NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai)

K.R.NAGAR, KOVILPATTI – 628 503

www.nec.edu.in

REGULATIONS - 2013

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM AND SYLLABI OF

B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING

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.

Program Educational Objectives (PEO)

- Excel in industrial or graduate work in Electrical Engineering and allied fields
- Practice their profession conforming to ethical values and active participation in the affairs of the profession
- Adapt to evolving technologies and stay current with their profession

Program Outcomes (PO)

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. Apply knowledge of mathematics, natural science, engineering fundamentals, power electronics and drives, power and energy systems, high voltage engineering, control and instrumentation, applied electronics to the solution of complex problems in Electrical and Electronics Engineering.
2. Identify, formulate, research literature and analyze complex Electrical and Electronics Engineering problems in power electronics and drives, power and energy systems, high voltage engineering, control and instrumentation, applied electronics problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. Design solutions and design systems/components/processes for complex problems in power electronics and drives, power and energy systems, high voltage engineering, control and instrumentation, applied electronics problems that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. Conduct investigations of complex power electronics and drives/ power and energy systems/high voltage engineering/control and instrumentation/ applied electronics 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 modeling, to complex power electronics and drives, power and energy systems, high voltage engineering, control and instrumentation engineering, applied electronics problems 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 and solutions to complex electrical and electronics engineering problems.
7. Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex electrical and electronics engineering problems in societal and environmental contexts.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of electrical and electronics engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary 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.

REGULATIONS 2013 – CURRICULUM AND SYLLABI

B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING

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

S. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	SH100	Technical English – I	3	1	0	4
2.	SH101	Matrices and Differential Calculus	3	1	0	4
3.	SH102	Applied Physics	3	0	0	3
4.	SH103	Engineering Chemistry	3	0	0	3
5.	SH104	Fundamentals of Computing and Programming in C	3	0	0	3
6.	SH105	Engineering Graphics	2	3	0	4
PRACTICAL						
7.	SH106	C Programming Laboratory	0	0	3	2
8.	SH107	Physics and Chemistry Laboratory – I Part A – Physics Laboratory – I Part B – Chemistry Laboratory – I	0	0	3	2
9.	SH108	Engineering Practices Laboratory Part A – Mechanical and Civil Engineering Practices Part B – Electrical and Electronics Engineering Practices	0	0	3	2
		Total Number of Credits :				**27**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	13D20	Technical English – II (***Common to all***)	3	0	0	3
2.	13D21	Integral Calculus and Transforms (***Common to all***)	3	1	0	4
3.	13D22	Solid State Physics (***Common to ECE, CSE, EEE, EIE, and IT***)	3	0	0	3
4.	13D23	Chemistry of Electrical and Electronic Materials (***Common to ECE, CSE, EEE, EIE and IT***)	3	0	0	3
5.	13D24	Circuit Theory (***EEE***)	3	1	0	4
6.	13D25	Basic Civil and Mechanical Engineering (***Common to ECE, CSE, EEE, EIE and IT***)	4	0	0	4
PRACTICAL						
7.	13D26	Computer Programming Laboratory (***Common to all***)	0	1	2	2
8.	13D27	Physics and Chemistry Laboratory – II (***Common to all***) Part A – Physics Laboratory – II Part B – Chemistry Laboratory – II	0	0	3	2
9.	13D28	Electric Circuits Laboratory (***Common to EEE and EIE***)	0	0	3	2
10.	13D29	English Language Skill Laboratory (***Common to all***)	0	0	3	2
		Total Number of Credits :				**29**

SEMESTER III

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	13EE31	Fourier Transforms and Complex Analysis	3	1	0	4
2	13EE32	Environmental Science and Engineering	3	0	0	3
3	13EE33	DC Machines and Transformers	3	1	0	4
4	13EE34	Electromagnetic Field Theory	3	1	0	4
5	13EE35	Renewable Energy Systems	3	0	0	3
6	13EE36	Electron Devices and Circuits	3	1	0	4
PRACTICALS						
7	13EE37	DC Machines and Transformers Laboratory	0	0	3	2
8	13EE38	Electron Devices and Circuits Laboratory	0	0	3	2
			18	**4**	**6**	**26**
		Total Number of Credits				**26**

SEMESTER IV

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	13EE41	Numerical Methods, Mathematical Logic, Probability and Statistics	3	1	0	4
2	13EE42	AC Rotating Machines	3	1	0	4
3	13EE43	Electrical Measurements and Instrumentation	3	0	0	3
4	13EE44	Linear Integrated Circuits and its Applications	3	0	0	3
5	13EE45	Digital Logic Circuits	3	1	0	4
6	13EE46	Signals and Systems	3	1	0	4
PRACTICALS						
7	13EE47	AC Rotating Machines Laboratory	0	0	3	2
8	13EE48	Integrated Circuits Laboratory	0	0	3	2
9	13EE49	Communication Skills and Technical Seminar	0	0	3	2
			18	**4**	**9**	**28**
		Total Number of Credits				**28**

SEMESTER V

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	13EE51	Transmission and Distribution	3	1	0	4
2	13EE52	Data Structures and Algorithms	3	0	0	3
3	13EE53	Digital Signal Processing and its Applications	3	1	0	4
4	13EE54	Control Engineering	3	1	0	4
5	13EE55	Professional Ethics and Human Values (Common to all branches)	3	0	0	3
6	13EE56	High Voltage Engineering	3	0	0	3
PRACTICALS						
7	13EE57	Control and Instrumentation Laboratory	0	0	3	2
8	13EE58	Data Structures and Algorithms Laboratory	0	0	3	2
			18	**3**	**6**	**25**
		Total Number of Credits				**25**

SEMESTER VI

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	13EE61	Power System Analysis	3	1	0	4
2	13EE62	Design of Electrical Apparatus	3	1	0	4
3	13EE63	Microprocessor and Microcontroller and its Applications	3	1	0	4
4	13EE64	Power Electronics	3	0	0	3
5	13EE65	Object Oriented Programming	3	0	0	3
6		Elective - I	3	0	0	3
PRACTICALS						
7	13EE67	Power Electronics Laboratory	0	0	3	2
8	13EE68	Microprocessor and Microcontroller Laboratory	0	0	3	2
9	13EE69	Object Oriented Programming Laboratory	0	0	3	2
			18	**3**	**9**	**27**
		Total Number of Credits				**27**

SEMESTER VII

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	13EE71	Principles of Management (Common to all branches)	3	0	0	3
2	13EE72	Solid State Drives	3	1	0	4
3	13EE73	Protection and Switchgear	3	0	0	3
4	13EE74	Embedded System Design	3	0	0	3
5		Elective - II	3	0	0	3
6		Elective - III	3	0	0	3
PRACTICALS						
7	13EE77	Power System Simulation and High Voltage Laboratory	0	0	3	2
8		Elective Laboratory	0	0	3	2
9	13EE78	Comprehension	0	0	3	1
			18	**1**	**9**	**24**
		Total Number of Credits				**24**

SEMESTER VIII

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	13EE81	Utilization and Conservation of Electrical Energy	3	0	0	3
2	13EE82	Special Electrical Machines	3	0	0	3
3		Elective - IV	3	0	0	3
4		Elective - V	3	0	0	3
PRACTICAL						
5	13EE87	Project Work	0	0	12	6
			12	**0**	**12**	**18**
		Total Number of Credits				**18**

LIST OF ELECTIVES

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
POWER ELECTRONICS AND DRIVES						
1	13EEAA	Switched Mode Power Conversions	3	0	0	3
2	13EEAB	Power Electronics for Renewable Energy Systems	3	0	0	3
3	13EEAC	CAD of Electrical Apparatus	3	0	0	3
4	13EEAD	Design of Power converters	0	0	3	2
POWER AND ENERGY SYSTEMS						
5	13EEBA	Power Plant Engineering	3	0	0	3
6	13EEBB	Power System Operation and Control	3	0	0	3
7	13EEBC	Power System Transients	3	0	0	3
8	13EEBD	Solar Photovoltaic Fundamentals and Applications (Common to MECH, EEE and EIE)	3	0	0	3
9	13EEBE	Energy Auditing and Management	3	0	0	3
10	13EEBF	Power Quality	3	0	0	3
11	13EEBG	Energy Laboratory	0	0	3	2
HIGH VOLTAGE ENGINEERING						
12	13EECA	Electromagnetic Interference and Electromagnetic Compatibility	3	0	0	3
13	13EECB	Insulation Technology	3	0	0	3
14	13EECC	Fundamentals of Nano Technology	3	0	0	3
15	13EECD	Flexible AC Transmission	3	0	0	3
16	13EECE	EHV Power Transmission	3	0	0	3
17	13EECF	High Voltage DC Transmission	3	0	0	3
CONTROL AND INSTRUMENTATION						
18	13EEDA	Robotics and Automation (Common to EIE and EEE)	3	0	0	3
19	13EEDB	Linear and Nonlinear Control Systems	3	0	0	3
20	13EEDC	PLC, DCS and SCADA	3	0	0	3
21	13EEDD	Medical Instrumentation	3	0	0	3
22	13EEDE	Advanced Control Theory	3	0	0	3
23	13EEDF	Soft Computing for Electrical Engineering	3	0	0	3
24	13EEDG	Fibre Optics and Laser Instruments (Common to EIE and EEE)	3	0	0	3
25	13EEDH	PLC and DCS Laboratory	0	0	3	2
26	13EEDJ	Soft computing for Electrical Engineering Laboratory	0	0	3	2
EMBEDDED SYSTEMS						
27	13EEEA	VLSI Design (Common to EIE and EEE)	3	0	0	3
28	13EEEB	DSP based System Design	3	0	0	3
29	13EEEC	MEMS and NEMS	3	0	0	3
30	13EEED	Real Time Operating Systems	3	0	0	3
31	13EEEE	Embedded System Laboratory	0	0	3	2

INTER DISCIPLINARY						
32	13EEFA	Principles of Communication Systems	3	0	0	3
33	13EEFB	Operating Systems	3	0	0	3
34	13EEFC	Cloud Computing (Common to CSE, IT, EEE and ECE)	3	0	0	3
35	13EEFD	Computer Architecture	3	0	0	3
36	13EEFE	Mobile Computing (Common to IT, EEE and ECE)	3	0	0	3
AUXILIARY SUBJECT						
37	13EEHA	Mini Project	0	0	3	2

TRANS DISCIPLINIARY ELECTIVES

S. No.	Course Code	Course Title	L	T	P	C
Any one of the following course is compulsory						
1.	13TD01	Indian Business Laws	0	0	0	3
2.	13TD02	Leadership and Personality Development	0	0	0	3
3.	13TD03	International Business Management	0	0	0	3
4.	13TD04	Basics of Marketing	0	0	0	3
5.	13TD05	Retailing and Distribution management	0	0	0	3
6.	13TD06	International Economics	0	0	0	3
7.	13TD07	Indian Economy	0	0	0	3
8.	13TD08	Rural Economics	0	0	0	3
9.	13TD09	International Trade	0	0	0	3
10.	13TD10	Global Challenges and issues	0	0	0	3
11.	13TD11	Indian Culture and Heritage	0	0	0	3
12.	13TD12	Indian History	0	0	0	3
13.	13TD13	Sustainable Development and Practices	0	0	0	3
14.	13TD14	Women in Indian Society	0	0	0	3
15.	13TD15	Indian Constitution	0	0	0	3
16.	13TD16	Bio Mechanics in Sports	0	0	0	3

SH100 TECHNICAL ENGLISH – I
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
3 1 0 4

COURSE OUTCOMES

The Student will

- apply basic grammar in Writing and Speaking.
- prepare formal Letter Writings.
- come out with proper pronunciation.
- speak confidently in interactions.
- develop interest to read any article.

UNIT I **12**

Language Focus: Technical Vocabulary, Word Formation, Concord, Tense (Present).
Writing: Leave Application Letter, Paragraph writing.
Listening: Listening to correct pronunciation of words.
Speaking: Self - Introduction, Greetings.

UNIT II **12**

Language Focus: Words often misspelled, Articles, Tense (Past)
Writing: Permission letters (In-plant training/Seminar/Workshop), Chart description.
Listening: Listening to the Sentences with correct stress and Intonation.
Speaking: Situational Conversations.

UNIT III **12**

Language Focus: Compound nouns, Tense (Future), Preposition, Comparative Adjectives.
Writing: Invitation Letter, Acceptance Letter, Declining Letter.
Listening: Listening to the conversations.
Speaking: One minute speech.

UNIT IV **12**

Language Focus: Modal verbs, Gerund, Infinitives, Voice.
Writing: Writing Instructions, Letters to Editor.
Listening: Listening to the different Tonal Expressions.
Speaking: Giving Opinions.

UNIT V **12**

Language Focus: 'If' Conditionals, 'Wh' questions, Question Tags.
Writing: Reading and Note - taking
Speaking: Group Discussion.
Reading: ERC, one word questions from the suggested book.

