-GIS standards-OGC-interoperability-assessment - types of data: raster data models -GRID-vector data models-topology-GPS data integration-rasterization-vectorization-TIN-attribute data-levels of measurement-spatial join –non spatial join-attribute data link-terrain representation-DEM, DSM, DTM-case study-2D, 3D map representation-choropleth-isopleth

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Richards, Remote sensing digital Image Analysis-An Introduction Springer - Verlag 1993.
2. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.
3. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice Hall of India Publishers, 2006
4. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.

REFERENCES

1. Arthur, H. Robinson, Elements of Cartography, Seventh Edition, John Wiley, and Sons, 2004.
2. John Campbell, "introductory Cartography", WC. Brown Publishers, 3rd Edition, 2004

19CE62E UAV PHOTOGRAMMETRY L T P C
4 0 0 4

COURSEOUTCOMES

Upon Successful completion of this course, the students will be able to

CO1 :identify the components of UAV (K2)
CO2: understand the photogrammetric concepts involved in UAV (K2)
CO3: classify the payloads and its applications (K2)
CO4: conceptualize the data processing involved in Preparation of data products (K2)
CO5: identify some application of UAV through case studies (K2)

UNITI INTRODUCTION TO UAV 12

Introduction-components-History of UAV – Classification - Parts and functions of Fixed, Rotorcraft and flapping wing UAV-types of drones-Launching methods – navigation-guidance-types-telemetry-communication systems-ground control stations

UNIT II PHOTOGRAMMETRIC CONCEPT 12

Photogrammetry-Definition-application- Types of photographs – Types of projections--photogrammetric sensors -Vertical photographs: perspective geometry - scale –flying height-ground coordinates- relief displacement-Tilted photograph-scale-flying height-ground coordinates- relief displacement –tilt displacement-stereoscopic vision-conditions for good stereo vision-depth perception-stereoscope-parallax-geometry of vertical photo-sources of errors in parallax equation-base lining-Flight planning – computation

UNIT III PAYLOADS FOR UAV 12

Payloads – Classification of Payloads – camera – sensors – radars – various measuring devices – classification of payload based on applications – Hyper spectral sensors – LiDAR – SAR – thermal cameras – ultra sonic detectors – case study

UNIT IV DATA PROCESSING 12

Interior Orientation – Exterior Orientation – Aerial Triangulation – Block Adjustment – DEM – DSM – DTM –3D Model –slope- Contour and Ortho photo Generation

UNITV APPLICATION AND CASE STUDIES 12

UAVs in Topographical Survey – Mine Surveying – Project Progress Monitoring – 3D Modelling of Monuments and Historical Sites – Agriculture

L: 60; TOTAL: 60 PERIODS

TEXT BOOKS

1. Rampal, K. K., 1982, Textbook of photogrammetry, Oxford & IBH: New Delhi.
2. Slama, C. C. (Editor-in-Chief), 1980, Manual of Photogrammetry, American Society of Photogrammetry, 4 th ed., Bethesda, MD.
3. Moffit, F. H., 1959, Photogrammetry, International Textbook company: Scranton.
4. Wolf, P. R. and Dewitt, 2000, Elements of Photogrammetry with applications in GIS, McGraw Hill: Boston.

REFERENCES

1. Tiwari, R. S. and Badjatia, R. C., 1985, Elements of Photogrammetry and Remote Sensing, QIP short term course, Department of Civil Engineering, University of Roorkee, June 23- July 6, 1995.
2. Sadasivam, S, 1988, Photogrammetry, Volume I, Lecture notes for Summer School on Photogrammetry for Transportation Engineers, Department of Civil Engineering, College of Engineering, Anna University, Madras, May 4 - 17, 1988.
3. Atkinson, K. B., 1996, Close range photogrammetry and machine vision, Whittles publishing, Caithness, Scotland, U.K.
4. Mikhail, E. M. and Bethel, J. S., 2001, Introduction to modern photogrammetry, John Wiley & Sons, Inc.

5. Wolf, P.R. and Ghilani, C.D., 2002, Elementary surveying, an introduction to geomatics, X edition, Prentice Hall: New Jersey.
6. Heipke, C., Digital Photogrammetric Workstations - A review of the state-of-the-art for topographic applications (downloaded in 2003).
7. Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010.
8. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
9. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007
10. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998

19CE63E TOTAL STATION AND GPS SURVEYING L T P C

4 0 0 4

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: understand the fundamentals of Total Station and GPS (K2)
CO2: characterize EDM and know the principles of EDM (K2)
CO3: know the components, types of Total station and methods of measurements (K2)
CO4: know the components, types of GPS and methods of measurements (K2)
CO5: determine the GPS observables, formats and data processing methods (K2)

UNIT I FUNDAMENTALS OF TOTAL STATION AND GPS 12

Introduction to Total Station, Historical Development, Classifications, Engineering applications – Introduction to GNSS - Historical perspective and development – classifications-Engineering applications - advantages over conventional surveying instruments - Datum- Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler’s Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept in IRNSS-GAGAN-GLONASS-GALILEO

UNIT II ELECTROMAGNETIC DISTANCE MEASUREMENT 12

Classification of EMR – EMR Propagation through atmosphere - working principle of EDM- wave propagation through atmosphere- Refractive index (RI) - Computation of group RI for light & near infrared waves at standard and ambient conditions-Computation of RI for microwaves - factors affecting RI – errors – velocity correction - first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -– geometric correction- Total atmospheric correction

UNIT III TOTAL STATION 12

EDM-principles- Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments -Total station- parts-features- Types- measurement modes-Field techniques: Point location, slope reduction, missing line measurement-resection-azimuth calculation, remote distance & elevation measurement-offset measurements-layout or setting out operation- area & volume measurement-tracking – stake out- field equipment's: reflector prism & targets-Care and maintenance of instruments- Modern positioning systems – Traversing and Trilateration – Methods of Measuring Distance, Area and volume -Flowchart of data collection- COGO functions, offsets and stake out-land survey applications- latest technologies- automatic target recognition

UNIT IV SATELLITE SYSTEM 12

Different segments - space, control, and user segments – Anti Spoofing and Selective Availability – Measurement &Positioning with GPS- Task of control segment - GPS receivers - types-components- Study of Handheld GPS, Geodetic GPS, Static and semi kinematics survey

UNIT V GPS DATA PROCESSING 12

GPS observables - Orbit determination and representation -GPS signal structure - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data -data processing – software modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi-Kinematic and pure Kinematic methods -basic constellation of satellite geometry & accuracy measures - applications- long baseline processing-use of different software's available in the market.

L: 60; TOTAL: 60 PERIODS

TEXT BOOKS

1. Duggal,Rueger, J.M. "Electronic Distance Measurement", Springer-Verlag, Berlin, 1990.
2. Satheesh Gopi, rasathishkumar, madhu N., "Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007

REFERENCES

1. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.
2. Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2003.
3. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.
4. Seeber G, "Satellite Geodesy", Walter De Gruyter, Berlin, 1998

19CE64E TERRESTRIAL, MOBILE, AND AERIAL LIDAR L T P C
3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: conceptualize LIDAR and classify LIDAR. (K2)
CO2: understand the working principles of TLS and BLS. (K2)
CO3: understand the working principles of MLS & ALS. (K2)
CO4: identify the processes involved in data acquisition and data processing. (K2)
CO5: identify some application of LIDAR through case studies. (K2)

UNIT I INTRODUCTION TO LIDAR 9

Introduction - History – Principle & properties of LiDAR – Wavelength –components - Types–Ranging principle- pulse laser and continuous wave laser – First return & second return – Ellipsoidal & Geoidal height- Difference between LiDAR & Photogrammetry – altimetry – LiDAR Platforms: Terrestrial, airborne & spaceborne-LASER classification: class I-VI – eye safety

UNIT II TERRESTRIAL LIDAR 9

Terrestrial Laser scanners (TLS) – introduction- working principle-static TLS- dynamic TLS-vehicle mounted TLS-Commercial TLS specifications-Components of Terrestrial LiDAR System – TLS Indoor Scanning Method – TLS Outdoor Scanning Method – Bathymetric Laser Scanners (BLS) -working principle of BLS-depth of penetration of BLS-Technical Specifications of market available various TLS and BLS- Applications of TLS & BLS

UNIT III MOBILE LIDAR & AERIAL LIDAR 9

Components of Mobile LiDAR – Mobile LiDAR Scanning Method – Airborne Topographic Laser Scanner (ALS) -–parameters of ALS - Components of ALS - GPS, IMU, laser scanner, imaging device, hardware & software -Technical Specifications of market available various MLS and ALS – Data formats

UNIT IV LIDAR DATA ACQUISITION & PROCESSING 9

Scanning Mechanisms - synchronization of GPS, IMU, laser scanner - data-reflectivity of terrain objects- Flight planning - determination of various data acquisition parameters – Pre-Processing - Area covered - swath width-point density- strips-point spacing - Data Transfer – determination of flight trajectory– Post Processing – geo location of laser foot prints – coordinate transformation – filtering – ground point filtering - Classification – Generation of General Outputs (Topographical Map, DEM, DSM, DTM, Contour)

UNIT V APPLICATION AND CASE STUDIES 9

Post processing software's - TLS Applications – 3D Documentation of Monuments; MLS Applications – Land Plan Survey; ALS Applications – Irrigation Applications; Infrastructure Applications: Corridor mapping applications, 3D city model; Forestry Applications -Application of BLS

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jie Shan and Charles K. Toth, Topographic Laser Ranging and Scanning – Principles and Processing,Second Edition, CRC Press, Taylor, and Francis Group, 2018
2. Pinliang Dong, Qi Chen, LiDAR Remote Sensing and Applications, 1st Edition, CRC Press 2018
3. George Vosselman and Hans-Gerd Maas, Airborne and Terrestrial Laser Scanning, Whittles Publishing, 2010.
4. Michael Renslow, Manual of Airborne Topographic LiDAR, The American Society for Photogrammetry and Remote Sensing, 2013.

REFERENCES

1. Matti Maltamo, Erik Naesset, Jari Vauhkonen, Forestry Applications of Airborne Laser Scanning-Concepts and Case Studies, Springer, Dordrecht, 2016, Reprint Edition. ISBN 97894-017-8662-1
2. Zhilin Li, Qing Zhu, Chris Gold, Digital terrain modeling: principles and methodology, CRC Press, 2005
3. Roger Read and Ron Graham, Manual of Aerial Survey: Primary Data Acquisition, Whittles Publishing, 2002.

19CE65E UAV PHOTOGRAMMETRY LABORATORY

L	T	P	C
1	0	2	2

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: understand the GIS environment and methods for preparation of map, layout & drawings. (K2)

CO2: summarize the UAV instruments and methods of survey. (K2)

CO3: construct 3D outputs and finished products. (K2)

LIST OFEXPERIMENTS

1. Spatial data: Raster & Vector Data Formats with File Extensions
2. Spatial Data Input:
   - Spatial data download: Raster & Vector data
   - Scanning
   - On-Screen Digitization, Creation of Point, Line, Polygon
   - Editing, Topology Creation, length, and Area Measurements,
3. Non spatial data Input: Data Attribution
4. Error Identification – Error estimation, Sources, Correction
5. Ground Control Network Establishment
6. Flight Planning
7. UAV Data Acquisition
8. Data Processing
9. Output Generation
   - Topographical Map
   - Orthophoto
   - DEM, DSM, DTM
   - Contour
   - 3D Model

L: 15; P: 30; TOTAL: 45 PERIODS

TEXTBOOKS

1. Zhilin Li, Qing Zhu, Chris Gold, Digital terrain modeling: principles and methodology, CRC Press, 2005
2. Roger Read and Ron Graham, Manual of Aerial Survey: Primary Data Acquisition, Whittles Publishing, 2002.

3. Felipe Gonzalez Toro, Antonios Tsourdos, UAV or Drones for Remote Sensing Applications, Sensors, MDPI
4. David R. Green, Billy J. Gregory, Alex R. Karachok Unmanned Aerial Remote Sensing: UAS for Environmental Applications, Taylor & Francis CRC press 2020

REFERENCES

1. Rampal, K. K., 1982, Textbook of photogrammetry, Oxford & IBH: New Delhi.
2. Slama, C. C. (Editor-in-Chief), 1980, Manual of Photogrammetry, American Society of Photogrammetry, 4th ed., Bethesda, MD.
3. Moffit, F. H., 1959, Photogrammetry, International Textbook company: Scranton.
4. Wolf, P. R. and Dewitt, 2000, Elements of Photogrammetry with applications in GIS, McGraw Hill: Boston.

19CE66E TOTAL STATION AND GPS SURVEYING LABORATORY L T P C

1 0 2 2

COURSEOUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: work with Total Station and GPS instruments for measurement and mapping. (K2)
CO2: use Total Station and GPS for alignment and setting out works. (K2)
CO3: process the data from Total Station and GPS. (K2)
CO4: prepare outputs and finished products. (K2)

LIST OFEXPERIMENTS

1. Tripod setting – bubble setting – tilt setting
2. Create job/file, station, back sight, fore sight, pole handling
3. Measuring and storing points – Length, Area & Volume Measurement
4. Check measurement conventional method - Length, area & volume calculation
5. Change point shift by foresight method
6. Change point shift by resection,
7. Remote distance &Elevation Method & Missing Line Method
8. Layout & setting out: Using coordinates method, using distance and angle method, points at equal length & column marking
9. Distance, angle, and Coordinate Measurement
10. slope reduction,
11. azimuth calculation,
12. offset measurements-
13. Traversing
14. Trilateration
15. Level shifting
16. GPS connections and settings and Operation
17. Differential Positioning: Base, Rover
18. Precise Positioning, RTK, PPK and static methods

19. Setting out, COGO
20. GPS Traversing
21. Data download
22. Data Processing
23. Converting data into dwg, shape and other interoperable format
24. Preparation of maps in GIS

L: 15; P: 30; TOTAL: 45 PERIODS

TEXTBOOKS

1. Rueger, J.M. "Electronic Distance Measurement", Springer-Verlag, Berlin, 1990.
2. Satheesh Gopi, ra Sathish kumar, madhu N., “Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007

REFERENCES

1. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.
2. Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Berlin, 2003.
3. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.
4. Seeber G, "Satellite Geodesy", Walter De Gruyter, Berlin, 1998.

19ID01E	**PRODUCT DESIGN AND DEVELOPMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: analyze various global trends and identify the scope of a new product (K4)
CO2: perform requirement analysis and convert the requirements into design specification (K4)
CO3: translate conceptual idea into detailed design (K6)
CO4: create prototype to demonstrate the product (K6)
CO5: perform sustenance engineering to improve the longevity of the product (K6)

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision: Types of various trends affecting product decision - Social Trends - Technical Trends - Economic Trends - Environmental Trends - Political/Policy Trends- PESTLE Analysis. Introduction to Product Development Methodologies and Management: Overview of Products and Services - Types of Product Development- Overview of Product Development methodologies - Product Life Cycle and PLM - Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering: Types of Requirements - Requirement Engineering - Analysis - Traceability Matrix and Analysis - Requirement Management System Design and Modeling: Introduction to System Modeling - Introduction to System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques - Concept Screening and Evaluation - Concept Design - S/W Architecture - Hardware Schematics and simulation Detailed Design: Component Design and Verification - High Level Design/Low Level Design of S/W Programs - S/W Testing-Hardware Schematic - Component design - Layout and Hardware Testing.

UNIT IV IMPLEMENTATION AND INTEGRATION 9

Prototyping: Types of Prototypes -Introduction to Rapid Prototyping and Rapid Manufacturing. System Integration - Testing - Certification and Documentation: Introduction to Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and S/W systems - Introduction to Product verification and validation processes - Product Testing standards, Certification and Documentation.

UNIT V SUSTENANCE ENGINEERING AND BUSINESS DYNAMICS 9

Sustenance - Maintenance and Repair – Enhancements Product End of Life (EoL): Obsolescence Management - Configuration Management - EoL Disposal.

The Industry - Engineering Services Industry overview - Product development in Industry versus Academia.

The IPD Essentials - Introduction to vertical specific product development processes - Product development Trade-offs - Intellectual Property Rights and Confidentiality - Security and configuration management.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development", Tata McGraw-Hill Education, 4th Edition, 2009.
2. George E Dieter, Linda C Schmidt, "Engineering Design", McGraw-Hill International Edition, 5th Edition, 2012.

REFERENCES

1. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Education, 2007.
2. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 4th Edition, John Wiley & Sons, 2013.
3. Yousef Haik, Shahin T M M, "Engineering Design Process", Cengage Learning, 2nd Edition Reprint, 2010.
4. James R Evens, William M Lindsay "The Management and control of Quality" Pub: son south-western (www.swlearning.com), 6th edition.
5. Reddy G B, "Intellectual Property Rights and the Law", Gogia Law Agency, 7th Edition Reprint, 2009.
6. Subbaram N R, "Demystifying Intellectual Property Rights", Lexisexis Butter worths Wadhwa, 1st Edition, 2009.

19ID02E DISASTER MANAGEMENT L T P C

3 0 0 3

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Classify the various types of disaster. (K2)
CO2: Interpret various natural and manmade disasters. (K2)
CO3: Choose a Hazard Assessment procedure. (K3)
CO4: Construct the protection measures against Disaster. (K3)
CO5: Apply Science and Technology in Disaster Management. (K3)

UNIT I INTRODUCTION TO DISASTER 9

Hazard, risk, vulnerability, disaster significance, nature, importance, dimensions and scope of disaster management - national disaster management frame work- financial arrangements- disaster- management cycle.

UNIT II SOURCES OF DISASTER 9

Natural disasters- significance, nature, types and effects - floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, climatic change - global warming - sea level rise - ozone depletion. Manmade disasters- nuclear ,chemical, biological, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents and sea accidents.

UNIT III DISASTER MITIGATION AND HAZARDS ASSESSMENT 10

Factors affecting damage – types, social status, habitation pattern, physiology and climate - Factors affecting mitigation measures - prediction – preparation - communication - area and accessibility - population - physiology and climate - Vulnerability Assessment and seismic strengthening of buildings - Vulnerability Assessment of Buildings procedure - Hazard Assessment-Visual Inspection and Study of Available Documents.

UNIT IV DISASTER MANAGEMENT 9

Disaster management - efforts to mitigate natural disasters at national and global levels - international strategy for disaster reduction- Rescue ,relief And Rehabilitation, Role Of National And International Agencies In Disaster Management-National Disaster Policy Of India (Salient Features).

UNIT V APPLICATIONS OF SCIENCE AND TECHNOLOGY AND CASE STUDIES 8

Applications of Science and Technology (RS, GIS, GPS) - Early Warning and Prediction Systems- Earthquake, cyclone, landslides, fire accidents, accidents- case studies

L: 45; TOTAL: 45 PERIODS

TEXT BOOKS

1. S.K.Singh, S.C.Kundu, Shobha Singh A, “Disaster Management”, William Publications, New Delhi, 1997.
2. Vinod K Sharma, “Disaster Management”, IIPA, New Delhi, 1995

REFERENCES

1. Annual Report, 2009-10, Ministry of Home Affairs, GOI.
2. K.Palanivel, “Disaster Management”, Allied Publishers, 2015.

19ID03E	**ENERGY ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: explain the operation of Solar Thermal application and Solar Photovoltaic. (K2)
CO2: explain the operation of wind energy systems. (K2)
CO3: describe the concepts of various Bio-Energy Conversion techniques. (K2)
CO4: illustrate the concepts of other conventional and nonconventional power plants. (K2)
CO5: explain the concepts of hydrogen and fuel cell technology. (K2)

UNIT I INTRODUCTION TO SOLAR ENERGY 9

Sun - Earth Geometry, solar radiation, Solar Collectors - Application of solar thermal systems. Direct Electricity Conversion - Types of Solar cell - Solar Photovoltaic system and types.

UNIT II WIND ENERGY 9

Wind energy potential, Principle of wind energy conversion; Basic components, types and their constructional features; design considerations: wind data and site selection.

UNIT III BIO-ENERGY 9

Biomass: sources, characterization, principles of energy transfer technologies. Biogas: Feedstock, types of Biogas plant - parameters affecting biogas production.

UNIT IV OTHER POWER PLANTS 9

Layout of Hydel - thermal - Nuclear - Gas turbine - Diesel - MHD - Geo thermal - OTEC - Tidal Power Plants.

UNIT V HYDROGEN AND FUEL CELLS 9

Energy carrier: Types - Hydrogen: generation, storage, transport and utilization - thermal energy storage: Principle and utilization - Fuel cells: Technologies, types and applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. SoterisKalogirou, “Solar Energy Engineering: Processes and Systems”, Academic Press, 2014.
2. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 3rd Edition, 2012.

REFERENCES

1. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, 2nd Edition, 2006.
2. Hart A B and Womack, G J, "Fuel Cells: Theory & Applications", Prentice Hall, 1997.
3. El-Wakil M M, "Power Plant Technology", Tata McGraw-Hill, 2010.
4. Khandelwal K C and Mahdi S S, "Biogas Technology" - A Practical Handbook, Tata McGraw Hill, 1986.
5. Duffie J A and Beckman W A, "Solar Engineering of Thermal Processes", Wiley, 4th Edition, 2013.
6. Chetan Singh Solanki, "Solar Photovoltaics Fundamentals, Technologies and Applications", Prentice Hall of India, 3rd Edition, 2015.