SUGGESTED ACTIVITIES

1. Matching words and meanings – Using words in context – Making sentences.
2. Exercises on gap filling and correction of errors on Concord (Subject – Verb Agreement).
3. Gap filling exercises using the appropriate Tense forms.
4. Exercises on transferring information from Graph to Text – Bar charts, Flow charts.
5. Making sentences using Modal verbs to express probability, compulsion, etc.
6. Exercises on Writing Instructions.
7. Exercises on framing Questions.
8. Other relevant classroom activities.

L: 45 T: 15 TOTAL: 60 PERIODS

BOOK SUGGESTED FOR READING

1. R.K.Narayanan, “Malgudi Days”, Indian Thought Publications, 1943.

REFERENCES

1. Rizvi. M. Ashraf, “Effective Technical Communication”, McGraw Hill Companies, 2005.
2. P.K.Dutt, G.Rajeevan and C.L.N. Prakash, “A Course in Communication Skills”, Cambridge University Press India, 2007.
3. Andrea.J.Rutherford, “Basic Communication Skills for Technology”, Pearson Education, 2nd Edition, 2007.

SH101 MATRICES AND DIFFERENTIAL CALCULUS
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
3 1 0 4

COURSE OUTCOMES

- Ability to find inverse and integral powers of matrices and to perform transformations of matrices.
- Ability to find the evolutes of various curves.
- Ability to solve ordinary and partial differential equations.
- Ability to obtain constrained maxima and minima.

UNIT I MATRICES 12

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties (excluding proofs); Cayley – Hamilton theorem (excluding proof) – Inverse and integral powers of a matrix using Cayley – Hamilton theorem; Diagonalisation of a matrix by orthogonal transformation; Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS 12

Curvature in cartesian, parametric and polar forms; Centre, radius and circle of curvature; Evolutes.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives; Total derivatives; Differentiation of implicit functions; Jacobians; Maxima and Minima - Method of Lagrangian multipliers.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients; Method of variation of parameters; Cauchy's and Legendre's linear equations; Simultaneous first order linear equations with constant coefficients.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations; Lagrange's linear equations; Solutions of standard types of first order partial differential equations; 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", Khanna Publications, Delhi, 40th Edition, 2007.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 8th Edition, Reprint 2011.

REFERENCES

1. Bali N. P. and Manish Goyal, "Text book of Engineering Mathematics", Laxmi Publications Private Limited, 7th Edition, Reprint, 2010.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
3. Jain.R.K. and Iyengar.S.R.K., "Advanced Engineering Mathematics", Narosa Publishing House Private Limited, 3rd Edition, 2007.
4. Veerarajan.T., "Engineering Mathematics for semester I and II", Tata McGraw Hill Education Private Limited, New Delhi, 3rd Edition, 2012.
5. Veerarajan.T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Private Limited, New Delhi, 2012.

SH102 APPLIED PHYSICS

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

L T P C
3 0 0 3

COURSE OUTCOMES

The students will be able to

- gain knowledge on the properties of matter and hydrodynamics.
- study and apply the ultrasonic methods for industrial and medical field.
- understand Lasers and to identify the appropriate Laser technique for industrial and medical field.
- understand the different types, fabrication, losses of optical fibers and the applications of fiber optics in communication and instrumentation.
- understand the physical properties of photons and electrons and to study the different Electron Microscopes.

UNIT I PROPERTIES OF MATTER AND HYDRODYNAMICS 9

Properties of Matter

Stress, Strain, Hooke's law; Types of moduli of elasticity; Torsional pendulum – Determination of Rigidity modulus of a wire; Bending of beams – Expression for bending moment – Measurement of Young's modulus by uniform and Non- uniform bending – I Shaped girders.

Hydrodynamics

Stream line flow, Turbulent flow, Poiseuille's formula for flow of liquid through a capillary tube, Determination of coefficient of viscosity of a liquid.

UNIT II ULTRASONICS 9

Production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezoelectric generator; Detection of ultrasonic waves; Properties – Cavitations – Velocity measurement – acoustic grating; Industrial applications – drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes – A,B and C scan displays; Medical applications – Sonograms.

UNIT III LASERS 9

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – derivation; Types of Lasers - CO_2 Laser, Nd-YAG Laser, Semiconductor Laser (Homojunction); Determination of wavelength of Laser using grating and Particle size; Applications of Lasers: Industrial applications – Welding, Cutting and Heat treatment; Medical applications; Holography (construction and reconstruction).

UNIT IV FIBER OPTICS AND ITS APPLICATIONS 9

Principle and propagation of light in optical fibers; Numerical aperture and Acceptance angle; Types of optical fibers – material, refractive index and mode; Double crucible technique of fiber drawing; Splicing – fusion splicing; Loss in optical fiber – attenuation, dispersion and bending; Fiber optical communication system (Block diagram); Advantages and Applications of optical fiber; Fiber optic sensors – temperature and displacement; Endoscope.

UNIT V QUANTUM PHYSICS AND MICROSCOPY 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh Jean's Law from Planck's theory; Photoelectric effect – Law of Photoelectric effect – Photoelectric equation; Matter Waves – De Broglie wavelength - Schrodinger's wave equation – time independent and time dependent equations – Particle in one dimensional box; Heisenberg's Uncertainty principle; Linear Harmonic oscillator; Electron microscope – scanning electron microscope – transmission electron microscope.

TOTAL: 45 PERIODS

TEXT BOOKS

1. R.K.Gaur and S.C.Gupta, "Engineering Physics", Dhanpat Rai Publications, New Delhi, 2009.
2. M.Arumugam, "Engineering Physics", Anuradha Publishers, 2010.

REFERENCES

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", John Wiley and Sons, Inc., USA, 9th Edition, 2013.
2. Arthur Beiser, "Concepts of Modern Physics", McGraw Hill Publications Private Limited, 5th Edition, 2008.
3. Richard P.Feynmann, Robert B.Leighton and Mathew Sands, "Feynmann's Lectures on Physics", Addison Wesley Publication, USA, 2010.
4. Yoav Peleg, Reuven Pnini, Elvahu Zaarur, Eugene Hecht, "Schaum's Outline of Quantum Mechanics", McGraw Hill Companies Limited, USA, 2nd Edition, 2010.

SH103 ENGINEERING CHEMISTRY
(Common to all B.E. / B.Tech., Degree Programmes)

L	T	P	C
3	0	0	3

COURSE OUTCOMES

The students will be able to

- select suitable water treatment techniques for industrial and domestic purpose.
- acquire knowledge of electrochemistry.
- apply the contextual knowledge of adsorption techniques for industrial applications.
- synthesize polymers for domestic and industrial applications.
- understand the knowledge of nano materials for their applications in Science and Engineering.

UNIT I WATER TREATMENT 9

Hardness: types of hardness, estimation of hardness of water – EDTA method – problems; disadvantages of hard water: scales and sludges – disadvantages of scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; domestic water treatment: screening, sedimentation, coagulation, filteration, disinfection – chlorine – UV method; water softening: demineralization process; desalination: definition, reverse osmosis.

UNIT II ELECTRO ANALYTICAL TECHNIQUES 9

Electrode potential: definition, measurement of electrode potential, Nernst equation – problems; EMF: definition, measurement of EMF – Poggendorff's method; reference electrode: standard hydrogen electrode, calomel electrode, glass electrode – measurement of pH using glass electrode; CO_2 sensing electrode; conductometric titrations: acid-base titration (HCI vs NaOH); potentiometric titrations: redox titration (Fe^{2+} vs $K_2Cr_2O_7$), precipitation titration (Ag^+ vs NaCl).

UNIT III CATALYSIS AND SURFACE PHENOMENA 9

Types of catalysis – homogeneous catalysis – heterogeneous catalysis, mechanism of catalytic action - contact theory, catalytic promoters, catalytic poison; enzyme catalysis: Michaelis-Menton equation; adsorption: definition, types – physical adsorption – chemical adsorption – differences between physical and chemical adsorption; adsorption isotherms: definition, Frendlich and Langmuir adsorption isotherms, applications of adsorption.

UNIT IV ENGINEERING POLYMERS 9

Polymerization – types of polymerization – addition – free radical addition polymerization mechanism – copolymerization – condensation polymerization; plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, teflon, perlon – U, backelite; rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.

UNIT V NANO MATERIALS 9

Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – fullerene; synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 15th Edition, 2005.
2. S.S.Dara, "A text book of Engineering Chemistry", S. Chand and Company Limited, New Delhi, 12th Edition, 2006.

REFERENCES

1. J.Hammer Mark, “Water and Waste water Technology”, Prentice Hall, New Arrivals, 2012.
2. G.Whitmore, “Electrochemistry and its Applications”, Sarup book publishers, New Delhi, 2009.
3. G.Whitmore, “Adsorption and Catalysis”, Sarup Book Publishers, New Delhi, 2008.
4. Fred.Bilmayer, “Text book of Polymer Science”, Wiley, 1st Edition, 2007.
5. T.Pradeep, “Nano – The Essential”, Tata McGraw Hill Education Private Limited, New Delhi, 2012.
6. S.C.Bhatia, “Engineering Chemistry”, CBS Publishers and Distributors, 1st Edition, 2011.

SH104 FUNDAMENTALS OF COMPUTING AND PROGRAMMING IN C
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
3 0 0 3

COURSE OUTCOMES
- Learn the major components of a computer system.
- Formulate the algorithms and analyze their complexity.
- Identify the correct and efficient ways of solving problems.
- Acquire knowledge about dynamic memory allocation, modular programming and data organization.
- Develop real time applications using the power of C language features.

UNIT I COMPUTER FUNDAMENTALS 10

Introduction – Characteristics of Computers – Evolution of Computers – Computer Generations – Classification of Computers – Basic Computer organization – Number Systems – Problem Analysis – Algorithms – Flow charts – Computer Software – Types of Software.

UNIT II BASIC C PROGRAMMING 9

Structure of C Program – Keywords, Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making – Branching and Looping.

UNIT III FUNCTIONS, ARRAYS AND POINTERS 9

Functions: User-defined functions – Definitions – Declarations - Call by reference – Call by value. Arrays: Declaration – Definition – Multidimensional Arrays – Functions with array as arguments. Pointers: Initialization – Pointers as Arguments – Pointers to Pointers – Dynamic Memory Management Functions.

UNIT IV STRUCTURES AND UNIONS 9

Derived types – Structures: Declaration – Definition – Initialization of structures – Accessing structures – Nested structures – Arrays of structures – Structures and functions – Pointers to structures – Self-referential structures – Unions.

UNIT V FILE HANDLING 8

File structure – binary and text files – File handling functions – File I/O — File Manipulations.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, Oxford University Press, 1st Edition, 2009.
2. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India), 2011.

REFERENCES
1. Ashok.N.Kamthane, “Computer Programming”, Pearson Education (India), 2008.
2. Stephen G.Kochan, “Programming in C”, Pearson Education (India), 3rd Edition, 2005.
3. Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc., 2005.

SH105 ENGINEERING GRAPHICS
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
2 3 0 4

COURSE OUTCOMES

- Students will be able to use the drawing instruments effectively.
- An ability to draw the basic engineering curves and problems related to projections of points, straight lines, planes and solids.
- Able to apply the knowledge acquired on practical applications of sectioning and development of solids.
- Able to draw simple solids and its sections in isometric view and projections and also to draw its perspective views.

Drawing Instruments – IS specifications on lines – drawing sheets – Printing letters and dimensioning – scales (not for examination) – First angle projection should be followed.

UNIT I PLANE CURVES 12

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloids – Epi and Hypo cycloids - construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of points and straight lines located in the first quadrant – Traces – Determination of true lengths and true inclinations.
Projection of regular polygonal surfaces and circular lamina inclined to any one reference plane.

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – obtaining true shape of section.
Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinder and cone – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale – isometric projections of simple solids – cube – prisms, pyramids, cylinder and cone in simple position only, truncated prisms, pyramids, cylinders and cones.
Perspective projection of prisms, pyramids and cylinders by visual ray method and vanishing point method.

TOTAL: 60 PERIODS

Note: In end semester examination from each unit one question with either or pattern may be asked. No short questions.

TEXT BOOK

1. N.D. Bhatt, "Engineering Drawing", Charotar Publishing House, 46th Edition, 2003.

REFERENCES

1. K.V.Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
2. M.S.Kumar, "Engineering Graphics", D.D. Publications, 2007.
3. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International Private Limited, 2008.
4. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, 2005.
5. K.R.Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, 1998.
6. Dhananjay A.Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw Hill Publishing Company Limited, 2008.
7. Basant Agarwal and Agarwal.C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

SH106 C PROGRAMMING LABORATORY
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
0 0 3 2

COURSE OUTCOMES

- Acquire logical thinking and problem solving skills.
- Implement the algorithms and analyze their complexity.
- Identify the correct and efficient ways of solving problems.
- Acquire hands on practice in dynamic memory allocation, modular programming and data organization.
- Implement real time applications using the power of C language features.