B.E. CIVIL ENGINEERING

ONE CREDIT COURSES

19CE01L RECENT ADVANCEMENTS INSPECIALCONCRETE L T P C

1 0 0 1

COURSE OUTCOME

Upon successful completion of this course, the student will be able to

CO1: Explain the suitability of special concrete making materials, properties of special Concrete with its applications. (K2)

COURSE CONTENTS

Ultra High Strength Concrete – No fines concrete – High density concrete - Testing Methods – Aerated Concrete – Applications of Nano-concrete – Hot weather concreting – Cold weather concreting – its applications - Bacterial Concrete.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Shetty M.S., “Concrete Technology”, S.Chand& Company, New Delhi,2008
2. Santhakumar. A.R, “Conrete Technology”, Oxford university press,2007
3. M.L. Gambhir, “Concrete Technology”, Tata Mc-Graw Hill Company, Noida, 2011.

REFERENCES

1. Orchard D.F., “Concrete Technology”, Vol I & II,1998
2. Neville A.M “Properties of Concrete”, Pearson Education,2008
3. “Construction and Building Materials” Elsevier Publications.
4. “Cement and Concrete Research, Elsevier Publications.

19CE02L DESIGN OF FOUNDATION ELEMENTS L T P C

1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Design Shallow Foundation (K2)

CO2: Design Deep Foundation (K2)

COURSE CONTENTS

Design of Combined footings- Design of Raft Foundation – Design of Piles- Design of Pile caps -Design of Machine foundations. Design of well foundation.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
2. Varghese P.C., "Design of Reinforced Concrete Foundations”, PHI Learning Private Limited, New Delhi, 2009
3. Gambhir. M.L., “Design of Reinforced Concrete Structures ", Prentice Hall of India Private Limited, New Delhi, Fourth Edition,2011.

REFERENCES

1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.

2. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, 3rd Edition, 2006.
3. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980.

19CE03L EARTH RETAININGSTRUCTURES L T P C

1 0 0 1

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Explain the concept of lateral earth pressure in soil (K2)
CO2: Design a suitable earth retaining structure (K2)

COURSE CONTENTS

Introduction – State of stress in retained soil mass – Earth pressure theories –Classical and graphical techniques– Earth pressure due to external loads, empirical methods - Wall movement –Retaining structures-Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls - Design of anchor systems- Introduction to reinforced earth.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, 3rd Edition, Survey University Press,2014.
2. Das, B.M., "Principles of Geotechnical Engineering", 8th Edition, The PWS series in Civil Engineering, 2015.

REFERENCES

1. Militisky, J. and Woods, R., "Earth and Earth retaining structures",Routledge,1992
2. Day, R.W., "Geotechnical and Foundation Engineering: Design and Construction", Mc-Graw Hill, 1999.

19CE04L TRAFFIC ENGINEERINGANDSAFETY L T P C

1 0 0 1

COURSE OUTCOME

Upon Successful completion of this course, the students will be able to

CO1: Explain the concepts of traffic survey, reasons of accidents and their preventive measures (K2)

COURSE CONTENTS

Traffic volume count, Methods of traffic volume count - Manual, mechanical, videography, passenger car unit. Presentation of traffic volume count. Speed studies, spot speed studies and its presentation, Speed and delay studies, Origin and destination studies and its presentation, Parking studies - Types of parking - Off street parking, On street parking, Accident studies - Causes of accidents, accident records condition and collision diagram, preventivemeasures.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2014.
2. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 2000.

REFERENCES

1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management
2. Guidelines of Ministry of Road Transport and Highways, Government of India.
3. Subhash C.Saxena, A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi, 1989.
4. Transportation Engineering – An Introduction, C.Jotin Khisty, B.KentLall, Prentice Hall of India Pvt. Ltd, 2006.

19CE05L BRIDGECONSTRUCTIONTECHNIQUES

L	T	P	C
1	0	0	1

COURSE OUTCOME

Upon Successful completion of this course, the students will be able to

CO1: Explain the concepts of bridge construction techniques (K2)

COURSE CONTENTS

Complete Scaffolding –span by span construction - Balanced Cantilever - Push (incremental) launching– box pushing – Prestressed Prefabrication techniques.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Company, New Delhi, 2018.
2. Rajagopalan,N “Bridge Superstructure”, Alpha Science International,2006

REFERENCES

1. Phatak D.R., “Bridge Engineering”, SatyaPrakashan, New Delhi, 1990.
2. Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi, 2017.

19CE06L DECENTRALISED WASTE WATER TREATMENT SYSTEM (DEWATS)

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Outline the basic concepts of waste water treatment (K2)

CO2: Illustrate the components of onsite sanitation (K2)

COURSE CONTENTS

Biological Treatment – Aerobic & Anaerobic Process – Suspended and Attached growth - Centralized and Decentralized waste water treatment system – Domestic waste water quality and quantity - Control Parameters – Dewats Components – Grease trap and Grit chamber– Anaerobic baffle reactor – Anaerobic filter – Planted soil filter – Horizontal gravel filter – Vertical sand filter – Ponds – Anaerobic and Aerobic ponds – Hybrid and Combined systems.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2014.
2. Soli.J Arceivala, "Waste water Treatment for Pollution Control and Reuse", Mc-Graw Hill Education, 2006.

REFERENCES

1. Metcalf and Eddy "Wastewater Engineering – Treatment and Reuse", Tata McGraw Hill, New Delhi, 2003.
2. Ludwig Sasse "DEWATS Decentralised wastewater treatment system in developing countries", Borda, 1998.

19CE07L BUILDING MARKING

L T P C
1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Marking the building structures (K2)
CO2: Marking for plumbing and electrical lines (K2)

COURSE CONTENTS

Study of building plan - Centre line method – Marking of load bearing structures – Marking of framed structures-Marking for plumbing and electrical lines – Setting out of building – Contour preparation – 3D scanning of building.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. S.C.Rangawala, "Engineering materials", Charotar Publishing House, NewDelhi, 2017.
2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, DhanpatRai and Sons, 1997.

REFERENCE

1. Edward Allen and Joseph Iano, "Fundamentals of Building Construction", John Wiley & sons, 2009

19CE08L INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM (GIS)

L T P C
1 0 0 1

COURSE OUTCOME

CO1: Outline the basic concepts of GIS and apply GIS software in Civil Engineering field (K2)

COURSE CONTENTS

Introduction – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS). Data models – vector and raster data – data compression - data input by digitization and scanning - Modeling in GIS Highway alignment studies.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Lillesand, T.M., Kiefer, R.W. and J.W.Chipman, "Remote Sensing and Image Interpretation", 5th Edition, John Willey and Sons (Asia) Private Limited, New Delhi. PP: 763, 2004.
2. Anji Reddy, M., "Remote Sensing and Geographical Information System", 2nd Edition, BS Publications, Hyderabad, 2001.

REFERENCES

1. Lo. C.P. and A.K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall of India Private Limited, New Delhi, Pp: 492, 2002.
2. Peter A.Burrough, Rachael A. Mc Donnell, "Principles of GIS", Oxford University Press, 2000.

19CE09L TIMBER STRUCTURES

L T P C
1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Explain the basic concepts of Timber Design (K2)

COURSE CONTENTS

Design process and structural loads - Timber building terminology (e.g. building systems) - Properties of timber and engineered wood products-General timber design principles - Design of bending, tension and compression members - Design of members under combined loads - Case Study of Existing Timber Structures, Design of formwork.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Abi Aghayere, Jason Vigil, "Structural Wood Design - ASD/LRFD, 2nd Edition", Taylor & Franchis (publisher), 2016.
2. Donald E. Breyer and Kelly Cobeen, "Design of wood structures-asd/lrfd (p/l custom scoring survey)" McGraw-Hill, 2014.

REFERENCES

1. Donald Breyer, Kenneth Fridley, Pollock Jr., Kelly Cobeen,"Design of Wood Structures-ASD/LRFD", McGraw Hill Professional, 2014.
2. Ram S Gupta, "Principles of Structural Design: Wood, Steel, and Concrete, Second Edition" Taylor & Francis (publisher), 2014.

19CE10L EARTHQUAKE RESISTANT DESIGN

	L	T	P	C
	1	0	0	1

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Analyze the earthquake forces and their application on different types of structures. (K2)

CO2: Design masonry and RC structures to resist the earthquake forces as per the IS Code recommendations.(K2)

COURSE CONTENTS

Structural Systems - Types of Buildings - Causes of damage - Planning Considerations – effect of material of construction on performance of structures application of lateral load - analysis of building frames under lateral load. Earthquake resistant design Concepts – virtues of EQR design – capacity based design - design of shear wall and frame members as per IS13920:1993 –Ductile detailing of frame members and shearwalls.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice - Hall of India, New Delhi, 2003.
2. S.K. Duggal, Earthquake resistant design of structures, Oxford University Press, 2007.

REFERENCE

1. Paulay.T and Priestley M.J.N., "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 1992.

19CE11L SEISMIC EVALUVATION AND RETROFITTING OF STRUCTRES

	L	T	P	C
	1	0	0	1

COURSE OUTCOME

Upon successful completion of this course, the student will be able to

CO1: explain the seismic evaluation methods and retrofitting of Seismic Damages (K2)

COURSE CONTENTS

Seismic Evaluation Methods -Push over Analysis- Seismic Retro fitting – Damage Assessment Methods.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice - Hall of India, New Delhi, 2003.
2. S.K. Duggal, Earthquake resistant design of structures, Oxford University Press, New Delhi - 1.

REFERENCE

1. Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996.

19CE12L TUNNELING TECHNIQUES L T P C

1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: discuss about provisions and application of tunneling techniques (K2)

COURSE CONTENTS

Site investigations, Geotechnical Considerations of tunneling -Design of Tunnels -Construction & Excavation methods, soft ground tunnels, Rock tunnels -Micro tunneling techniques, Tunnel grouting, Tunnel support design-Ventilation of tunnels, tunnel utilities, safety aspects

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. J O Bickel & T R Kuesel "Tunnel Engineering Handbook", CBS, 2nd Edition, 2004.
2. R. Srinivasan "Harbourand Dock and Tunnel", Charotar Publishing House, 28th Edition, 2016.

19CE13L SOIL CONTAMINATION AND REMEDIATION L T P C

1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Explain the soil-chemical interaction mechanism (K2)

CO2: Explain various methods in soil remediation (K2)

COURSE CONTENTS

Role of Geo-environmental Engineering–soil pollution -factors influencing soil-pollutant interaction – modification of index, chemical and engineering properties – physical and physio-chemical mechanisms - Transport of contaminant in subsurface – characterization of contaminated sites – In-situ contamination– soil remediation - methods of soil remediation-vitrification-chemical oxidation-thermal desorption-stabilization-soil washing-bioremediation.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 2012.
2. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering, John Wiley and Sons, INC, USA, 2004.
3. Ott, W.R., Environmental Indices, Theory and Practice, Ann Arbor, 1978.

REFERENCES

1. Lagrega, M.D., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management,, McGraw Hill, Inc. Singapore, 1994.
2. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.

19CE14L ENVIRONMENTAL NOISE POLLUTION

L	T	P	C
1	0	0	1

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Outline the basic concepts of noise pollution (K2)
CO2: Perceive the components of noise pollution mitigations. (K2)

COURSE CONTENTS

Noise Pollution – Causes- Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – Effects of noise pollution – auditory effects, non-auditory effects- effects of noise on workers efficiency- General Control Measures- Designing out Noise – Industrial Noise Control- Acoustic quieting - mechanical isolation technique, acoustical absorption, constrained layer damping – OSHA Noise standards – public education – other non legislative measures.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2014.
2. S.K.Agarwal., Noise pollution APH Publishing corporation, 2005.

REFERENCES

1. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 2009.
2. OSHA Standards for noise pollution (OSHAwebsite)(https://www.osha.gov/SLTC/noisehearingconservation/index.html).

19CE15L SAFETYINCONSTRUCTION

L	T	P	C
1	0	0	1

COURSE OUTCOME

Upon successful completion of this course, the student will be able to

CO1: Explain the Causes of accidents and principles selecting, operations, inspection and testing of various construction machinery. (K2)

COURSE CONTENTS

Problems impeding safety in construction industry- causes and types of accidents, construction regulations - design aids for safe construction - Temporary Structures-Economic Impact of Accidents-Modes of Failure-Causes and Characteristics of Accidents-Codes and Standards-Hazard Assessment and Control.

L: 15, TOTAL: 15 PERIODS

REFERENCES

1. Krishnamurthy, N., Notes for various short courses on Safety in Construction Industry.
2. Allan St John Holt, Principles of Construction Safety, Blackwell Science Publication, 2006.

19CE16L DESIGN OF INDUSTRIAL ROOFING SYSTEM

L T P C
1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Analyze Industrial components (K2)
CO2: Design Industrial components by appropriate identification of structural steel (K2).

COURSE CONTENTS

Introduction to Indian Standard Code Provision – Applications of Roof truss system for industries – Analysis of Fink type, Fan type and Fink fan type Trusses- Roof and side coverings – Design loads – design of purlins –Analysis and Design of Tubular Trusses – Introduction to Pre Engineered Buildings.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Dayaratnam.P, “Design of Steel Structures”, 2nd Edition, S.Chand & Company, 2003.
2. Ramachandra.S and Virendra Gehlot, “Design of Steel Structures – Vol. I & II”. Standard Publication, New Delhi, 2007.

REFERENCE

1. Bhavikatti.S.S., “Design of steel Structures”, I.K.International Private Limited, 2009.

19CE17L ADVANCED ENGINEERING MATERIALS IN CONSTRUCTION

L T P C
1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: To impart knowledge from various types of properties uses and application of advanced materials used in construction (K2)

COURSE CONTENTS

Overview of advanced Materials - Factors Affecting Choice of selection of Materials - Steel, Non-ferrous, special concrete, construction chemicals, Glass, Plastics, Composites-

Fundamentals of Non-Mechanical Properties (physical properties, durability)- Fundamentals of Mechanical Properties (strength, structural performance) - Relation between Materials and their Applications in Buildings / Case Studies.

L: 15, TOTAL: 15 PERIODS

TEXT BOOKS

1. Errol Van Amsterdam "Construction Materials for Civil Engineering", Juta & Co. Ltd, 2008.
2. X. Yong, "Advanced Materials Science and Civil Engineering", WIT Press, 2015.

REFERENCES

1. G. D. Taylor, "Materials in Construction: An Introduction", published by route ledge 2013.
2. Peter Domone, John Illston, "Construction Materials: Their Nature and Behaviour, 4th Edition", Taylor & Francis, 2000.

19CE18L	ENVIRONMENTAL CLEARANCE	L T P C
		1 0 0 1

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

- CO1: Apply the procedures and formats for Environmental Clearance in the Construction Field. (K2)
- CO2: Identify the procedures needed for Environmental impact Assessment and Environmental Clearance. (K2)

COURSE CONTENTS

Impact – Environmental Impact Assessment (EIA) & Environmental Clearances – EIA necessity and its limitations- Environmental Impact Statement (EIS) – EIA capability and limitations –Impact assessment due to construction project- Legal provisions for EC– Environmental Clearance for Construction Projects- case studies.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Garg S.K., "Sewage Disposal and Air pollution Engineering", Khanna publishers, New Delhi.
2. T.V.Ramachandra, Vijay Kulkarni, "Environmental Management", Teri Publications, The Energy and the Research Institute New Delhi, 2009
3. Bala Krishnamoorthy, "Environmental management Texts and Cases", PHI learning Private Ltd.,New Delhi,2012

REFERENCES

1. http://www.moef.nic.in/environmental_clearance general; Indian Government official website MOEF-Ministry of Environment and forest and climate change.
2. http://www.indiaenvironmentportal.org.in/ basic engineering principles involved in EC and EIA.

19CE19L ENVIRONMENTAL LEGISLATIONS L T P C

1 0 0 1

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Perceive the Environmental legislative laws and its governing authorities. (K2)
CO2: Know the role of legislations and law in the field of climate Change. (K2)

COURSE CONTENTS

Different Environmental laws in India- Environmental laws World perspective- Importance of MoEF- Statutory bodies of pollution prevention CPCB,SPCB - Environmental Protection act 1986- Umbrella Legislations-The Air act - The water act -Role of NGT(National Green Tribunal)- Kyoto protocol -COP22.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Daniel Bodansky, Jutta Brunne., "International Climate Change law", Oxford university Press, London.Edition (2017).
2. Sengar, Dharmendra S "Environmental Law", Prentice Hall India Learning Private Limited; 1st Edition, 2007.
3. Bala Krishnamoorthy, "Environmental management Texts and Cases", PHI learning Private Ltd, New Delhi, 2012.

REFERENCES

1. http://unfccc.int/meetings/marrakech_nov_2016/session/9676.php United Nations framework and Convention on climate change.
2. http://www.indiaenvironmentportal.org.in/ basic engineering principles involved in Climate change.

19CE20L ENVIRONMENTAL ENGINEERING DRAWING L T P C

1 0 0 1

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

CO1: Design the components of water and waste water treatment plant. (K3)
CO2: Draw the components of water and waste water treatment plant. (K2)

Design and drawing of

1. Clariflocculator
2. Screening along with Rapid sandfilters
3. Tricklingfilter
4. Activated sludgeprocess
5. Septic tank with dispersion trench and soakpit

L: 15; TOTAL: 15 PERIODS

REFERENCES

1. Modi, P.N., "Environmental Engineering I & II", Standard Book House, Delhi, 2010.
2. Garg, S.K., "Environmental Engineering Vol I & II", Khanna Publishers, New Delhi, 2014.

3. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw Hill, New Delhi, 2003.

19CE21L ANALYTICAL INSTRUMENTATION

L T P C
1 0 0 1

COURSE OUTCOME

Upon successful completion of this course, the student will be able to

CO 1: Acquire the knowledge about the different types of analytical techniques to analysis the industrial liquid, solid, gases and radio chemical. (K1)

COURSE CONTENTS

Liquid Analysis

Liquid Analysis: Electrical conductivity, pH electrode potentials, Electrochemical analyser

Soild Analysis

X-ray diffraction, spectroscopic techniques IR and Raman, Electron microscopy (SEM, TEM and AFM)

Dissolved Component And Gas Analysis

Dissolved oxygen analyser–sodium analyser–silica analyser–moisture measurement – Oxygen analyser–CO monitor –NOx analyser–H_2S analyser–dust and smoke measurement–thermal conductivity type –thermal analyser–industrial analysers.

L: 15, TOTAL: 15 PERIODS

REFERENCES

1. R S Khandpur, "Hand book of Analytical Instruments", Tata McGraw-Hill Publishing Company, 2015.
2. Francis Rousseau and Annick Rouesssac, "Chemical analysis Modern Instrumentation Methods and Techniques", John Wiley& Sons Limited, 2007.
3. Dwayne Heard, "Analytical Techniques for atmospheric measurement", Blackwell Publishing, 2007.

19CE22L COATING TECHNOLOGY

L T P C
1 0 0 1

COURSE OUTCOME

Upon Successful completion of this course, the students will able to

CO1: acquire the knowledge about the different types of coatings (K2)

COURSE CONTENTS

INTRODUCTION

Organic and metallic coatings- oil and alkyd paints – thermosetting alkyd – polyester and acrylic paint based on nitrogen resin- epoxy coating.

NOBLE AND NON-NOBLE COATING

Tin coating – lead coating –copper coating- Zinc coating –zinc-iron alloy coating – aluminum coating.

CONVERSION COATING AND VAPOUR PROCESS COATING

Phosphate coating – chromate coating-oxide coating - Vacuum Evaporation – Sputtering - Chemical Vapor Deposition- Thermal spray coating.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. Philip A.Schweitzer, P.E. "Paint & Coating – Application and Corrosion Resistance", Toylor and Francis, New York, CRC press, 2006.
2. Arthur A. Tracton, "Coating Technology Hand book", CRC Press, Taylor & Francis Group, 2006.

REFERENCES

1. Arthur A. Tracton, "Coatings Materials and Surface Coatings" 3rdEdition, CRC Press, Taylor & Francis Group, 2006.
2. Philip A. Schweitzer, P.E. "Corrosion resistant lining and coating", New York, 2001.

19CE23L ACOUSTICS L T P C

1 0 0 1

COURSE OUTCOMES

Upon Successful completion of this course, the students will be able to

CO1: Acquire knowledge on the acoustic properties of buildings (K2)
CO2: Apply prediction methods to assess the transmission of noise in buildings (K3)
CO3: Make basic room acoustic measurements (K2)

COURSE CONTENTS

UNIT I ACOUSTICS OF BUILDING 5

Introduction - Sound generation mechanisms - Sound Insulation - Air Borne sound insulation-Impact sound insulation - Airborne sound reduction index for a solid, Homogeneous, Impervious wall -Coincidence effect - Methods of improving airborne sound insulation of building elements - Vibration control - Ventilation and conditioning systems.