LIST OF EXPERIMENTS

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Finding the 2's complement of a binary number.
3. Generation of the first 'n' terms of the Fibonacci sequence and prime sequence.
4. Computing Sine series and Cosine series.
5. Given distance traveled by a vehicle as $\mathbf{d = ut + 1/2at^2}$, where 'u' and 'a' are the initial velocity and acceleration. Calculate the distance traveled for different time intervals.
6. Solving the roots of a quadratic equation.
7. Designing a simple arithmetic calculator. (Use switch statement)
8. Performing the following operations: (Use loop statement)
    i. Generate Pascal's triangle.
    ii. Construct a Pyramid of numbers.
9. Performing the following operations to a string:
    i. To insert a sub-string into main string at a given position.
    ii. To delete 'n' characters from a given position in a string.
    iii. To replace a character of string either from beginning or ending or at a specified location.
10. Performing the following operations: (Use arrays)
    i. Matrix addition.
    ii. Transpose of a matrix.
    iii. Matrix multiplication by checking compatibility.
11. Performing the following operations: (Use recursive functions)
    i. To find the factorial of a given integer.
    ii. To find the GCD (Greatest Common Divisor) of two given integers.
    iii. To solve Towers of Hanoi problem.
12. Performing the Student Information Processing using File Handling concepts.

TOTAL: 45 PERIODS

SOFTWARE REQUIREMENTS

- Turbo C/ ANSI C Compiler
- Gcc compiler

SH107 PHYSICS AND CHEMISTRY LABORATORY – I

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

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PART A – PHYSICS LABORATORY – I

COURSE OUTCOMES

At the end of the Laboratory classes, the students are able to

- develop collaborative learning skills and to add some of their own ideas to the experiments and their explanations.
- understand the optical properties, mechanical properties and electrical properties.

LIST OF EXPERIMENTS

1. (a) Particle size determination using Diode Laser.
   (b) Determination of Laser parameters – Wavelength, and angle of divergence.
   (c) Determination of Numerical aperture and acceptance angle of an optical fiber.
2. Determination of thickness of a thin wire – Air wedge method.
3. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
4. Determination of Dispersive power of a prism using Spectrometer.
5. Determination of Young's modulus – Non-uniform bending method.
6. Determination of coefficient of viscosity of liquid – Poiseuille's method.
7. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.

• A minimum of FIVE experiments shall be offered.

PART B - CHEMISTRY LABORATORY – I

COURSE OUTCOMES

The student

- can estimate the amount of hardness and acidity present in the water sample.
- gain knowledge about the estimation of nickel in an alloy.
- quantify the electrolyte by measuring the conductance and pH.

LIST OF EXPERIMENTS

1. Estimation of hardness of Water sample by EDTA method.
2. Estimation of acidity of Water sample.
3. Estimation of Nickel by EDTA method.
4. Conductometric titration (HCl Vs NaOH).
5. Conductometric titration ($BaCl_2$ Vs Na_2SO_4).
6. pH metric titration (HCl Vs NaOH).
7. Determination of molecular weight and degree of polymerization using Viscometry.

• A minimum of FIVE experiments shall be offered.

• Laboratory classes on alternate weeks for Physics and Chemistry.

TOTAL: 45 PERIODS

SH108 ENGINEERING PRACTICES LABORATORY
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
0 0 3 2

COURSE OUTCOMES

- Students will be able to prepare the pipe connections and identify the various components used in plumbing.
- An ability to prepare simple wooden joints using wood working tools.
- An ability to prepare simple lap, butt and tee joints using arc welding equipments.
- An ability to prepare simple components using lathe and drilling machine.

PART A – MECHANICAL AND CIVIL ENGINEERING PRACTICES

I PLUMBING WORKS: **5**
Study of components related to plumbing.
Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

II CARPENTRY PRACTICES: **6**
Study of the joints in roofs, doors, windows and furniture.
Hands-on-exercise:
Wood work, joints by sawing, planning and cutting.

III WELDING: **5**
Study of the tools used in welding Gas welding practice.
Preparation of butt joints, lap joints and tee joints using arc welding.

IV BASIC MACHINING: **7**
(a) Simple Turning and Taper turning.
(b) Drilling Practice.

REFERENCES

1. Ramesh Babu.V., "Engineering Practices Laboratory Manual", VRB Publishers Private Limited, Chennai, Revised Edition, 2013 – 2014.
2. Jeyachandran.K., Natarajan.S. and Balasubramanian.S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
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.

PART B – ELECTRICAL AND ELECTRONICS ENGINEERING PRACTICES

COURSE OUTCOMES

- An ability to develop familiarity with rudimentary measurement equipment – signal generators, oscilloscopes, multimeters and power supplies.
- Ability to demonstrate and evaluate the parameters of basic electronic components (wires, resistors, capacitors, diodes etc.) based on their physical parameters and dimensions.
- Define, describe, and analyze fundamentals of Boolean algebra and digital logic gates.
- An ability to predict qualitatively and quantitatively compute the steady state AC responses of basic circuits using the phasor method.
- Gain experience in the documentation of measurements and procedures as well as the preparation of formal reports.

I ELECTRICAL ENGINEERING PRACTICE 10

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair-case wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

II ELECTRONICS ENGINEERING PRACTICE 12

1. Study of Electronic components and equipments – Resistor, colour coding, measurement of AC signal parameters (peak-peak, rms period, frequency) using CRO
2. Study of logic gates AND, OR, XOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

REFERENCES

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

13D20 TECHNICAL ENGLISH – II

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

L T P C
3 0 0 3

COURSE OUTCOMES

The student will be able to

- apply correct form of language while Speaking and Writing.
- prepare his own Professional letter writings.
- interpret any passage after listening.
- interact at different situations fluently.

UNIT I **10**

Language Focus: Homonyms, Different grammatical forms of the same word, correct usage of words / phrases.
Writing: Recommendation writing.
Listening: Interpreting Poetic lines.
Speaking: Telephone English.

UNIT II **9**

Language Focus: Cause and Effect, Phrasal Verbs.
Writing: Quotation letter, Clarification Letter, Placing orders, Complaint Letter.
Listening: Conversations.
Speaking: Asking questions.

UNIT III **9**

Language Focus: Idioms and Phrases with animal names.
Writing: Checklist, Process Description.
Speaking: Presentations.

UNIT IV **9**

Language Focus: Technical Definitions, Transformation of Sentences.
Writing: Job Application Letter, Curriculum Vitae, Bio-data, Resume.
Speaking: Mock Interview.

UNIT V **8**

Language Focus: British and American Vocabulary, Numerical Expressions.
Writing: E-mail Writing, Report Writing.
Speaking: Group Discussion.

SUGGESTED ACTIVITIES

1. Making sentences using different grammatical forms of the same word.
2. Exercises on combining sentences using Cause and Effect expressions.
3. Writing Formal Letters.
4. Writing exercises on Recommendations.
5. Exercises on Idioms and Phrases.
6. Exercises on preparing letter of Job Application with annexure.
7. Exercises on British and American English words with meanings.

TOTAL: 45 PERIODS

BOOK SUGGESTED FOR READING

1. A.P.J.Abdul Kalam, Arun Tiwari, “Wings of Fire”, an Autobiography, University Press Private Limited India, 1999, 30th Impression, 2007.

REFERENCES

1. T.M.Farhathullah, “Communication Skills for Technical Students”, Orient Longman Private Limited, 2002.
2. K.R.Lakshmi Narayanan, “English for Technical Communication”, SciTech Publications, 1999.
3. Jack.C.Richards, Jonathan Hull and Susan Protor, “English for International Communication”, Cambridge University Press, 3rd Edition, 2004.

13D21 INTEGRAL CALCULUS AND TRANSFORMS
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
3 1 0 4

COURSE OUTCOMES

- Ability to find area and volume of objects using double and triple integrals.
- Ability to analyze the concepts related to vector calculus and to apply them in engineering field.
- Ability to perform the ideas of Laplace transform and Z-transform in their respective engineering subjects.

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; Volume as triple integral.

UNIT II VECTOR CALCULUS 12

Gradient, Divergence and Curl – Directional derivative – 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 LAPLACE TRANSFORM 12

Definition of Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and Integrals of Transform – Transform of derivatives and integrals – Transform of unit step function and impulse function – Transform of periodic function – Initial and final value theorems.

UNIT IV INVERSE LAPLACE TRANSFORM 12

Definition of Inverse Laplace transform – Convolution theorem – Solution of linear ordinary differential equations of second order with constant coefficients using Laplace transformation techniques and solution of simultaneous differential equations of first order with constant coefficients using Laplace transformation techniques.

UNIT V Z – TRANSFORM 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publications, New Delhi, 40th Edition, 2007.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 8th Edition, 2011.

REFERENCES

1. Bali.N.P. and Manish Goyal, "Text book of Engineering Mathematics", Laxmi Publications Private Limited, 7th Edition, 2008.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
3. Jain.R.K. and Iyengar.S.R.K., "Advanced Engineering Mathematics", Narosa Publishing House Private Limited, 3rd Edition, 2007.
4. Veerarajan.T., "Engineering Mathematics for semester I & II", Tata McGraw Hill Education Private Limited, 3rd Edition, New Delhi, 2012.
5. Veerarajan.T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Private Limited, New Delhi, 2012.

13D22 SOLID STATE PHYSICS
(Common to ECE, CSE, EEE, EIE and IT)

L T P C
3 0 0 3

COURSE OUTCOMES

The Student will be able to

- identify the crystal lattices, their structures and how the structure influences its major properties at different levels.
- choose the major functional and structural properties required for specific applications of conducting materials
- check the parameter that satisfies superconducting behaviour.
- relate technology to the physics of semiconductor devices.
- classify the magnetic materials and their storage applications.
- design optical materials that are able to be manufactured and measured using the state of art optical fabrication technologies.

UNIT I CRYSTAL PHYSICS 9

Lattice, Unit cell, Bravais lattice, Lattice planes; Miller indices – d-spacing in cubic lattice; Calculation of number of atoms per unit cell, Atomic radius, Coordination number and Packing factor for SC, BCC, FCC and HCP structures; Crystal defects – point, line and surface defects; Burger vector.

UNIT II CONDUCTING MATERIALS AND SUPERCONDUCTORS 9

Conductors

Band theory of solids - Distinguish between conductors, semiconductors and insulators on the basis of band theory of solids; Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann Franz law – Lorentz number – Draw backs of classical theory; Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

Superconductors

Superconductivity: Properties – Meissner effect – Isotopic effect; Types of superconductors – Type I and Type II superconductors; Applications of superconductors – Magnetic levitation.

UNIT III SEMICONDUCTORS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – variation of Fermi level with temperature – electrical conductivity – bandgap determination; Extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level – with temperature and impurity concentration; Hall effect – Determination of Hall coefficient – Applications.

UNIT IV MAGNETIC MATERIALS AND STORAGE DEVICES 9

Origin of magnetic moment, Bohr magneton, Dia and Para magnetism, Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials; Anti-ferromagnetic materials; Ferrites – structure and applications; magnetic recording and readout – storage of magnetic data – tapes, floppy, Hard disk and CD ROM.

UNIT V OPTICAL MATERIALS 9

Optical properties of metals, insulators and semiconductors; Phosphorescence and fluorescence; Excitons traps and color centre and their importance; Different phosphors used in CRO screens, liquid crystal display, LED – working of LED; Thermography and its applications; Solar cell – PN junction solar cell – Conversion efficiency and solar concentration – Hetero junction solar cell.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Charles Kittel, "Introduction to Solid State Physics", John Wiley and Sons, Singapore, 7th Edition, 2007.
2. Dr.N.Sankar, S.O.Pillai, "A Text book of Engineering Physics", New Age International Publications, New Delhi, 2009.

REFERENCES

1. Donald A.Neamen "Semiconductor Physics and Devices", Tata McGraw Hill Publication, New Delhi, 3rd Edition, 2007.
2. M.Arumugam, "Materials Science", Anuradha publications, Kumbakonam, 2010.
3. Calister, "Material Science and Engineering: An Introduction", John Wiley and Sons, 6th Edition, 2009.

13D23 CHEMISTRY OF ELECTRICAL AND ELECTRONIC MATERIALS
(Common to ECE, CSE, EEE, EIE and IT)

L T P C
3 0 0 3

COURSE OUTCOMES

The students can

- apply the knowledge in designing new energy storing devices.
- identify the types of corrosion and to design a method to control the corrosion.
- apply the knowledge of photochemistry in designing the various electronic materials.
- choose proper analytical technique for analyzing the synthesized electronic materials.

UNIT I ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy: definition – mass defect; types of nuclear reactions: nuclear fission – characteristics – nuclear chain reaction – fusion reactions – difference between nuclear fusion and fission reaction; nuclear reactor: components – light water nuclear reactor – breeder reactor; solar energy: solar cell – advantages; wind energy: wind mill – advantages; storage batteries: types – primary battery – alkaline battery – secondary battery – lead-acid, nickel-cadmium; lithium battery; fuel cell: H_2-O_2 fuel cell.

UNIT II CORROSION AND ITS CONTROL 9

Chemical corrosion: oxidation corrosion – Pilling-Bedworth rule; electrochemical corrosion: mechanism – hydrogen evolution mechanism – oxygen absorption mechanism – galvanic corrosion – differential aeration corrosion; factors influencing corrosion; corrosion control: cathodic protection: sacrificial anodic protection – impressed current cathodic protection – inhibitors; electroplating: methods of cleaning the article – electroplating of gold; electroless plating: advantages over electroplating – electroless plating of nickel.