UNIT II CRITERIA FOR NOISE CONTROL AND SOUND INSULATION 5

Introduction - Hearing damage - Noise rating and Noise criteria curves noise in the home - Sound insulation between dwellings.

UNIT III MEASURING TECHNIQUES 5

Generalized chain of measurement - Sources of sound and vibrations - Microphones and accelerometers - Amplifiers, Filters, Analyzers and Recorders.

L: 15; TOTAL: 15 PERIODS

TEXT BOOKS

1. A Text Book of Building Construction and Construction Materials, G S Birdie, T D

Ahuja, Dhanpat Rai Publishing Co, New Delhi,2007.
2. Architectural Acoustics Principles and Practice Cavanaugh & Wilkes John Wiley and Sons, New York, 1999.

REFERENCES

1. M. L. Munjal, 2014, Noise and Vibration Control, World Scientific Press: Singapore.
2. E. G. Williams, 1999, Fourier Acoustics: Sound Radiation and Near Field Acoustic Holography, Academic Press: New York.

19CE24L COMPUTER AIDED BUILDING LAYOUT DRAWING L T P C

0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Generalize basic concepts of various elements of Residential / Institutional / Workshop buildings.(K1)

CO2: Identify and practice simulation software to draw truss structures, plan, elevation and sectional view of a building.(K2)

LIST OF EXPERIMENTS

1. Buildings with load bearing walls (Flat and pitched roof) – Including details of doors andwindows
2. RCC framedstructures
3. Industrial buildings – North light roof structures –Trusses
4. Perspective view of one and two storeybuildings

P: 30 TOTAL: 30 PERIODS

TEXT BOOKS

1. Varma B.P, “Civil Engineering Drawing & House Planning”, 11th Edition, Khanna Publishers, Delhi,2013.
2. Shah M.G, “Building Drawing”, Tata McGraw Hill,2012.

REFERENCES

1. Kumaraswamy N, KameswaraRao A, “Building Planning & Drawing”, Charotar Publishing, 2012.
2. Shah, Kale and Patki, “Building Drawing with integrated approach to Built Environment”, Tata McGraw Hill, 2012.

LIST OF EQUIPMENTS (For a batch of 30 students)

Sl. No	Description of Equipment’s	Quantity
1.	Computer system of Pentium IV or Equivalent	1 for each student
2.	Licensed version of any reputed Analysis, Design & Drafting software	1 copy for a set of 3 student

19CE25L C PROGRAMMING APPLICATIONS FOR CIVIL ENGINEERING-I

L T P C
0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Apply the basic concepts to solve simple problems. (K3)

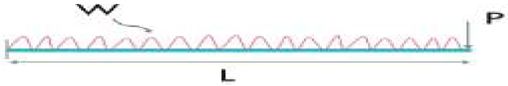
CO2: Apply the appropriate solution to solve problems using Array and String handling. (K3)

LIST OF EXERCISES

1. Expression Evaluation: A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).
2. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3+…………+x^n. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.
3. A hydraulic piston has two ends of the area A1 = 1m^2 and A2 = 0.2m^2. A Force (F1) of 100N is applied on the piston with a smaller area. Write a C program to find the force on the other end. Given,

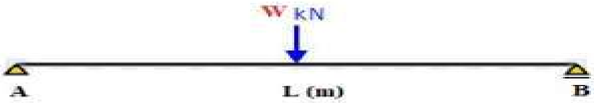
$$F_2 = \frac{F_1 A_2}{A_1}$$

4. A cantilever beam is given as shown in the following figure.

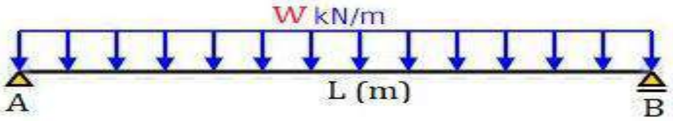


Write a C program to compute the shear and moment of beam at every L/N distance from a free end. Here, length of beam(L) is measured in metre, Concentrated Load (P) is measured in kN. Uniformly distributed load (W) is measured in kN/m. Let i indicate the sectional distance from the right side of the beam. Compute Shear and moment at each sectional point.

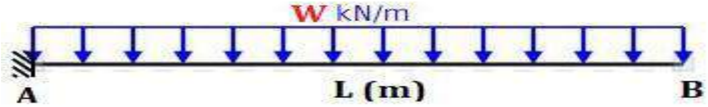
5. Write a C program to find the pressure difference that comes when someone goes 10m deep inside the water. Given, the density of water = 1000Kg/m^3.
6. Write a C program to find the maximum deflection in metre of a simply supported beam of span (AB) length L is measured in metre under mid-point load W in (kN).



7. Write a C program to find the maximum deflection in metre of a simply supported beam of span (AB) length L is measured in metre under Uniformly distributed load W is measured in kN/m.



8. Write a C program to find the maximum deflection in meter of a cantilever beam of span (AB) length L is measured in metre under Uniformly distributed load W is measured in kN/m



9. The flow rate of fluid required for the thermal energy - heat power transfer can be calculated

$$Q = \frac{3600.P}{\rho c \Delta T}$$

where: q - flow rate [m3/h]; ρ - density of fluid [kg/m3]; c - specific heat of fluid [kJ/kgK];
ΔT - temperature difference [K]; P - power [kW]; Write a C program to calculate the same by getting appropriate input values.

10. Two pipes are connected in parallel between two reservoirs that have difference in levels (HL) of 3.5 m. The length, the diameter, and friction factor (4 f) are 2400 m, 1.2 m, and 0.026 for the first pipe and 2400 m, 1 m, and 0.019 for the second pipe. Write a C program to calculate the total discharge between the two reservoirs (Q_1+Q_2).

$$H_L = \frac{32 f_1 L {Q_1}^2}{\pi^2 g d_1 5} = \frac{32 f_2 L {Q_2}^2}{\pi^2 g d_2 5}$$

11. Your task is to arrange the cement bags according to the weight (low to high or high to low). Take the input parameters in an array.
12. Write a program to initialize a one dimensional array of size N with the input elements as capacity of the sandbag and display the average of the total capacity.
13. Write a program in C to print individual characters of “Construction Materials” in reverse order.
14. Write a program in C to count total number of alphabets, special characters in a string “ Reinforced Cement Concrete Structures”
15. Write a program to separate the individual characters from a string “CIVIL ENGINEERING”

Software Requirement: Turbo C **P: 30; TOTAL: 30 PERIODS**

REFERENCES

1. Yashavant Kanetkar - Let Us C: Authentic guide to C programming language (18th Edition), 2021
2. Harsha Priya, R. Ranjeet, Programming and Problem Solving through C Language-‖, Fire wall Media, 2006.
3. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner's Companion‖, Pearson Education, (Kindle Edition), 2002.

19CE26L C PROGRAMMING APPLICATIONS FOR CIVIL ENGINEERING-II L T P C

0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Analyze the problems using functions(K3)
CO2 : Solve problems using pointers(K3)

LIST OF EXERCISES

1. Using Functions, print all strong numbers between given intervals m,n (Hint: A number is strong whose sum of the factorial of the individual digits is equal to the number)
2. Using functions, read an integer and to check whether the
   - i) number is prime
   - ii) number is Armstrong
   - iii) number is perfect number
3. Using recursive function, check whether the given string is a palindrome or not
4. Using pointers add two numbers and print the output
5. Using pointers swap elements using call by reference.
6. Using pointers store n elements in an array and print the elements using pointer.
7. Using pointers print a string in reverse using a pointer.
8. Using pointers, calculate sum of non-diagonal elements of m x n matrix using dynamic memory allocation.
9. Using Functions and pointers, calculate sum of major and minor diagonal elements of m xn matrix using dynamic memory allocation

Domain related questions:

1. Write a C program to find the total head of a flow (H) through a pipe. Get input variables as pressure (p), Specific Weight (ρg), velocity (v) and datum head (z). Using functions compute total head using the formula, H=(p/a) +((v*v)/(2*g))+z
2. Water flows in a steel pipe (d = 40 mm, k = 0.045x10-3 m, µ = 0.001 k/ms) with a rate of 1lit/sec. Using functions determine the friction coefficient and the head loss due to friction per meter length of the pipe.
3. Write a C program to read temperature in centigrade and display a suitable message according to temperature state below :
   - Temp < 0 then Freezing weather
   - Temp 0-10 then Very Cold weather
   - Temp 10-20 then Cold weather
   - Temp 20-30 then Normal in Temp
   - Temp 30-40 then Its Hot
   - Temp >=40 then Its Very Hot

Software Requirement: Code Blocks **P: 30; TOTAL: 30 PERIODS**

REFERENCES

1. Brain W Kernighan, Dennis Ritchie, “C Programming Language”, Pearson Edition, 2015
2. Yashavant P. Kanetkar, “Understanding Pointers in C”, PBP Publications, 2007

19CE27L C PROGRAMMING APPLICATIONS FOR CIVIL ENGINEERING-III L T P C

0 0 2 1

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Solve problems using Structure and unions (K3)
CO2: implement linear data structures to solve simple problems (K3)

LIST OF EXERCISES

1. Write a C program to create student structure with members name,rno,dept,dob and arrange student data alphabetically.
2. Write a C program to create an employee structure with members empid, empname, salary. Access the members
    i. Using structure variable
    ii. Using structure pointer
3. Write a C program to create a book structure with members bookname, authorname and accessno. Write a menu driven program for the following library operations
    i. add the book details
    ii. display the book details
    iii. display the total number of books
4. Create two lists L1 and L2. While creating, the new nodes should be added in the front of the list by default.
    i. Find the intersection of the two lists L1 and L2 and display the resultant list.
    ii. Find the union of two lists L1 and L2 eliminates the duplicates and display the resultant list.
5. Create a list. While creating, the new nodes should be added in the front of the list by default.
    i. Delete the specified node
    ii. Find the specified node and return its position
    iii. Display the list and the number of nodes after each operation
    iv. Sort the given list
6. Create a stack ADT and perform the basic operations like pushing the element, popping the element and display.
7. Create a queue with 3 elements. Insert two elements at the front end and delete the last element at the rear end. Display the queue after each operation and number of elements in the queue.

Software Requirement: Code Blocks **P: 30; TOTAL: 30 PERIODS**

REFERENCES

1. M.A. Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson, 2002.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.

B.E. – CIVIL ENGINEERING

OPEN ELECTIVE COURSES

19ID01E	PRODUCT DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: analyze the customer needs and convert them into product design specifications (K4)
- CO2: perform concept generation and selection tools to identify the final concept (K4)
- CO3: construct the detail design from the conceptual idea (K4)
- CO4: understand rapid prototyping techniques in product development (K2)
- CO5: recognize the Intellectual Property Protection methods and project management techniques (K2)

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Introduction - A Generic Development Process - Field and Market analysis - Data collection techniques - Analysis of Data, PESTEL analysis - Identifying Customer Needs - House of Quality for Specifications - Establishing Target Specifications - Setting the Final Specifications.

UNIT II CONCEPT GENERATION AND SELECTION 9

Concept generation activities - Pugh concept selection method: Concept screening; Concept scoring - Concept testing - Concepts for smart systems - Value Analysis.

UNIT III EMBODIMENT DESIGN 9

System level Design and issues - Architecture of Product - Sizing of Parts - PESTEL analysis; SWOT analysis - Theory of inventive problem solving (TRIZ) - FAST Method - Failure Mode and Effects Analysis (FMEA) - Design for Assembly - Design for Ergonomics - Virtual Manikins

UNIT IV RAPID PROTOTYPING 9

Prototyping techniques - Additive Manufacturing - Metal Additive Manufacturing techniques - Virtual Prototyping - Topology Optimization - Generative Design.

UNIT V PROJECT MANAGEMENT AND INTELLECTUAL PROPERTY 9

Product Development Economics: Economic Analysis Process - Managing Projects: Protecting intellectual property - Patents, Trade mark and copy right.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. George E Dieter, Linda C Schmidt, “Engineering Design”, McGraw-Hill, International Edition, 5th Edition, 2012.
2. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata McGraw-Hill Education, 4th Edition, 2009.

REFERENCES

1. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint, Pearson Education, 2007.
2. Clive L.Dym, Patrick Little, “Engineering Design: A Project-based Introduction”, 4th

Edition, John Wiley & Sons, 2013.
3. Yousef Haik, Shahin T M M, “Engineering Design Process”, Cengage Learning, 2nd Edition Reprint, 2010.
4. James R Evens, William M Lindsay “The Management and control of Quality” Pub: son south-western (www.swlearning.com), 6th edition.
5. Reddy G B, “Intellectual Property Rights and the Law”, Gogia Law Agency, 7th Edition Reprint, 2009.
6. Subbaram N R, “Demystifying Intellectual Property Rights”, Lexisexis Butterworths Wadhwa, 1st Edition, 2009.

19ID02E	**DISASTER MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Classify the various types of disaster. (K2)
CO2: Interpret various natural and manmade disasters. (K2)
CO3: Choose a Hazard Assessment procedure. (K3)
CO4: Construct the protection measures against Disaster. (K3)
CO5: Apply Science and Technology in Disaster Management. (K3)

UNIT I INTRODUCTION TO DISASTER 9

Hazard, risk, vulnerability, disaster significance, nature, importance, dimensions and scope of disaster management - national disaster management frame work- financial arrangements- disaster- management cycle.

UNIT II SOURCES OF DISASTER 9

Natural disasters- significance, nature, types and effects - floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, climatic change - global warming - sea level rise - ozone depletion. Manmade disasters- nuclear, chemical, biological, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents and sea accidents.

UNIT III DISASTER MITIGATION AND HAZARDS ASSESSMENT 10

Factors affecting damage – types, social status, habitation pattern, physiology and climate - Factors affecting mitigation measures - prediction – preparation - communication – area and accessibility - population - physiology and climate - Vulnerability Assessment and seismic strengthening of buildings - Vulnerability Assessment of Buildings procedure - Hazard Assessment-Visual Inspection and Study of Available Documents.

UNIT IV DISASTER MANAGEMENT 9

Disaster management - efforts to mitigate natural disasters at national and global levels - international strategy for disaster reduction- Rescue, relief And Rehabilitation, Role of National and International Agencies in Disaster Management - National Disaster Policy of

India (Salient Features).

UNIT V APPLICATIONS OF SCIENCE AND TECHNOLOGY AND CASE STUDIES 8

Applications of Science and Technology (RS, GIS, GPS) - Early Warning and Prediction Systems- Earthquake, cyclone, landslides, fire accidents, accidents- case studies.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. S.K.Singh, S.C.Kundu, Shobha Singh A, - Disaster Management‖, William Publications, New Delhi, 1997.
2. Vinod K Sharma, Disaster Management‖, IIPA, New Delhi, 1995.

REFERENCES

1. Annual Report, 2009-10, Ministry of Home Affairs, GOI.
2. K.Palanivel, Disaster Management, Allied Publishers, 2015.

19ID03E ENERGY ENGINEERING

	L	T	P	C
	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- CO1: explain the operation of Solar Thermal application and Solar Photovoltaic. (K2)
- CO2: explain the operation of wind energy systems. (K2)
- CO3: describe the concepts of various Bio-Energy Conversion techniques. (K2)
- CO4: illustrate the concepts of other conventional and nonconventional power plants. (K2)
- CO5: explain the concepts of hydrogen and fuel cell technology. (K2)

UNIT I INTRODUCTION TO SOLAR ENERGY 9

Sun - Earth Geometry, solar radiation, Solar Collectors - Application of solar thermal systems. Direct Electricity Conversion - Types of Solar cell - Solar Photovoltaic system and types.

UNIT II WIND ENERGY 9

Wind energy potential, Principle of wind energy conversion; Basic components, types and their constructional features; design considerations: wind data and site selection.

UNIT III BIO-ENERGY 9

Biomass: sources, characterization, principles of energy transfer technologies. Biogas: Feedstock, types of Biogas plant - parameters affecting biogas production.

UNIT IV OTHER POWER PLANTS 9

Layout of Hydel - thermal - Nuclear - Gas turbine - Diesel - MHD - Geo thermal - OTEC - Tidal Power Plants.

UNIT V HYDROGEN AND FUEL CELLS 9

Energy carrier: Types - Hydrogen: generation, storage, transport and utilization - thermal energy storage: Principle and utilization - Fuel cells: Technologies, types and applications.

L:45; TOTAL:45 PERIODS

TEXT BOOKS

1. Soteris Kalogirou, “Solar Energy Engineering: Processes and Systems”, Academic Press, 2014.
2. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K, 3rd Edition, 2012.

REFERENCES

1. Mukund R Patel, “Wind and Solar Power Systems”, CRC Press, 2nd Edition, 2006.
2. Hart A B and Womack, G J, “Fuel Cells: Theory & Applications”, Prentice Hall, 1997.
3. El-Wakil M M, “Power Plant Technology”, Tata McGraw-Hill, 2010.
4. Khandelwal K C and Mahdi S S, “Biogas Technology” - A Practical Handbook, Tata McGraw Hill, 1986.
5. Duffie J A and Beckman W A, “Solar Engineering of Thermal Processes”, Wiley, 4th Edition, 2013.
6. Chetan Singh Solanki, “Solar Photovoltaics Fundamentals, Technologies and Applications”, Prentice Hall of India, 3rd Edition, 2015.

19TD01E	SOFT SKILLS AND INTERPERSONAL COMMUNICATION	L	T	P	C
		0	0	0	3

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to:

CO 1: To Enhance the Soft skills for the usage of language effectively. (K3)
CO 2: To inculcate the various components of language skills. (K3)
CO 3: To Uplift the student's presentation skills and interpersonal skills. (K3)
CO 4: To enhance employability skills in students. (K3)
CO 5: To train the students in interview skills and preparing for job interviews. (K3)

UNIT 1

Introduction to Soft Skills- Aspects of Soft Skills- Types of Listening - Language Skills – Understanding and Overcoming barriers in communication- Ethics and Etiquettes (Social and Official Settings)- Negotiation.

UNIT II

Principles of communication - LSRW in communication - Oral – Speaking words – Articulation -written communication- Advanced Writing Skills- Evaluation and Organization of Data in Report Writing.

UNIT III

Advanced Speaking Skills- Verbal & Non verbal communication – Body language - Leadership and Assertiveness Skills-Networking- Decision-Making- Conflict-Resolution

UNIT IV

Methods of Presentation- Effective Reading - Group Discussion - Preparation for a group discussion- Emotional Intelligence- Critical Thinking.

UNIT V

Practicing for the Interview – Effective Resume building-Stress Interview and traditional Interview- Life and Career Planning- Facing Job Interviews.

TEXTS BOOKS

1. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
2. Kumar, Sanajy and Pushp Lata. Communication Skills. New Delhi: OUP. 2011.
3. Chauhan, G.S. and Sangeeta Sharma. Soft Skills. New Delhi: Wiley. 2016.
4. Lucas, Stephen E. The Art of Public Speaking. McGraw-Hill Book Co. International Edition, 11th Ed. 2014.

19TD02E	**IMPACT OF SOCIAL MEDIA ON SOCIETY**	**L**	**T**	**P**	**C**
		0	**0**	**0**	**3**

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: discuss the basic operation of social media and its network.
CO2: analyze the various theory corresponding to communication contexts.
CO3: illustrate the impact of social media in physical and mental health of human beings.
CO4: discuss the legal and ethical issues in public and private spheres
CO5: illustrate the dark side of social media over growth of the society.

UNIT I INTRODUCTION TO SOCIAL MEDIA

Evolution of Social Media, utility of social networks, Professional Networking for Career growth, photo sharing service, impact of video sharing on business, online communities

UNIT II COMMUNICATION CONTEXTS FOR SOCIAL MEDIA

Mass Media theory, Social Sphere, Social Bookmarking and Social News, Social Opinion, Wikis, Crowdsourcing, Social Mobility, Privacy and Data Security.

UNIT III SOCIAL MEDIA AND HEALTH

Stress and Anxiety, Depression, Suicide rates, Sleeping Patterns, Fitness, health and Eating habits, Addiction to social media. Psychological and Physiological impacts of Social media

UNIT IV LEGAL AND ETHICAL ISSUES

Legal Pitfalls of Social Media usage, Redefining the Public and Private Spheres in Social Media, Tweets, Blogs, Facebook and Ethics of 21st Century Communication Technology.

UNIT V DARK SIDE OF SOCIAL MEDIA USE FOR SOCIETIES

Privacy, Privacy Paradox and Social Media, Privacy Literacy, Use and gratifications Theory, Lying as a form of Deception, Online Deception, Deception using SOCIAL Media, Catfishing, Self-Presentation lies, Misinformation and Rumors.

TEXT BOOKS

1. Regina Luttrell and Adrienne A. Wallace “Social Media and Society – An Introduction to the Mass Media Landscape” by Rowman and Littlefield, 2021.
2. Pavica Sheldon, Philipp A. Rauschnabel, James M.Honeycutt “The Dark side of Social Media”, Academic Press.

REFERENCES

1. Hana S.Noor AL-Deen and John Allen Hendricks “ SOCIAL Media – Usage and Impact” Lexington Books,2018

19TD03E INTERNATIONAL BUSINESS MANAGEMENT

L	T	P	C
0	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the global business environment.
CO 2: explain the impact of economic, legal, cultural, geographical and political factors on international business.
CO 3: discuss the issues and problems of Multinational Enterprises.
CO 4: discuss the role of various international financial institutions.
CO 5: discuss about important aspects of WTO and GATT agreement.