UNIT III PHOTOCHEMICAL PROCESSES 9

Photochemical reactions: definition, characteristics; laws of photochemistry – Grothus-Draper's law – Stark-Einstein's law – Beer-Lambert's Law; quantum yield: definition, reason for low and high yield; photochemical equilibrium: photochemical synthesis of hydrogen chloride; photophysical processes: types – non radiative transition – internal conversion – inter system crossing – radiative transition – fluorescence – phosphorescence; chemiluminescence, thermoluminescence, photosensitization: definition, halogen photosensitizer, applications.

UNIT IV ELECTRONIC MATERIALS 9

Organic semiconducting materials: advantages; p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic dielectric material: definition, examples – polystyrene – PMMA; organic light emitting polymer: polythiophene; conducting polymers: types – intrinsically conducting polymer – doped conducting polymer – extrinsically conducting polymer – coordination conducting polymer, applications; polymer with piezoelectric, pyroelectric and ferroelectric properties: polyvinylidenefluoride; OLED materials: definition, polymer OLED material – polyphenylene vinylene.

UNIT V ANALYTICAL INSTRUMENTATION 9

UV-Visible spectroscopy: types of transitions – chromophore, auxochrome – instrumentation (block diagram only) – applications; IR spectroscopy: molecular vibrations – linear molecule – CO_2 – nonlinear molecule – H_2O – instrumentation (block diagram only) – applications; Atomic absorption spectroscopy: principle – instrumentation (block diagram only) – estimation of nickel by AAS; flame photometry: principle – instrumentation (block diagram only) – estimation of sodium by flame photometry; thermogravimetry (TG): definition – instrumentation (block diagram only) – characteristics of thermogram – factors influencing thermogravimetry – analyzing $CuSO_4.5H_2O$ thermogram – applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 15th Edition, 2002.
2. S.S.Dara, "A text book of Engineering Chemistry" S.Chand and Company Limited, New Delhi, 13th Edition, 2006.
3. B.S.Chauhan, "Engineering Chemistry", University science press, New Delhi, 3rd Edition, 2009.

REFERENCES

1. S.C.Bhatia, "Engineering Chemistry", CBS Publishers and Distributors, 1st Edition, 2011.
2. Kuriacoarse J.C., and Rajaram.J., "Chemistry in Engineering and Technology", Vol.1 & 2, Tata McGraw Hill Publishing Company Limited, New Delhi, 1989.
3. Hagen Klauk, "Organic Electronics: Materials, manufacturing and applications", Wiley - VCH, 2006.
4. S.Rao, Dr.B.B.Parulekar, "Energy Technology", Khana Publishers, New Delhi, 21st Edition, 2004.
5. Skoog, Holler, Crouch, "Instrumental Analysis", Cengage Learning India Private Limited, New Delhi, 2011.
6. R.Chaudhary, "Basics of Photochemistry", Anmol Publications and Company, New Delhi, 2009.

13D24 CIRCUIT THEORY
(EEE)

L T P C
3 1 0 4

COURSE OUTCOMES

- Describe the basic concepts of electric circuits.
- Illustrate the network theorems for DC and AC circuits.
- Explain the concept of resonant circuits.
- Analysis the dynamic behavior of electric circuits
- Analyze the three phase electric circuits.

UNIT I BASIC CIRCUITS ANALYSIS 12

Ohm's Law – Kirchoff's laws – DC and AC Circuits – 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 – frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and AC with sinusoidal input.

UNIT V ANALYSIS OF THREE PHASE CIRCUITS 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.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Sudhakar.A. and Shyam Mohan.S.P., "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.
2. William H. Hayt Jr Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, New Delhi, 6th edition, 2002.

REFERENCES

1. John Bird, "Electrical Circuit Theory and Technology", Newnes Publication, 4th Edition, 2010.
2. Paranjothi.S.R., "Electric Circuits Analysis," New Age International Limited, New Delhi, 1996.
3. Joseph A.Edminister, Mahmood Nahri, "Electric Circuits", Schaum's series, Tata McGraw Hill, New Delhi, 2001.
4. Chakrabati.A., "Circuits Theory (Analysis and synthesis)", Dhanpath Rai and Sons, New Delhi, 1999.
5. Charles K.Alexander, Mathew N.O.Sadik, "Fundamentals of Electric Circuits", McGraw Hill, 2nd Edition, 2003.

13D25 BASIC CIVIL AND MECHANICAL ENGINEERING
(Common to ECE, CSE, EEE, EIE and IT)

L	T	P	C
4	0	0	4

COURSE OUTCOMES

- An ability to identify the various systems and its components of various power plants.
- An ability to state and differentiate the working principles of IC engines.
- Students will be able to identify the various systems and components of refrigeration and air conditioning systems.

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

***Civil Engineering Materials*:** Bricks – stones – sand – cement – concrete – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 10

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV IC ENGINES 10

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

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.

TOTAL: 60 PERIODS

REFERENCES

1. ShanmugamG. and Palanichamy M.S., "BasicCivilandMechanical Engineering", Tata McGraw Hill Publishing Company Limited, New Delhi, 1996.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Company Private Limited, 1999.
3. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
4. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.
5. Shantha Kumar S.R.J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

13D26 COMPUTER PROGRAMMING LABORATORY
(Common to all B.E. / B.Tech., Degree Programmes)

L	T	P	C
0	1	2	2

COURSE OUTCOMES

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

- Demonstrate how to use the UNIX Shell commands.
- Use the Shell programming constructs.
- Learn tracing mechanisms (for debugging), user variables, Shell variables, read-only variables, positional parameters, reading input to a Shell script.
- Test on numeric values, test on file type, and test on character strings using shell scripts.
- Write moderately complex Shell scripts and make them executable.

Execute programs written in C under UNIX environment.

LIST OF EXPERIMENTS

1. Study of UNIX OS, vi Editor.

2. Use of Basic UNIX Shell Commands:
   ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.

3. Shell Programming:
   i. Interactive shell scripts
   ii. Positional parameters
   iii. Arithmetic Operators
   iv. if-then-fi, if-then-else-fi, nested if-else
   v. Logical operators
   vi. if - elif, case structure
   vii. while, until, for loops, use of break
   viii. Metacharacters

4. Shell scripts for the following:
   i. Showing the count of users logged in
   ii. Printing column wise list of files in your home directory
   iii. To count lines, words and characters in its input (do not use wc)

5. C Programming on UNIX:
   i. Dynamic Storage Allocation
   ii. Pointers
   iii. Functions
   iv. File Handling

TOTAL: 45 PERIODS

SOFTWARE REQUIREMENTS

- UNIX/LINUX OS
- Gcc compiler

13D27 PHYSICS AND CHEMISTRY LABORATORY – II
(Common to all B.E. / B.Tech., Degree Programmes)

L	T	P	C
0	0	3	2

PART A - PHYSICS LABORATORY – II

COURSE OUTCOMES

At the end of the Laboratory classes, the students

- demonstrate and report the elastic behaviour of materials
- demonstrate the interference property of light waves
- demonstrate the diffraction property of light waves
- measure the thermal properties of conducting materials
- identify the substance that deforms continuously when subjected to shearing stress.

LIST OF EXPERIMENTS

1. Determination of Young's modulus – Uniform bending method.
2. Determination of Band Gap of a semiconductor material.
3. Determination of Hall Co-efficient.
4. Determination of Radius of curvature of a Plano convex lens using Newton's rings Method.
5. Determination of wavelength of mercury spectrum using spectrometer and grating
6. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
7. Torsional pendulum – Determination of Moment of Inertia of the disc and Rigidity modulus of the material of the wire.

• ***A minimum of FIVE experiments shall be offered.***

PART B - CHEMISTRY LABORATORY – II

COURSE OUTCOMES

The student

- can estimate the amount of alkalinity and Dissolved Oxygen (DO) present in the water sample.
- gain knowledge in the estimation of copper in an alloy and iron in rust.
- quantify electrolyte and ion by measuring the conductance and emf.

LIST OF EXPERIMENTS

1. Estimation of copper in brass by EDTA method.
2. Determination of Dissolved Oxygen (DO) in water (Winkler's method)
3. Estimation of alkalinity of Water sample
4. Estimation of Fe^{2+} ion in rust by Dichrometry
5. Conductometric titration (Mixture of acids vs NaOH)
6. Potentiometric Titration (Fe^{2+} vs $K_2Cr_2O_7$)
7. Estimation of Fe^{2+} ion by spectrophotometry.

TOTAL: 45 PERIODS

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

13D28 ELECTRIC CIRCUITS LABORATORY
(Common to EEE and EIE)

L	T	P	C
0	0	3	2

COURSE OUTCOMES

- Illustrate the basic concepts of electric circuits.
- Relate the physical observations in network theorems of electrical circuits to theoretical principles.
- Examine the electric circuits using mesh and nodal analysis.
- Analyze the dynamic behavior of electric circuits using PSIM.
- Compute the frequency response of resonant and tuned circuits.

LIST OF EXPERIMENTS

1. Verification of Ohm's laws and Kirchoff's laws
2. Verification of Thevenin's and Norton's theorem
3. Verification of Superposition theorem
4. Verification of Maximum Power Transfer theorem
5. Verification of Reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis
8. Transient response of RL and RC circuits for DC input
9. Frequency response of series and parallel resonance circuits
10. Frequency response of single tuned coupled circuits

TOTAL: 45 PERIODS

13D29 ENGLISH LANGUAGE SKILL LABORATORY
(Common to all B.E. / B.Tech., Degree Programmes)

L T P C
0 0 3 2

COURSE OUTCOMES

The Student will

- improve their pronunciation skill.
- gather information from any speech.
- imbibe the stress and intonation of the native speakers' accent.

1. Micro Skills

- Spotting the Homonyms / Silent letter words / mispronounced words
- Identifying the missing words in native speech
- Finding the cluster words
- Marking correct punctuation
- Marking word chunks
- Identification of sentences

2. Content Comprehension and making inferences

- Listening to audio files of Speech, Poetry, Recent Issues, News clippings, etc
    a. True / False
    b. Multiple Choice Questions
    c. Filling the blanks
    d. Filling the charts

3. Listen and Act

- Drawing the map using audio
- Picture completing task
- Transferring data to Graph

4. Interpreting the video clippings

5. Listening to Conversations

TOTAL: 30 PERIODS

13EE31 FOURIER TRANSFORMS AND COMPLEX ANALYSIS L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Perform Fourier series analysis of the functions.
- Implement the properties of Fourier transforms and Compute the Fourier transforms of various functions.
- Calculate the Fourier series solution of Wave and Heat equations.
- Grasp analytic functions and their properties and be introduced to the host of conformal mappings with suitable examples that have direct applications.
- Understand the basics of complex integration and the concept of contour integration encountered in practice.

UNIT I FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range Sine series – Half range Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT II 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.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

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) – Fourier series solutions in Cartesian coordinates.

UNIT IV 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 V COMPLEX INTEGRATION 12

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's expansions – Singular points – Residues – Residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

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

TEXT BOOKS

1. Grewal, B.S, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 40th Edition, 2007.
2. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Laxmi Publications Private Limited, 7th Edition, Reprint 2010.

REFERENCES

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House Private Limited, 3rd Edition, 2007.
3. T.Veerarajan "Transforms and Partial Differential Equations", Tata McGraw-Hill Education Private Limited, updated Edition, 2012.

13EE32 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
(Common to all B.E./B.Tech. Degree Programmes) **3 0 0 3**

COURSE OUTCOMES

Upon successful completion of course the student will be able to

- Understand the various ecosystem and biodiversity
- Classify the different types of natural resources and identify the role of individual in conservation of resources
- Identify and analyse the causes, effects and control measures of environmental pollution
- Identify the different types of environmental hazards and their management
- Analyse the social issues related to the environment and how human population affect the environment

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers– energy flow in the ecosystem – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) aquatic (pond) ecosystems. Field study of simple ecosystems –pond and forest. Introduction to biodiversity: definition - genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –India as a mega-diversity nation – hot spots of biodiversity –threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation. Field study of common plants, insects, birds.

UNIT II NATURAL RESOURCES 9

Forest resources: Use and over-exploitation, deforestation, case studies- dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide Problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, case studies – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – e-Waste: Definition-dimension of the problem - source-toxic Substances in e-waste - risks related to toxic substances–environmental problems-role of an individual in prevention of pollution.

UNIT IV ENVIRONMENTAL HAZARDS 9

Environmental hazards**:** Definition – Hazard- Types-Natural and man-made hazards – Natural hazards: Causes, effect and management of Earthquake, Flood, Landslide, Cyclones and Tsunami; Man-made Hazards**:** Hazards due to dams and reservoirs, hazards due to nuclear power plant, Industrial hazards. Case study: Chernobyl disaster, Bhopal gas tragedy.