UNIT I INTERNATIONAL BUSINESS ENVIRONMENT

International Business Environment - Globalization - Forces, Meaning, Dimensions and Stages in Globalization - Trading Environment of International Trade - Tariff and Non-tariff Barriers - Trade Blocks.

UNIT II RISK ANALYSIS AND PRACTICES

Country Risk Analysis - Political, Social and Economic - Cultural and Ethical practices - Responsibilities of International Business - Economic crisis in foreign countries.

UNIT III MULTINATIONAL ENTERPRISES

Managing Multinational Enterprises - Problems and Potential - Multinational Service Organizations - Indian companies becoming multinationals - Potential, Need and Problems.

UNIT IV INTERNATIONAL FINANCIAL MANAGEMENT

Introduction to International Financial Management - Balance of Trade and Balance of Payment - International Monetary Fund, Asian Development Bank and World Bank - Financial Markets and Instruments - Introduction to Export and Import Finance - Methods of Payment in International Trade.

UNIT V INTERNATAIONAL AGREEMENT

General Agreement on Trade and Tariffs, (GATT) - World Trade Organization - Seattle and Doha Round of Talks - Dispute Settlement Mechanism under WTO - Problems of Patent Laws - International Convention on Competitiveness - Global Sourcing and its Impact on Indian Industry - Globalization and Internal Reform Process.

TEXT BOOKS

1. Bhalla V.K, Shivaramu S, “International Business Environment”, 9th Edition, Anmol Publications Pvt. Ltd., Delhi, 2005.
2. Apte P.G, “International Financial Management”, 5th Edition, Tata McGraw Hill, India, 2008.
3. Cherulinam F, “International Business”, 5th Edition, Prentice Hall of India, New Delhi, 2010.

REFERENCES

1. Rao, Rangachari, "International Business", Himalaya Publishing House, New Delhi, 2010.
2. Hill C, "International Business", 10th Edition, Tata McGraw Hill Education, New Delhi, 2014.
3. Daniels J.D, "International Business Environment", 15th Edition, Prentice Hall of India, New Delhi, 2014.

19TD04E BASICS OF MARKETING

L	T	P	C
0	0	0	3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: describe the basic concepts of marketing.

CO 2: discuss the significance of consumer behavior and market segmentation.

CO 3: discuss brand, trade mark, after- sales service and product life cycle concepts.

CO 4: formulate strategies for pricing and channels of distribution.

CO 5: analyze and selection of best promotional technique.

UNIT I INTRODUCTION

Nature and Scope of Marketing - Importance of Marketing – Concepts: Traditional and Modern - Selling Vs. Marketing - Marketing Mix - Marketing Environment.

UNIT II CONSUMER BEHAVIOR AND MARKET SEGMENTATION

Nature, Scope and Significance of Consumer Behavior - Market Segmentation - Concept and Importance - Bases for Market Segmentation.

UNIT III PRODUCT PLANNING

Concept of Product - Consumer and Industrial Goods - Product Planning and Development - Packaging - Role and Functions - Brand Name and Trade Mark - After-Sales Service - Product Life Cycle Concept.

UNIT IV PRICING AND PHYSICAL DISTRIBUTION

Price - Importance of Price in the Marketing Mix - Factors Affecting Price of a Product/Service - Discounts and Rebates - Distribution Channels - Concept and Role - Types of Distribution Channels - Factors Affecting Choice of a Distribution Channel - Retailer and Wholesaler - Distributions Channels and Physical Distribution.

UNIT V PROMOTION

Definition - Methods of Promotion - Optimum Promotion Mix - Advertising Media - Their Relative Merits and Limitations - Characteristics of an Effective Advertisement - Personal Selling - Selling as a Career - Classification of a Successful Sales Person - Functions of Salesman.

TEXT BOOKS

1. Etzel M.J, Walker B.J, Stanton W.J, “Fundamentals of Marketing”, 13th Edition, McGraw Hill, New York, 2004.
2. Tanner J, Raymond M, “Principles of Marketing”, University of Minnesota Libraries Publishing, New York, 2015.

REFERENCES

1. Rajan Nair N, Varma M.M, “Marketing Management”, 2nd Edition, S.Chand & Sons, New Delhi, 2005.
2. Ramaswamy V.S, Namakumari S, “Marketing Management", 3rd Edition, Macmillan India Limited, London, 2002.

19TD05E	INDIAN ECONOMY	L T P C
		0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to
CO 1: discuss the current economic development in India
CO 2: describe the key indicators of estimation of national income
CO 3: explain elementary concepts of economic planning and development in India
CO 4: discuss the concept of public finance and preparation of budget
CO 5: discuss the influence of infrastructure growth on economic development

UNIT I ECONOMIC DEVELOPMENT

Meaning - Measurement of Economic Development - Characteristic of underdeveloped and developed economies - Causes for Indian economic underdevelopment - Major issues in development - Strategies for economic development Import substitution and Export oriented strategies - Determinants of economic development.

UNIT II NATIONAL INCOME

The National Income and its estimates in India - Limitations of National income estimation - Trends in National income of India: Growth and Structure - Inter-state variations in National income - Income distribution - Measurement of poverty in India.

UNIT III ECONOMIC PLANNING

Planning and economic development in India - Planning models in India (Elementary concepts) - Capital formation - Growth of Public and Private sector in India – Industrial policies an assessment - Capital formation and domestic saving.

UNIT IV INDIAN PUBLIC FINANCE

Budgetary policies of the central government - Composition and trends in public revenue and expenditure - Expenditure control and government consumption expenditure - concepts of Budgetary deficits and implications - state budget.

UNIT V INFRASTRUCTURE AND ECONOMIC DEVELOPMENT

Power and energy - Transport system in India's economic development - Communication system in India - Urban infrastructure - Science and technology - Private investment in infrastructure - Outlook and prospects.

TEXT BOOKS

1. Dutt R, Sundaram K.P.M, "Indian Economy", S.Chand and Co., New Delhi, 2006.
2. Agarwal A.N, Agarwal M.K, "Indian Economy: Problems of Development and Planning", 41st Edition, New Age International Ltd., New Delhi, 2016.

REFERENCES

1. Arvind P, "India:The Emerging Giant", Oxford University Press, USA, 2008.
2. Government of India, Economic Survey, (2010 -11 to 2014 -15).

19TD06E INTERNATIONAL TRADE

L T P C
0 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: discuss the importance of international trade in developing countries.
CO 2: describe the impact of Trade agreements in international Business environment.
CO 3: explain the role of foreign exchange and their impact on trade and investment flows.
CO 4: discuss the benefits of Multinational Corporation in Internal Trade
CO 5: analyze the key role of globalisation in Indian economy.

UNIT I INTRODUCTION

International Marketing - Trends in International Trade - Reasons - Global Sourcing and Production Sharing - International Orientations - Internationalization Stages and Orientations - Growing Economic Power of Developing Countries – International Business Decision.

UNIT II INTERNATIONAL BUSINESS ENVIRONMENT

Trading Environment - Commodity Agreements – State Trading - Trading Blocks and Growing Intra-Regional Trade - Regional Groupings – SAARC, BRICS, ECM, ASEAN - Trade Liberalization - The Uruguay Round-Evaluation – UNCTAD – GATT – WTO.

UNIT III INTERNATIONAL FINANCIAL ENVIRONMENT

International Money and Capital Markets - Foreign Investment Flows – Pattern, Structure and Effects - Movements in Foreign Exchange and Interest Rates and their Impact on Trade and Investment Flows - Exchange Rate Mechanism and Arrangement.

UNIT IV MULTINATIONAL CORPORATIONS

Definition - Organizational Structures - Dominance of MNC's - Recent Trends - Code of Conduct - Multinationals in India - Issue in Investment, Technology Transfer, Pricing and Regulations - International Collaborations and Strategic Alliances.

UNIT V INDIA IN THE GLOBAL SETTING

India an Emerging Market - India in the Global Trade - Liberalization and Integration with Global Economy - Factors Favouring and Resisting Globalization - Trade Policy and Regulation in India - Trade Strategies - Export-Import Policy - Regulation and Promotion of Foreign Trade in India.

TEXT BOOKS

1. Daniels J.D, Radebaugh L.H, Sullivan D.P, “International Business: Environment and Operations”, 12th Edition, Prentice Hall, USA, 2009.
2. Ricky W.G, Michael W.P, “International Business: A Managerial Perspective”, Prentice Hall, USA, 2009.

REFERENCES

1. Bhattacharya B, Varshney R.L, “International Marketing Management”, 25th Revised Edition, S. Chand & Sons, New Delhi, 2015.
2. Verma M.L, “International Trade”, Common wealth Publisher, New Delhi, 2010.

19TD07E GLOBAL CHALLENGES AND ISSUES

L T P C
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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the various global issues.
CO 2: demonstrate a reasonable understanding of environmental debates and issues.
CO 3: explain the developmental issues relating to food, health and energy.
CO 4: demonstrate the economical issues in international trade.
CO 5: describe the civilization issues relating to human rights and social justice.

UNIT I SECURITY ISSUES

Nuclear Issues - Global and South Asian Context - Small Weapons Proliferation and Internal Arms Race - Chemical and Biological Weapons – Terrorism - Causes, Consequences And Trends - Cyber Terrorism – Counter Terrorism.

UNIT II ENVIRONMENTAL ISSUES

Global Warming and Climate Change - Threats to Bio-Sphere and Space - Pollutions, De-Forestation, Solid, Chemical and Nuclear Wastes and their Management - Preserving the Green Cover and Wild Life.

UNIT III DEVELOPMENTAL ISSUES

Food Security - Poverty and Hunger - Energy Security - Supply and Demand - Traditional and Alternative Sources of Energy – ITER - Health Security – Health for all - Development Vs. Environment - Sustainable Development.

UNIT IV ECONOMIC ISSUES ON INTERNATIONAL TRADE

International Trade - GATT, WTO - Regional Associations - ECM, ASEAN, OPEC, BRICS - Financial Crisis - ASEAN, Mexico and Greece - Global Issues in Trade and Commerce.

UNIT V CIVILIZATION ISSUES

Human Rights - Issues Relating to Freedom of Speech and Expression - Right to Self Determination - Preservation of Cultures and Cultural Diversities - Rights of Women and Children - Dividends of Globalization and Social Justice – Good Governance.

TEXT BOOKS

1. Payne R, "Global Issues", 4th Edition, Pearson Education Ltd., New York, 2013.
2. Owens P, Baylis J, Smith S, "The Globalization of World Politics", 3rd Edition, Oxford University Press, USA, 2013.