UNIT V SOCIAL ISSUES, HUMAN POPULATION AND THE ENVIRONMENT 9

Water conservation: rain water harvesting-climate change: global warming, acid rain, ozone layer depletion-Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ravikrishnan. A., "Environmental Science and Engineering, Sri Krishna Hitech Publishing Company Private Limited, 2010.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

REFERENCES

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2004.
2. Rajagopalan. R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2005.
3. Natural Hazards – Local, National, Global: G. F. White (ed), Oxford University Press.

13EE33 DC MACHINES AND TRANSFORMERS L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Describe the concepts of electromechanical energy conversion.
- Discuss the characteristics and applications of DC generators.
- Recognize the characteristics and speed control of DC motors.
- Analyze the performance of transformers.
- Estimate the efficiency of DC machines and transformers by conducting suitable tests.

UNIT I BASIC CONCEPTS OF ROTATING MACHINES 12

Electrical machine types – Introduction to magnetic circuits – Magnetically induced emf - AC operation of magnetic circuits – Hysteresis and Eddy current losses – Energy in magnetic systems – Field energy & mechanical force – Single and Multiple excited systems - MMF of distributed windings – Magnetic fields in rotating machines – Generated voltages – Torque.

UNIT II DC GENERATORS 12

Constructional features of DC machine – Principle of operation of DC generator – EMF equation – Methods of excitation – Types – No load & load characteristics of series, shunt & compound generators – Armature reaction effects, methods of compensation – Commutation - Parallel operation of generators.

UNIT III DC MOTORS 12

Principle of operation of DC motors - Back emf – Torque equation –Types of DC motors- Speed – Torque characteristics of DC motors – Starting of DC motors – Types of starters –Speed control of DC series & shunt motors – Losses and efficiency –Applications.

UNIT IV TRANSFORMERS 12

Principle of operation – Constructional features of single phase and three phase transformers - EMF equation-Transformer on No load and Load – Phasor diagram – Equivalent circuit – Regulation - Three phase transformer connections - Parallel operation of single phase and three phase transformer - Auto transformers.

UNIT V TESTING OF DC MACHINES & TRANSFORMERS 12

Losses and efficiency – Condition for maximum efficiency – Testing of DC machines: Brake test, Swinburne's test, Retardation test, Hopkinson's test – Testing of transformer: polarity test, load test, open circuit and short circuit test, Sumpner's test – All day efficiency.

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

TEXT BOOKS

1. Nagrath I. J and Kothari D. P, "Electric Machines", Tata McGraw Hill, 2010.
2. Bimbhra P.S, "Electrical Machinery", Khanna Publishers, 2003.

REFERENCES

1. Fitzgerald. A.E, Charles Kingsely Jr and Stephen D.Umans, "Electric Machinery", Tata McGraw Hill, 2003.
2. Theraja, B.L and Theraja,A.K, "A text book on Electrical Technology", Volume–II, S.Chand and Company Limited, 2009.
3. Sen. P. C., "Principles of Electrical Machines and Power Electronics", John Wiley and Sons, 2007.
4. Murugesh Kumar. K, "Electric Machines", Vikas Publishing House Private Limited, 2010.

13EE34 ELECTROMAGNETIC FIELD THEORY L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Apply vector calculus for static electric and magnetic fields
- Analyze the concepts of electrostatic fields and magneto static fields
- Develop the boundary condition for different medium
- Formulate the Maxwell's equations
- Employ the Maxwell equation for electromagnetic wave propagation

UNIT I INTRODUCTION 12

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems- vector calculus – Gradient, Divergence and Curl - Divergence theorem – Stoke's theorem.

UNIT II ELECTROSTATICS 12

Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and application – Electric potential – Electric field and equipotential plots – Electric field in free space, conductors, dielectric - Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations – Capacitance- Energy density.

UNIT III MAGNETOSTATICS 12

Lorentz Law of force, magnetic field intensity – Biot–Savart Law - Ampere's Law – Magnetic field due to straight conductors, circular loop, infinite sheet of current – Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization – Magnetic field in multiple media – Boundary conditions – Scalar and vector potential – Magnetic force – Torque – Inductance – Energy density – Magnetic circuits.

UNIT IV ELECTRODYNAMIC FIELDS 12

Faraday's laws – induced emf – Transformer and motional EMF – Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory.

UNIT V ELECTROMAGNETIC WAVES 12

Electromagnetic wave equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors – skin depth, Poynting vector – Transmission lines – Line equations – Input impedances – Standing wave ratio and power.

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

TEXT BOOKS

1. Mathew N. O. Sadiku, "Elements of Electromagnetics", Oxford University press Inc. 1st India Edition, 2007.
2. Ashutosh Pramanik, "Electromagnetism – Theory and Applications", Prentice-Hall of India Private Limited, New Delhi, 2006.

REFERENCES

1. Joseph. A. Edminister, "Theory and Problems of Electromagnetics", 2nd Edition, Schaum Series, Tata McGraw Hill, 1993.
2. William. H. Hayt, "Engineering Electromagnetics", Tata McGraw Hill, 2011.
3. Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International Editions, 5th Edition, 1999.

13EE35 RENEWABLE ENERGY SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Apply the solar energy concept in various applications.
- Explain the fundamentals of wind energy.
- Indicate the essential of biomass energy.
- Describe the importance of geothermal energy.
- Discuss the concept of ocean energy

UNIT I SOLAR ENERGY COLLECTION, STORAGE AND APPLICATIONS 9

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors - Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications - Solar heating / cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT II WIND ENERGY 9

Sources and potentials -Horizontal and vertical axis windmills - Performance characteristics - Betz criteria - Wind Power estimation techniques - Principles of Aerodynamics of wind turbine blade - Various aspects of wind turbine design - Wind Turbine Generators: Induction, Synchronous machine - Constant V & F and variable V & F generations - Reactive power compensation.

UNIT III BIO-MASS 9

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 IV GEOTHERMAL ENERGY 9

Resources - methods of harnessing the energy - Various Types of Systems to use Geothermal Energy - Direct heat applications -Power Generation using Geothermal Heat - Sustainability of Geothermal Source - Status of Geothermal Technology - Economics of Geothermal Energy.

UNIT V OCEAN ENERGY 9

Ocean Thermal Energy Conversion (OTEC) - Principles utilization - setting of OTEC plants - thermodynamic cycles - Tidal and wave energy: Potential and conversion techniques - mini-hydal power plants and their economics.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Rai. G.D, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 1999.
2. Kothari D.P, Singal. K.C and Rakesh Ranjan, “Renewable Energy Sources and Emerging Technologies”, PHI Private Limited, 2008.

REFERENCES

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 1996.
2. Twidell J.W and Weir. A, “Renewable Energy Sources”, EFN Spon Limited, UK, 1986.
3. Tiwari. G.N, “Solar Energy – Fundamentals Design, Modeling & Applications”, Narosa Publishing House, New Delhi, 2002.
4. Freris. L.L, “Wind Energy Conversion systems”, Prentice Hall, UK, 1990.
5. S.P. Sukhatme, “Solar Energy”, Tata McGraw Hill, 1997.
6. Garg. H.P and Jai Prakash, “Solar Energy: Fundamentals and Applications”, Tata McGraw Hill, 2000.
7. Sukhatme. S.P, “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill, 2008.

13EE36 ELECTRON DEVICES AND CIRCUITS L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Discuss the VI characteristics of diode and apply the diode concept in rectifiers.
- Analyze the VI characteristics of BJT and FET in different configurations.
- Analyze the different BJT Biasing Circuits and its applications.
- Describe the operation of amplifier and oscillators.
- Discuss the concepts of pulse circuits.

UNIT I PN DIODE AND ITS APPLICATIONS 12

PN junction diode - VI characteristics – Resistance - temperature effects – Drift and diffusion currents – Rectifiers: HW, FW, Bridge Rectifiers, filters - Zener diode – VI characteristics - LED - Regulators (series and shunt) - Introduction to Switched mode power supply.

UNIT II BJT AND FETS 12

Bipolar junction transistor – Construction – Input and output characteristics – CE, CB and CC configurations – hybrid model – Analytical expressions - JFET – VI characteristics, Pinch off Voltage – small signal model - MOSFET - Characteristics – enhancement and depletion.

UNIT III BJT BIASING AND AMPLIFIERS 12

Need for biasing - Fixed bias and Different types of biasing circuits - Classification of amplifiers - CE CB amplifier and small Signal analysis - frequency response - Class A, B, AB, C&D - RC and transformer coupled power amplifiers - Class B complementary - symmetry, push-pull power amplifiers - Darlington connection.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 12

Differential amplifiers: Common Mode and Differential Mode - CMRR – feedback amplifiers - Voltage / current, series / shunt feedback –condition for oscillation - oscillators – LC, RC, crystal oscillators.

UNIT V PULSE CIRCUITS 12

RC wave shaping circuits – Diode clampers and clippers – Monostable, Astable and Bistable Multivibrators – Schmitt triggers – UJT based sawtooth oscillators.

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

TEXT BOOKS

1. Paynter, “Introductory electronic devices and circuits”, PHI, 2006.
2. David Bell, “Electronic Devices and Circuits”, PHI, 2007.

REFERENCES

1. Theodre F. Boghert, “Electronic Devices & Circuits” Pearson Education, 6th Edition, 2003.
2. Rashid, “Microelectronic circuits”, Thomson Publication, 1999.
3. Singh. B.P and Rekha Sing, “Electronic Devices and Integrated Circuits”, Pearson Education, 2006.
4. Salivahanan. S, Suresh Kumar. N and Vallavaraj. A, “Electronic Devices and circuits”, Tata McGraw Hill, 2003.

13EE37 DC MACHINES AND TRANSFORMERS LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Describe the performance of DC generators.
- Summarize the characteristics of DC motors under loaded conditions.
- Predetermine the performance of DC motors.
- Implement the speed control in DC shunt motor.
- Analyze the performance of transformers.

LIST OF EXPERIMENTS

1. Study of starters.
2. Open circuit and load characteristics of separately excited DC generators.
3. Open circuit and load characteristics of self excited DC shunt generators.
4. Load characteristics of DC compound generator.
5. Load characteristics of DC shunt and compound motor.
6. Load characteristics of DC series motor.
7. Swinburne's test and speed control of DC shunt motor.
8. Hopkinson's test on DC motor – Generator set.
9. Load test on single-phase transformer.
10. Open circuit and short circuit tests on single phase transformer.
11. Load test on three phase transformer.
12. Sumpner's test on transformers.
13. Separation of no-load losses in single phase transformer.

TOTAL: 45 PERIODS

13EE38 ELECTRON DEVICES AND CIRCUITS LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Describe the VI characteristics of PN diode and Zener diode and design the rectifier and regulator using PN and Zener Diode.
- Compute and Distinguish the VI characteristics of BJT, FET and UJT.
- Develop the Clipping and Clamping Circuits using PN Diode.
- Analyze the frequency response of Amplifiers.
- Illustrate the operation of Oscillators.

LIST OF EXPERIMENTS

1. Characteristics of PN diode and zener diode.
2. Diode Clippers and Clampers.
3. Single phase half wave and full wave rectifiers.
4. Characteristics of Voltage Regulators.
5. Characteristics of Transistor under CE, CC and CB configuration.
6. Characteristics of FET.
7. Characteristics of MOSFET.
8. Characteristics of UJT.
9. Frequency response of Common Emitter Amplifier.
10. Frequency response of Common Collector Amplifier.
11. Frequency response of Common Source FET Amplifier.
12. RC Phase Shift Oscillator.

TOTAL: 45 PERIODS

13EE41 NUMERICAL METHODS, MATHEMATICAL LOGIC, PROBABILITY AND STATISTICS L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Solve the algebraic equations and construct the interpolating polynomials.
- Develop skills in numerical integration and initial value problems.
- Use computational tools to solve ordinary differential equations and partial differential equations.
- Formulate and interpret statements presented in normal forms and determine their validity by applying the rules and methods of propositional calculus.
- Understand the mathematical basis and foundations of probability and statistics.

UNIT I SOLUTION OF ALGEBRAIC EQUATIONS AND INTERPOLATION 12

Direct methods - Gauss Elimination method – Gauss Jordan methods – Iterative methods – Gauss-Seidel method - Interpolation – Lagrange's and Newton's divided difference formula for unequal intervals – Newton's forward and backward difference formulas for equal intervals.

UNIT II NUMERICAL INTEGRATION AND INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules - Taylor series method – Euler methods – Fourth order Runge – Kutta method for solving first and second order equations - Milne's predictor and corrector method.

UNIT III BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation.

UNIT IV MATHEMATICAL LOGIC 12

Propositions and logical operators – Truth table – Propositions generated by a set, equivalence and implication – Basic laws – Some more connectives – Normal forms – Proofs in Propositional calculus.

UNIT V PROBABILITY AND STATISTICS 12

Probability – Basic concepts – Baye'S Theorem; Statistics – Concepts on mean, median, mode, standard deviation and expectation – Skewness – Kurtosis – Correlation and Regression.

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

TEXT BOOKS

1. Veerarajan. T and Ramachandran. T, "Numerical mehods with programming in C", Tata McGraw Hill, 2nd Edition, First reprint 2007.
2. Trembly. J. P and Manohar. R, "Discrete Mathematics Structure with Applications to Computer Science", Tata McGraw Hill, 35th Reprint, 2008.
3. Dr. Venkataraman. M.K, "Engineering Mathematics III A", Rajan and Company, Chennai, 2002.

REFERENCES

1. Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 6th Edition, 2004.
2. Veerarajan. T and Ramachandran. T, "Numerical methods with programming in C", Tata McGraw Hill, 2nd Edition, First Reprint, 2007.
3. Tamilarasi. A and Natarajan. A.M, "Discrete mathematics and its Applications", Khanna Publishers, 3rd Edition, 2008.
4. Gupta. S.C and Kapoor. V.K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, 2007.

13EE42 AC ROTATING MACHINES L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Analyze the performance of synchronous machines.
- Examine the performance of three phase induction machines.
- Discuss the starting and speed control methods of three phase induction motors.
- Describe the performance of single phase induction motor.
- Summarize the features of special machines.

UNIT I SYNCHRONOUS GENERATOR 12

Constructional details – Types of rotors – EMF equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF, ZPF and ASA methods – Synchronizing and parallel operation – Synchronizing torque – Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics – Capability curves.

UNIT II SYNCHRONOUS MOTOR 12

Principle of operation – Torque equation – Equivalent circuit – V-curves and Inverted V-curves – Power input and power developed equations – Starting methods – Operation on infinite bus bars – Hunting.

UNIT III THREE PHASE INDUCTION MOTOR 12

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip torque characteristics – Condition for maximum torque – Losses and efficiency – Load test – No load and blocked rotor tests - Equivalent circuit – Phasor diagram – Circle diagram – Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12

Need for starting – Types of starters – Cogging and Crawling – Speed control – Change of voltage, rotor resistance, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 12

Constructional details of single phase induction motor – Double revolving field theory – Types – operation – Equivalent circuit – No load and blocked rotor test– Performance analysis – Starting methods of single-phase induction motors – Special machines – Universal motor, reluctance motor, repulsion motor, hysteresis motor, stepper motor and AC series motor.

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

TEXT BOOKS

1. Kothari. D.P and Nagrath. I.J, “Electric Machines”, Tata McGraw Hill, Reprint 2010.
2. Mehta. V.K and Rohit Mehta, “Principle of Electrical Machines”, S.Chand Publishers, 2009.

REFERENCES

1. Fitzgerald. A.E, Charles Kingsley, Stephen D. Umans, “Electric Machinery”, Tata McGraw Hill, 2003.
2. Theraja. B.L, Theraja. A.K, “A text book on Electrical Technology”, Volume–II, S.Chand and Company Limited, 2009.
3. Gupta. J.B, “Theory and Performance of Electrical Machines”, S. K. Kataria and Sons, 2009.
4. Murugesh Kumar. K, “Electric Machines”, Vikas Publishing House Private Limited, 2010.
5. Rajput. R.K, “A Text Book of Electrical Machines”, Firewall Media, 2008.

13EE43 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION L T P C
3 0 0 3

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Summarize the basic concept of measurement system.
- Recognize the measuring instruments for analog electrical quantities.
- Justify appropriate methods for measuring electrical and magnetic parameters.
- Choose appropriate transducers for measuring non electrical quantities
- Summarize the operations of various digital electronic instruments and display devices.

UNIT I INTRODUCTION 9

SI units – Fundamental elements of an instrument – Static and dynamic characteristics – Types of error - Error analysis – Standard and Calibration.

UNIT II MEASURING INSTRUMENTS 9

Principle and types of analog meters – Moving iron instruments – Moving coil instruments – Extension of meter range – watt meters: Dynamometer type, induction type – Errors in measuring instruments – Induction type energy meters – Instruments transformer – Application of instrument transformer in measurement of power and energy.

UNIT III BRIDGES 9

Resistance measurement – Wheatstone bridge, Kelvin double bridge, substitution method – Transformer ratio bridges – Measurement of earth resistance, insulation resistance – Megger. Measurement of inductance and capacitance – Maxwell's bridge, Anderson bridge, Desauty's bridge and schering bridge – Measurement of frequency - Wien bridge.

UNIT IV TRANSDUCERS 9

Introduction of transducers – Classifications – Resistive transducer – Potentiometer - Strain gauge – Inductive transducer - LVDT – Capacitive transducer - Piezo-electric transducers – Encoders – Measurement of pressure and flow – Measurement of temperature: Resistance thermometers, thermistors, thermocouples, optical and radition pyrometers.

UNIT V DIGITAL INSTRUMENTS AND DISPLAY DEVICES 9

Digital voltmeters, Types – Ramp and integrating – Digital multimeter, block diagram – Data logger, block diagram – CRT display – Dot matrix display – LED and LCD displays – Digital Energy meter – Digital storage Oscilloscope – Digital printers and plotters – Special Instruments: Power quality analyzer, Measurement of wind velocity, Measurement of solar radiation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Doebin. E, "Measurement Systems: Application and Design", 5th Edition, Tata McGraw Hill, 2006.
2. Sawhney. A.K, "A Course in Electrical and Electronics – Measurement and Instrumentation", Dhanpal Rai and Sons, New Delhi, 2001.

REFERENCES

1. Helfrick, Albert. D and Copper. W.D, "Electronics Instrumentation and Measurement Techniques", Prentice Hall of India Limited and Company, New Delhi, 2010.
2. Rangan. C.S, Sharma. G.R and Mani. V.S, "Instrumentation Devices and Systems", 2nd Edition, Tata McGraw Hill, 2010.
3. Kalsi. H.S, "Electronic Instrumentation", Tata McGraw Hill, 2011.
4. Arun K. Ghosh, "Introduction to Measurements and Instrumentation", 2nd Edition, Prentice Hall of India Limited and Company, New Delhi, 2011.
5. www.cwet.tn.nic.in

13EE44 LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS L T P C
3 0 0 3

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Describe the IC fabrication procedure for basic electronic circuits.
- Infer the characteristics of Op-amp ICs.
- Design and construct the basic applications of Op-amp.
- Interpret the internal functional blocks and the applications of special ICs.
- Illustrate the operation of application ICs.

UNIT I IC FABRICATION 9

IC classification - fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities - Realization of monolithic ICs and packaging - Fabrication of diodes, capacitance, resistance and FETs.

UNIT II CHARACTERISTICS OF OP-AMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics - offset voltage and current - differential amplifier - frequency response of OP-AMP - Basic applications of OP-AMP – summer, differentiator and integrator.

UNIT III APPLICATIONS OF OP-AMP 9

Instrumentation amplifier - first and second order active filters - V/I & I/V converters - comparators, multivibrators - clippers, clampers, peak detector, S/H circuit, D/A converter - R-2R ladder and weighted resistor types - A/D converter -Dual slope, successive approximation and flash types.

UNIT IV SPECIAL ICs 9

Timer: Introduction to 555 timers and its functional diagram, monostable, astable and Schmitt Trigger applications - Voltage Controlled Oscillator: Operation and Applications using IC 566 - Phase Locked Loops: Introduction, Principles, Block Schematic and Description of IC 565, Applications of PLL: Frequency multiplication and frequency translation.

UNIT V APPLICATION ICs 9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ramakant A. Gayakward, “Op-amps and Linear Integrated Circuits”, 4th Edition, Pearson Education, 2003.
2. Roy Choudhary. D, Sheil B.Jani, “Linear Integrated Circuits”, 2nd Edition, New Age, 2003.

REFERENCES

1. Jacob Millman, Christos C.Halkias, “Integrated Electronics - Analog and Digital circuits system”, Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, “Op-amp and Linear ICs”, 4th Edition, Pearson Education, 2002.
3. David A.Bell, “Op-amp & Linear ICs”, 2nd Edition, Prentice Hall of India, 1997.

13EE45 DIGITAL LOGIC CIRCUITS L T P C
3 1 0 4

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Devise the number systems and simplify Boolean functions
- Illustrate the various combinational circuits
- Design the synchronous and asynchronous circuits.
- Analyze the characteristics of digital ICs and memory devices.
- Develop VHDL coding for simple circuits.

UNIT I BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS 12

Boolean algebra: switching functions and simplification using K-maps & Quine McCluskey method, Parity checker - Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and Demultiplexers.

UNIT II ANALYSIS AND DESIGN OF SYNCHRONOUS SEQUENTIAL CIRCUITS 12

Realization of Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Counters state diagram; state reduction; state assignment. Shift Register, Sequence detector.

UNIT III ANALYSIS AND DESIGN OF ASYNCHRONOUS SEQUENTIAL CIRCUITS 12

Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

UNIT IV DIGITAL INTEGRATED CIRCUITS 12

Characteristics of digital ICs –Voltage and current ratings, Fan in-Fan out-propagation delay-Noise Margin-power dissipation. Digital logic families: TTL, ECL, CMOS - Memories: ROM, PROM, EPROM, PLD, PAL, PLA and FPGA - Trouble shooting.

UNIT V VHDL 12

RTL Design – Behavior, Dataflow and Structural modeling – Data Types – Operators – Packages – Sequential circuit – Sub programs – Test benches. (Examples: adders, counters, flipflops, FSM, Multiplexers / Demultiplexers).

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

TEXT BOOKS

1. Raj Kamal, “Digital systems-Principles and Design”, 2nd Edition, Pearson Education, 2007.
2. Salivahanan. S and Arivazhagan. S, “Digital Circuits and Design”, 4th Edition, Vikas Publishing House Private Limited, New Delhi.
3. Donald Givone, “Digital Principles and Design”, Tata Mc Graw Hill, 2003.
4. Roth C H, “Digital Systems Design using VHD”, Thomson Asia, 2007.

REFERENCES

1. Charles H.Roth, “Fundamentals Logic Design”, 6th Edition, Jaico Publishing House, 2006.
2. Floyd and Jain, “Digital Fundamentals”, 10th Edition, Pearson Education, 2005.
3. John F.Wakerly, “Digital Design Principles and Practice”, 4th Edition, Pearson Education, 2005.
4. Ronald J. Tocci, “Digital Systems: Principles and applications”, 10th Edition, Pearson Education, 2009.
5. Avinashi Kapoor and Maheshwari, “Digital Electronics Principles and Practice”, Macmillan India limited, 1st edition, 1992.
6. Morris Mano. M, “Digital Design”, Pearson Education, 5th Edition, 2012.
7. John M.Yarbrough, “Digital Logic, Application & Design”, Thomson Asia, 2002.

13EE46 SIGNALS AND SYSTEMS L T P C
3 1 0 4

COURSE OUTCOMES

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

- Recognize, analyze and manipulate basic continuous time (CT) and discrete time (DT) signals.
- Classify continuous and discrete time systems as to their linearity, time invariance, causality and stability.
- Represent and analyze both CT and DT Signals using appropriate transforms.
- Analyze both CT and DT Linear Time Invariant systems using appropriate transforms.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 12

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 12

Fourier series analysis, Spectrum of CT signals, Fourier Transform and Laplace Transform in Signal Analysis.

UNIT III LINEAR TIME INVARIANT -CONTINUOUS TIME SYSTEMS 12

Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response, LTI systems analysis using Fourier and Laplace transforms, State variable equations and matrix representation of systems.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 12

Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z-transform.

UNIT V LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS 12

Difference equation, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms, State variable equations and matrix representation of systems.

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

TEXT BOOKS

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson Education, 2007.
2. Edward W Kamen and Bonnie's Heck, “Fundamentals of Signals and Systems”, Pearson Education, 2007.

REFERENCES

1. P. Ramesh Babu and R.Ananda Natarajan, “Signals and Systems”, SciTech Publications, 4th Edition, 2010.
2. Simon Haykin and Barry Van Veen, “Signals and Systems”, 2nd Edition, Willey Publication (Reprint), 2010.
3. Hwei P. Hsu, “Signals and Systems- Schaum's Outline Series”, Tata McGraw Hill, (Indian Reprint), 2nd Edition, 2010.
4. John Alan Stuller, “An Introduction to Signals and Systems”, Cengage Learning India Private Limited, 2008.
5. B.P Lathi, “Linear Systems and Signals”, 2nd Edition, Oxford University, 2008.

13EE47 AC ROTATING MACHINES LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Compute the regulation of Three Phase Alternator using various methods.
- Evaluate the performance characteristics of AC motors.
- Explain the various staring methods of AC motors.
- Predict the performance characteristics of AC motors.

LIST OF EXPERIMENTS

1. Study of AC Motor Starters.
2. Regulation of Three Phase Alternator by EMF methods.
3. Regulation of Three Phase Alternator by MMF methods.
4. Regulation of Three Phase Alternator by ZPF methods.
5. Regulation of Three Phase Alternator by ASA methods.
6. Regulation of Three Phase Salient Pole Alternator by Slip test.
7. Parallel operation of two Alternators.
8. V and Inverted V curves of Three Phase Synchronous Motor.
9. Load test on Three Phase Induction Motor.
10. No load and blocked rotor test on Three Phase Induction Motor.
11. Separation of No-load losses of Three Phase Induction Motor.
12. Load test on Single Phase Induction Motor.
13. No load and blocked rotor test on Single Phase Induction Motor

TOTAL: 45 PERIODS

13EE48 INTEGRATED CIRCUITS LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Realize adder, subtractor and code converters.
- Design and realize the basic applications of Op-amp and timer.
- Design and implement the 4-bit modulo counters as synchronous and asynchronous types.
- Illustrate the various combinational and sequential circuits.
- Examine the behavior of special ICs.