REFERENCE

1. Chirco J.A, "Globalization: Prospects and Problems", Sage Publications, New Delhi, 2013.

19TD08E INDIAN CULTURE AND HERITAGE

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe Indian culture, civilization and its features.
CO2: demonstrate stone age, Indian races and their contribution in pre-historic culture.
CO3: explain historical development of Indian culture.
CO4: explain the significance, conditions and development of Vedic culture.
CO5: analyze the advent of Islam and European culture.

UNIT I INTRODUCTION

Introduction to Culture - Meaning and Scope - Culture and Civilization - General Characteristics Features of Indian Culture - Geographical Impact on Indian Culture.

UNIT II PRE-HISTORIC CULTURE

Dravidian Culture - Old Stone Age - New Stone Age - Metal Age - Indian Races and their Contribution to Indian Culture.

UNIT III HISTORICAL DEVELOPMENT OF INDIAN CULTURE

Indus Valley Culture - City Planning - Social and Religious Conditions - Vedic and Later Vedic Cultures - Dharmasastras and Caste Systems - Comparison of Indus and Vedic Culture - IMPORTANCE of Indus Valley and Vedic Cultures.

UNIT IV CULTURE IN SANGAM AGE AND POST SANGAM AGE

Sangam Literature - Society - Political and Economical Conditions - Trade - Religion and Fine Arts.

UNIT V ADVENT OF ISLAM AND EUROPEAN CULTURE

Impact on Indian Culture and Heritage – Reform Movements - Brahma Samaj, Ariya Samaj, Self Respect Movement – Post Colonial Development.

TEXT BOOKS

1. Luniya B.N, "Evolution of Indian Culture", Lakshmi Narain Agarwal Publishers, Agra, 1986.
2. Jeyapalan N, "History of Indian culture", Atlantic publishers, New Delhi, 2001.
3. Sharma H.C, "Indian Culture and Heritage", Neha Publishers & Distributors, New Delhi, 2012.

REFERENCES

1. John G.A, "Dictionary of Indian Philosophy (Sanskrit-English)", University of Madras, Madras, 1998.
2. Misra R.S, "Studies in philosophy and Religion", Bharathiya Vidya Prakasans, Varanasi, 1991.
3. Misra S.K, "Culture and Rationality", Sage publications India Pvt. Ltd., New Delhi, 1988.
4. Suda J.P, "Religious in India", Sterling Publishers Pvt. Ltd., New Delhi, 1978.

19TD09E INDIAN HISTORY

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: illustrate the basics of Indian cultural heritage.
- CO2: describe interaction between Ancient Indian cultural heritage and Islamic culture.
- CO3: demonstrate Innovation by rulers of medieval period in the area of Administration, and their contact with the Europeans.
- CO4: analyse modern Indian movements, Economic history and Impact of the British rule on India.
- CO5: demonstrate the concepts of Indian National Movement and the history of freedom struggle in India.

UNIT I ANCIENTY INDIAN CULTURE

Ancient Indian Cultural Heritage - Social, Political, Legal and in the Area of Religion and Philosophy.

UNIT II LAW RELATING TO CULTURE

Law Givers and Dispute Resolution Systems in Ancient India (Administration of Justice in Ancient India - Pre-Islamic Period) - Law Relating to Culture - The Advent of Islam - Interaction between Ancient Indian Cultural Heritage and Islamic Culture - The Emergence of Synthetic Indian Culture.

UNIT III ADMINISTRATION IN ANCIENT INDIA

Innovation by Rulers of Medieval Period in the Area of General and Revenue

Administration - District Administration - Court Systems - Indian Contact with the Europeans.

UNIT IV SOCIO-ECONOMIC HISTORY

Socio-Religious Reform Movements in Modern India and its Legal Culture - Economic History of India During British Period - Impact of the British Rule on India – Education.

UNIT V EUROPEAN CULTURE IMPACT

Impact of European Culture and Liberal Thought on India – The Indian National Movement - The History of Freedom Struggle in India upto 1947.

TEXT BOOKS

1. Sreenivasa M.H.V, "History of India Part I and II", JBA Publishers, New Delhi, 2015.
2. Agarwal R.C, Bhatnagar M, "Constitutional Development and National Movement of India", S. Chand Publishers, New Delhi, 2005.

REFERENCES

1. Altekar S, "State and Government in Ancient India", Motilal Banarsidass Publishers, New Delhi, 2002.
2. Majumdur R.C, "History and Culture of the Indian People", Vol. 2, The Age of Imperial Unity, Bharatiya Vidya Bhavan, New Delhi, 2001

19TD10E SUSTAINABLE DEVELOPMENT AND PRACTICES

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: recognize the sustainable development and the way to achieve the sustainable development.
- CO 2: outline the concept, factors governing the sustainability and their linkages.
- CO 3: explain the environmental impact assessment and environmental audit.
- CO 4: describe the environmental planning and managing the resources.
- CO 5: acquire the knowledge about the environmental problems and their solutions.

UNIT I SUSTAINABLE DEVELOPMENT

Need for Sustainability - Nine Ways to Achieve Sustainability - Economics as the Dismal Science - Population, Resources and Environment.

UNIT II CHALLENGES OF SUSTAINABLE DEVELOPMENT

Concept of Sustainability - Factors Governing Sustainable Development - Linkages among Sustainable Development, Determinants of Sustainable Development - Case Studies on Sustainable Development.

UNIT III ENVIRONMENT IMPACT ASSESSMENT AND AUDIT

Concepts-process-evaluation methodology-EIA and EMS integration-setting up of audit programme - typical audit process - carrying out the audit-benefits of environmental auditing-environmental audit programmes in India.

UNIT IV ENVIRONMENTAL PLANNING

Introduction - Perspective of Environmental Planning - land resource development planning - Planning and managing the natural resources - landscape ecological planning - information and decision of environmental planning - Land use policy in India.

UNIT V ENVIRONMENTAL EDUCATION

Knowledge about the environment - Knowledge about the environment and population growth -Knowledge about the solution and environmental problems - Environmental education (EE) – Strategies for EE – Models for future Environmental Education Systems.

TEXT BOOKS

1. Rogers P, Jalal K.F, Boyd J.A, “An Introduction to Sustainable Development”, Earth scan Publications Ltd., UK, 2006.
2. Santra S.C,” Environmental Science”, 3rd Edition, New Central Book Agency (P) Ltd., London, 2013.

REFERENCES

1. Stavins R.N. “Economics of the Environment: Selected Readings”, 5th Edition, W.W. Norton and Company, New York, 2005.
2. Sachs J.D, “The Age of Sustainable Development”, Columbia University Press, New York, 2015.

19TD11E WOMEN IN INDIAN SOCIETY L T P C

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Demonstrate historical perspective about women in Indian society.
CO2: Explain social problems of women.
CO3: Understand the legislation for women protection in India.
CO4: Demonstrate the involvement of women literacy, career and politics.
CO5: Analyse the role of NGO’s in women empowerment.

UNIT I INTRODUCTION

A Historical Perspective - Early Vedic, Colonial and Modern Periods - Position of Women in Contemporary India.

UNIT II SOCIAL ISSUES

Issues of Girl Child - Female Infanticide and Foeticide, Sex Ratio, Child Marriage, Dowry and Property Rights - Women's Health and Birth Control - Reproduction - Violence against Women - Domestic Violence - Female Headed Households - Women in the Unorganized Sector of Employment - Women's Work- Status and Problems - Problems of Dalit Women.

UNIT III PROTECTIVE LEGISLATION FOR WOMEN

Protective Legislation for Women in the Indian Constitution - Anti Dowry, SITA, PNDT, And Prevention Sexual Harassment At Workplace (Visaka Case) - Domestic Violence (Prevention) Act.

UNIT IV WOMEN AND EDUCATION

Formal and Non-Formal Literacy - Post Literacy - Vocational Training - Dual Career Modernization – Women and Politics - Political Status - Global Movements and Indian Movements.

UNIT V ROLE OF NGO'S IN WOMEN EMPOWERMENT

Gender Economy - All India Women's Conference (AIWC) – Women's India Association (WIA) - National Council of Women in India (NCWIE) - Indian Association of Women's Studies – Women Development Cells - Self Help Groups.

TEXT BOOKS

1. Majumdar M, "Social Status of Women in India", Wisdom Press, New Delhi, 2012.
2. Harish R, Harishankar V.B, "Re-Defining Feminisms", Rawat Publications, Jaipur, 2011.

REFERENCES

1. Rathod P.B, "An Introduction to Women's Studies", ABD Publishers, Jaipur, 2010.
2. Ray R, "Hand Book of Gender", Oxford University Press, New Delhi, 2012.

19TD12E BIO MECHANICS IN SPORTS

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COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1**:** discuss the basics of biomechanics in sports & movement technique accurately.
CO2**:** discuss the basics of linear kinematics and its applications in the field of sports.
CO3: demonstrate the linear kinematics in the field of sports.
CO4**:** discuss the basics of angular kinematics and its applications in the field of sports.
CO5: demonstrate the angular kinematics in the field of sports.

UNIT I INTRODUCTION

Meaning, Aim and Objectives, Importance of Biomechanics in Sports - Types of Motion Linear, Angular, Curvilinear and Circular Motion.

UNIT II LINEAR KINEMATICS

Speed, Velocity, Acceleration, Motion, Projectile Motion – Application of Linear Kinematics in The Field of Physical Education and Sports.

UNIT III ANGULAR KINEMATICS

Angular Speed - Angular Velocity - Angular Acceleration - Relationship between Linear and Angular Motion – Application of Angular Kinematics in the Field of Physical Education and Sports.

UNIT IV LINEAR KINETICS

Mass, Weight, Force, Pressure, Work, Power, Energy, Impulse, Momentum, Impact, Friction, Newton's Law of Motion - Law of Inertia and Types of Inertia.

UNIT V ANGULAR KINETICS

Levers, Equilibrium and Centre of Gravity – Friction and its Types, Centrifugal and Centripetal Force Bio Mechanical Principles Involved in Designing Sports Equipments.

TEXT BOOKS

1. Singh S.K, "Biomechanics in Sports", Neha Publishers & Distributors, New Delhi, 2009.
2. McGinnis P.M, "Biomechanics of Sports and Exercise", 2nd Edition, Human Kinetics Publishers, USA, 2004.

REFERENCES

1. Saxena A, "Biomechanics in Sports", Neha Publishers & Distributors, New Delhi, 2011.
2. Heyward V.H, Gibson A.L, "Advanced Fitness Assessment and Exercise Prescription", 7th Edition, Human Kinetics, USA, 2014.