LIST OF EXPERIMENTS

1. Study of Basic Digital IC's. (Verification of truth table for AND, OR, XOR, NOT, NOR, NAND, JK FF, RS FF, D FF).
2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
3. (a) Code converters, Parity generator and parity checking, Excess-3, 2'sComplement, Binary to Gray Code using suitable IC's.
   (b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
5. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
6. Multiplex/ De-multiplex: Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer
7. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
8. Application of Op-Amp: Slew rate verifications, inverting and non-inverting amplifier, Adder, Comparator, Integrator and Differentiator.
9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.
10. Study of VCO and PLL ICs:
    i. Voltage to frequency characteristics of NE/ SE 566 IC.
    ii. Frequency multiplication using NE/SE 565 PLL IC.

TOTAL: 45 PERIODS

13EE49 COMMUNICATION SKILLS AND TECHNICAL SEMINAR L T P C
0 0 3 2

COURSE OUTCOMES

On the successful completion of the course, the student should be able to,

- Express themselves fluently and appropriately in social and professional contexts.
- Develop the sub-skills required for paper presentations and group discussions.
- Acquire the soft skills and interpersonal skills which will help them to excel in their workplace.

A) LANGUAGE FUNCTIONS 15

1. Compare and contrast
2. Giving reasons
3. Reporting
4. Expressing agreement and disagreement
5. Evaluating different standpoints
6. Analyzing a problem and giving solution.
7. Describing daily routines, events, and weather
8. Describing Objects
9. Defending a point of view
10. Talking about future plans and intentions

Language Functions:

The teacher should build micro activities to develop the use of language required to handle these Sub-functions of communication. In the process, the learners should get used to the linguistic Elements needed for these functions.

B) SPEECH PRACTICE 15

The themes are:

1. Cloning
2. Artificial satellites
3. Renewable sources
4. Telecommunication
5. Cyber Revolution
6. Space research
7. Polythene pollution
8. Fossil fuels
9. Safety measures in Automobiles
10. Ecological threats
11. Water resources
12. Nuclear technology
13. Scientific farming
14. Thermal power plants
15. Nano Technology
16. Robotics
17. Artificial intelligence
18. Role of Fibre Optics
19. Exploration of Mars
20. Gas turbines
21. Indian space missions
22. Converting agricultural wastes for useful purposes
23. Developments in transportation
24. Scientific farming
25. Impact of global warming
26. Desalination of water
27. Technology for national security
28. Industrial development and ecological issues

29. Recent trends in Automobiles
30. Hazards of E-waste
31. Mobile Jammer
32. Touch Screen Technology
33. Tidal Power
34. 3G Technology
35. Tsunami Warning System
36. Blue Tooth Technology

Seminar presentation on the themes allotted:

Each student should collect materials from Books, Internet, Journals and Newspapers for his/her theme and prepare a short Seminar Paper for 4 to 5 Pages. The presentation should be for 10 minutes using power point frames. It should be followed by a Viva Voce during which others should come forward to question, clarify, supplement or evaluate.

C) GROUP DISCUSSION / DEBATE 10

Grouping (each group consisting of 12 members)

Topics (12 topics – 3 topics to be selected by each group - to be practiced in cycles)

Group Discussion / Debate Topics:

1. Advertising is a legalized form of lying- Discuss.
2. Communicative competency in English is the golden key for success in the Global arena.
3. Is it just to force people to retire?
4. Attitude decides one's altitude in life.
5. Should an aspiring student go for a course which is in demand or for a course which he/she likes?
6. Is westernization a cultural degradation or enrichment?
7. Is brain drain a threat to India?
8. Can nuclear energy be replaced by solar energy? – Discuss.
9. Do mobile phones spoil the youth?
10. No two generations see eye to eye- Discuss.
11. Is scientific advancement a boon or a bane?
12. Does ragging develop friendship?

D) SPEAKING ON THE GIVEN PICTURE/DIAGRAM/CHART/TABLE 5

RECORD LAY OUT:

Every student has to maintain a record in which he/she has to incorporate the following details.

- First page containing learner details and the topic of specialization
- Use of appropriate Language used in Language Function should be listed.
- Three news paper cuttings or journal or internet sources related to the specialized theme. (To be pasted on the pages)
- 10 Quiz questions of the specialized topic with expected answers.
- The seminar paper presented by the learner (to be pasted).
- Notes of observation - Lab. (Details about Interview skills – GD – Soft skills)
- The record should be duly signed by the course teacher and submitted to the External Examiner for verification during the semester practical.

TOTAL: 45 PERIODS

REFERENCES

1. Rizvi M.Ashraf, "Effective Technical Communication", Tata McGraw Hill, 2010.
2. Sangeetha Sharma and Binod Mishra, "Communication Skills for Engineers and scientists", PHI Learning Private Limited, Delhi, 2009.

13EE51 TRANSMISSION AND DISTRIBUTION L T P C
3 1 0 4

COURSE OUTCOMES

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

CO1: Explain the principle and structure of various electric power systems.
CO2: Design the electrical parameters of Transmission line parameters.
CO3: Calculate the performances of different transmission lines.
CO4: Calculate the voltage distribution and string efficiency of insulators and cables.
CO5: Explain substation and distribution system.

UNIT I POWER SYSTEM STRUCTURE 12

Structure of electric power system – Generation, Transmission and distribution voltages – HVDC system – structure – Types - Comparison of AC and DC system - EHV AC transmission- need and environmental aspects – FACTS- TCSC – SVC – STATCOM – UPFC (qualitative treatment only) – Mechanical design of transmission line between towers – sag and tension- calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS 12

Transmission line Resistance - Inductance and Capacitance calculations for - single and three phase transmission lines with single and double circuits lines - Symmetrical and unsymmetrical spacing - Transposition - Application of self and mutual GMD -Stranded and bundled conductors - Skin and proximity effects.

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 12

Classification of lines – Short, medium and long transmission lines – Equivalent circuits Transmission efficiency and voltage regulation – Generalized constants of the transmission line- Surge impedance – Surge impedance loading- Real and reactive power flow in the line- Power angle diagram - Power circle diagrams – Ferranti effect -corona formation and loss.

UNIT IV INSULATORS AND CABLES 12

Insulators – Types – Voltage distribution in string insulator and grading – Improvement of string efficiency – Underground cables – Constructional features of LT and HT cables – Capacitance single core and three core cables – Dielectric stress and grading – Thermal characteristics.

UNIT V SUBSTATION AND DISTRIBUTION SYSTEM 12

Types of substations- substation equipments – Bus-bar arrangements – Substation bus schemes – Single bus scheme – Double bus with double breaker – Double bus with single breaker – Main and transfer bus – Ring bus – Breaker-and-a-half with two main buses – Double bus-bar with bypass isolators.

Neutral grounding- System and equipment grounding- grounded and ungrounded transmission system- Solid, Resistance, reactive, Peterson coil grounding systems –Distribution systems- types - Radial and ring main (qualitative treatment only).

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

TEXT BOOKS

1. Wadhwa C.L., “Electric Power Systems”, New Age International (P) Ltd., 2000.
2. Gupta B.R., “Power System Analysis and Design”, S. Chand Company & Ltd, New Delhi, 2003.

REFERENCES

1. Singh S.N., “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India, New Delhi, 2002.
2. Mehta V. K. and Rohit Mehta, “Principles of Power System”, S.Chand Company & Ltd, New Delhi, 2006.
3. Kothari D.P. and Nagarath I.J., “Power System Engineering”, Tata McGraw-Hill Publishing Company limited, New Delhi, 2007.
4. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Publishing Company, 2003.
5. Uppal.S.L., “Electrical Power: Generation, Transmission, Distribution, Switchgear and Protection, Utilization of Electrical Energy and Electric Traction : in M.K.S. Units”, Khanna Publisher, 1984.

13EE52 DATA STRUCTURES AND ALGORITHMS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO1: Implement various sorting and searching algorithms.
CO2: Implement basic ADTs like linked list, queue and stack using both static and dynamic memory allocations.
CO3: Recognize the data organization and applications of binary trees and binary search trees.
CO4: Identify suitable algorithms for solving hashing, shortest path, network link analysis, and minimum spanning tree.
CO5: Identify data structuring strategies that are appropriate to a given contextual problem.

UNIT I SORTING AND SEARCHING ALGORITHMS 9

Sorting – Internal and External Sorting: Bubble Sort – Insertion Sort – Shell Sort – Merge Sort – Quick Sort – Bucket Sort – Radix Sort. Searching: Linear Search – Binary Search.

UNIT II LINEAR STRUCTURES 9

Definition – Types – Applications of Data Structures - Abstract Data Types (ADT) – List ADT – Array-based implementation – Linked List implementation – Doubly-linked lists – Applications of lists – Stack ADT – Balancing Symbols – Infix to Postfix Conversion – Evaluation of Postfix Expression – Queue ADT .

UNIT III TREE STRUCTURES 9

Non Linear Data Structures -Tree ADT – Terminologies of Trees –Binary Tree ADT – Tree Traversals - Expression Trees – Binary search Tree ADT – Threaded Binary Trees - Applications of Trees.

UNIT IV HASHING AND HEAPS 9

Hash Function – Separate chaining – Open Addressing – Rehashing – Extendible hashing - Heaps – Binary Heaps – Applications of Binary Heaps – d Heaps – Leftist Heaps.

UNIT V GRAPHS 9

Definitions – Terminologies of Graph - Topologicalsort – Breadth-first traversal – Depth First Traversal - Shortest Path Algorithms – Minimum panning Tree – Prim's and Kruskal's Algorithms – Biconnectivity.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Weiss M. A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2005.
2. Aho A.V., Hopcroft J. E., and Ullman J. D., “Data Structures and Algorithms”, 1st Edition, Pearson Education, Reprint 2003.

REFERENCE

1. Gilberg R.F., Forouzan B.A., “Data Structures”, 2nd Edition, Thomson India Edition, 2005.

13EE53 DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS L T P C
3 1 0 4

COURSE OUTCOMES

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

CO1: Compute frequency spectrum of signals using DFT.
CO2: Design and realize IIR digital filters.
CO3: Design and realize FIR digital filters.
CO4: Recognize the effects of finite word length in DSP.
CO5: Apply DSP for motor control.

UNIT I DISCRETE FOURIER TRANSFORM 12

DTFT and its properties, DFT and its properties, Relation between DTFT and DFT, FFT 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 12

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 transformation - pre warping - Realization using direct, cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 12

Symmetric and Antisymmetric FIR filters - Linear phase FIR filters – Windowing Techniques - Design using Rectangular, Hamming, Hanning, Blackmann and Kaiser Windows - Frequency sampling method - Realization of FIR filters - Transversal, Linear phase and Poly phase structures.

UNIT IV FINITE WORD LENGTH EFFECTS 12

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 – Round off noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling.

UNIT V PROGRAMMABLE DSP CHIPS 12

Architecture and features of TMS 320C5X signal processor - Addressing Modes - Overview of instruction set – DSP based Stepper motor and DC motor control (Qualitative treatment only)

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

TEXT BOOKS

1. Proakis J.G. and Manolakis D.G., “Digital Signal Processing Principles, Algorithms and Applications”, Pearson Education, New Delhi, 2003.
2. Mitra S.K., “Digital Signal Processing – A Computer Based Approach”, Tata McGraw-Hill, New Delhi, 2001.

REFERENCES

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, “Discrete – Time Signal Processing”, Pearson Education, New Delhi, 2003.
2. Venkataramani B. and Bhaskar M., “Digital Signal Processors, Architecture, Programming and Applications”, Tata McGraw-Hill, New Delhi, 2003.
3. Salivahanan S., Vallavaraj A. and Gnanapriya C., “Digital Signal Processing”, Tata McGraw- Hill, New Delhi, 2003.
4. Chitode J.S., “Digital Signal Processing”, Technical Publications, 2009.
5. C. Ramesh Babu Durai, “Digital Signal Processing”, Laxmi Publications, 2nd Edition, 2007.

13EE54 CONTROL ENGINEERING L T P C
3 1 0 4

COURSE OUTCOMES

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

CO1: Model the dynamics of different physical systems.

CO2: Predict the time domain behavior of systems and location of roots.

CO3: Analyze the open loop and closed loop frequency responses of systems.

CO4: Apply the concepts of stability and design of compensator in frequency domain.

CO5: Analyze the system using state model.

UNIT I SYSTEMS AND THEIR REPRESENTATION 12

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE 12

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Characteristics equation – Routh Hurwitz criterion – Root locus construction.

UNIT III FREQUENCY RESPONSE 12

Frequency response - Correlation between frequency domain and time domain specifications – Bode plot – Polar plot – Determination of closed loop response from open loop response - Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.

UNIT IV STABILITY AND COMPENSATOR DESIGN IN FREQUENCY DOMAIN 12

Nyquist stability criterion - Performance criteria –Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots – PID controller - Design using Ziegler-Nichols technique for I and II order system.

UNIT V STATE VARIABLE ANALYSIS 12

Concept of state variables for linear time invariant Systems – State models from transfer function – State transition matrix - Solution of state and output equation in autonomous system – Concepts of controllability and observability – Kalman's test (without proof).

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

TEXT BOOKS

1. Nagrath J. and Gopal M., Control Systems Engineering, Tata McGraw-Hill Education Private Limited, Reprint, 2010.
2. Gopal M., "Control Systems, Principles and Design", 4th Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES

1. Arthur, G.O.Mutambara, Design and Analysis of Control; Systems, CRC Press, 2009.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Prentice Hall, 2012.
3. Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010.
4. Ogata K., 'Modern Control Engineering', 5th Edition, PHI, 2012.
5. Dhanesh. N. Manik, Control System, Cengage Learning, 2012.
6. Bhattacharya S.K., Control System Engineering, 3rd Edition, Pearson, 2013.

13EE55 PROFESSIONAL ETHICS AND HUMAN VALUES **L T P C**
(Common to all branches) **3 0 0 3**

COURSE OUTCOMES

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

CO1: Understood the core values that shape the ethical behavior of an engineer
CO2: Exposed awareness on professional ethics and human values.
CO3: Known their role in technological development

UNIT I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – 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 - the challenger case study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V GLOBAL ISSUES 9

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -Moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
4. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint)

13EE56 HIGH VOLTAGE 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 various causes of overvoltage phenomenon.

CO2: Choose appropriate method to generate HVAC, HVDC and Impulse voltage and Current.

CO3: Analyze the various breakdown mechanisms of different dielectric materials.

CO4: Identify exact method to measure HVAC, HVDC and Impulse voltage and current.

CO5: Summarize the various tests in power apparatus as per standards.

UNIT I OVER VOLTAGE PHENOMENON AND INSULATION COORDINATION 9

Natural causes for over voltages – Lightning phenomenon, overvoltage due to switching surges, system faults and other abnormal conditions – Principles of insulation coordination.

UNIT II GENERATION OF HIGH VOLTAGES AND CURRENTS 9

Generation of high direct current voltages– Generation of high alternating voltages– Generation of impulse voltages– Generation of impulse currents– Tripping and control of impulse generators

UNIT III BREAK DOWN IN SOLID, GASEOUS AND LIQUID DIELECTRICS 9

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice - Breakdown in composite dielectrics - Solid dielectrics used in practice – Gases as insulating media, collision process, ionization process - Townsend's criteria of breakdown in gases - Paschen's law – Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND CURRENTS 9

Measurement of high direct current voltages– Measurement of high voltages alternating and impulse - Measurement of high currents–direct, alternating and Impulse - Oscilloscope for impulse voltage and current measurements.

UNIT V HIGH VOLTAGE TESTING 9

IEEE, IEC and ANSI Standards - Testing of insulators and bushings, Testing of isolators and circuit breakers, Testing of cables - Testing of transformers - Testing of surge arresters.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Naidu M.S. and Kamaraju V., "High Voltage Engineering", TMH Publications, 4th Edition, 2009.
2. Kuffel E., Zaengl W.S. and Kuffel J., "High Voltage Engineering: Fundamentals", Elsevier, 2nd Edition, 2000.

REFERENCES

1. Wadhwa C.L., "High Voltage Engineering", New Age Internationals Private Limited, 1997.
2. Ravindra Arora, Wolfgang Mosch, "High Voltage Insulation Engineering", New Age International Private Limited, 1995.
3. Alston L. L., "High Voltage Technology", Oxford University Press, New Delhi, 1st Indian Edition, 2006.
4. Subir Roy, "An introduction to High Voltage Engineering", Prentice Hall Private Limited, 2004.
5. M.Jeraldin Ahila, "High Voltage Engineering", A.R.S publications, 2014.

13EE57 CONTROL AND INSTRUMENTATION LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

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

CO1: Construct transfer function models for electro - mechanical systems.

CO2: Choose appropriate method for measurement of electrical and non electrical parameters

CO3: Calibrate the energy meter by direct and phantom loading method.

CO4: Evaluate time, frequency domain specifications and stability of system.

CO5: Design the compensators

LIST OF EXPERIMENTS

1. Study of displacement and pressure transducers
2. AC bridges
3. DC bridges
4. Calibration of current transformer
5. Calibration of single phase energy meter direct loading and Phantom loading
6. Calibration of three phase energy meter direct loading
7. Speed torque characteristics AC servo motor
8. Frequency response analysis of armature and field controlled DC Servo motor
9. Design and implementation of Lag, Lead compensator
10. Stability analysis of linear system
11. Transfer function of AC Servo motor
12. Time Response analysis of First and Second order systems
13. Measurement using data acquisition card.

P: 45 TOTAL: 45 PERIODS

13EE58 DATA STRUCTURES AND ALGORITHMS LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

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

CO1: Describe the basic concept of data structures.
CO2: Implement linked list using static and dynamic memory allocation.
CO3: Analyze the operations of stack and queue.
CO4: Implement the arithmetic expression using trees.
CO5: Distinguish the opened and closed hashing techniques.

LIST OF EXPERIMENTS

1. Implement insertion sort
2. Implement binary search
3. Implement singly and doubly linked lists.
4. Represent a polynomial as a linked list and write functions for polynomial addition.
5. Implement stack and use it to convert infix to postfix expression.
6. Implement a double-ended queue (dequeue) where insertion and deletion operations are possible at both the ends.
7. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
8. Implement binary search tree.
9. Implement priority queue using binary heap.
10. Implement hashing with open addressing.
11. Implement Prim's algorithm and Kruskal's Algorithm using priority queues to find MST of an undirected graph.
12. Implement Dijkstra's algorithm to find the shortest path.

P: 45 TOTAL: 45 PERIODS

LIST OF EQUIPMENTS AND COMPONENTS FOR A BATCH OF 30 STUDENTS (PER BATCH)

HARDWARE

- 30 Systems with core i5 Processor

SOFTWARE

- Turbo C++/GCC Compiler – to be installed in all PCs.
- OS – LINUX/ Windows 2000/ Windows XP/ NT

13EE61 POWER SYSTEM ANALYSIS L T P C
3 1 0 4

COURSE OUTCOMES

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

CO1: Compute the per unit quantities for power system components.
CO2: Model equivalent circuit of a network using single line diagram.
CO3: Evaluate the parameters of power system using various methods of Load flow Analysis.
CO4: Estimate the fault current for different types of short circuits.
CO5: Analyze the concepts of power system stability.

UNIT I POWER SYSTEM OVERVIEW 12

Power system components, Representation – Single line diagram – Per unit quantities – Per phase analysis of symmetrical three-phase system – Impedance and reactance diagram – sequence impedances and sequence networks.

UNIT II NETWORK MODELLING 12

Primitive network and its matrices – Bus admittance and bus impedance matrix formation – Equivalent circuit of transformer with off-nominal-tap ratio. Modelling of generator, load, shunt capacitor, transmission line and shunt reactor.

UNIT III POWER FLOW ANALYSIS 12

Introduction – Bus classification – Formation of power flow equation – Solution by Gauss Seidel, Newton Raphson and Fast Decoupled methods – Computation of slack bus power, real and reactive power flow – Transmission loss.

UNIT IV SHORT CIRCUIT ANALYSIS 12

Need for short circuit study – Symmetrical component transformation - Symmetrical fault analysis – Z bus in phase frame and in sequence frame fault matrices – unsymmetrical fault analysis.

UNIT V STABILITY ANALYSIS 12

Introduction to stability studies – classification – Swing equation – Solution to swing equation – Step by step method – Power angle equation – Equal area criterion – Critical clearing angle and time. Stability analysis of single machine connected to infinite bus by modified Euler's method.

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

TEXT BOOKS

1. John J. Grainger and Stevenson Jr.W.D., "Power System Analysis", Tata McGraw Hill,2003.
2. Nagarath I.J., Kothari D.P., "Power System Engineering", Tata McGraw Hill, 2nd Edition, 2008.

REFERENCES

1. Wadhwa C. L., "Electrical Power systems", 6th Edition, New Age Publishers.
2. Nagarath I.J. and Kothari D.P., "Modern Power System Analysis", 4th Edition, Tata McGraw Hill Publishing Company, 2012.
3. Hadi Saadat, "Power system Analysis", Tata McGraw Hill Publishing Company, 3rd Edition, 2010.
4. Venkatesh P.V.,Manikandan B.V., charles Raja S and Srinivasan A., " Electrical Power systems", PHI Learning Private Limited, New Delhi, 2012.
5. Chakrabarti A. and Halder S., "Power System Analysis: Operation and Control", PHI Private Limited, 2010.

13EE62 DESIGN OF ELECTRICAL APPARATUS L T P C
3 1 0 4

COURSE OUTCOMES

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

CO1: Formulate Specific Electrical and Magnetic loadings for various electrical DC and AC machines.
CO2: Devise main dimensions (D, L) of armature and field systems for D.C. machines.
CO3: Design overall Dimensions of single and three phase transformers core, windings and cooling systems for transformers.
CO4: Design main dimensions of squirrel cage and Slip ring induction machines.
CO5: Estimate enhanced dimensions of stator of AC machines.

UNIT I INTRODUCTION 12

Major considerations in Electrical Machine Design - Electrical Engineering Materials - Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal consideration - Heat Dissipation - Temperature gradient in cores slots and windings - Rating of machines – Standard specifications.

UNIT II DC MACHINES 12

Output Equations – Main Dimensions - Magnetic circuit calculations - 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 12

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Design of core and windings - Overall dimensions – No load current – Temperature rise in Transformers – Design of Tank with cooling tubes - Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS 12

Output equation of Induction motor – Main dimensions – 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 polyphase machines - Magnetizing current - Short circuit current .

UNIT V SYNCHRONOUS MACHINES 12

Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Design of field winding – Design of turbo alternators – Rotor design.

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

TEXT BOOKS

1. Sawhney A.K., "A Course in Electrical Machine Design", Dhanpat Rai & Sons, New Delhi, 2006.
2. Say.M.G, "The Performance and Design of Alternating current Machines", Isaac Pitman & sons Limited, 1995.

REFERENCES

1. Sen S.K., "Principles of Electrical Machine Designs with Computer Programmes", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2009.
2. Shanmugasundaram A., Gangadharan G. and Palani R., "Electrical Machine Design Data Book", New Age International Pvt. Ltd., Reprint 2007.
3. Rai.H.M, "Electrical Machine Design", Sathiya Prakashan Publications, 3rd Edition, 2004.
4. Clayton.A.E, "Performance & Design of Direct current Machines", English Language Book society & Sri Isaac Pitman & Sons Limited, London 1995.
5. A.Nagoor Kani , "Electric Machine Design", RBA Publications, 2nd Edition 2000.

13EE63 MICROPROCESSOR AND MICROCONTROLLER AND ITS APPLICATIONS **L T P C 3 1 0 4**

COURSE OUTCOMES

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

CO1: Recognize the architecture of Microprocessor (8085/8086) and Microcontroller (8051).
CO2: Develop simple programs based on the instruction sets of 8085 and 8051.
CO3: Design and implement memory and peripheral device interfacing using 8085.
CO4: Discriminate the different interrupt structures of 8085 and 8051.
CO5: Implement various addressing modes and programming towards simple project development.

UNIT I INTRODUCTION TO MICROPROCESSORS 12

Hardware Architecture pin outs - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure. Introduction to 8086 processor (Architecture and modes of operation only).

UNIT II PROGRAMMING OF 8085 PROCESSOR 12

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions - stack.

UNIT III PERIPHERAL INTERFACING 12

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing.

UNIT IV 8051 MICRO CONTROLLER 12

Functional block diagram - Instruction format and addressing modes – Timing Diagram Interrupt structure – Timer –I/O ports – Serial communication.

UNIT V MICRO CONTROLLER PROGRAMMING AND APPLICATIONS 12

Data Transfer, Manipulation, Control & I/O instructions – Simple programming exercises key board and display interface – Design of PID controller - Closed loop control of servo motor - Stepper motor control - Washing Machine Control.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Senthilkumar N. and Saravanan M. “Microprocessor and Microcontrollers”, Oxford University Press, 2011
2. Krishna Kant “Microprocessor and Microcontrollers” Eastern Company Edition, Prentice – Hall of India, New Delhi, 2007.

REFERENCES

1. Ankaj Gupta “Microcontroller and Embedded System” S.K.Kataria and Sons Publishers 2013
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely “The 8051 Micro Controller and Embedded Systems” (Using Assembly Language and C), PHI Pearson Education, 2011
3. Ramesh Gaonkar, ‘Microprocessor Architecture Programming and Application’, CBS Publishers 2011
4. The 8088 & 8086 Microprocessors , Walter A Tribal & Avtar Singh, Pearson, 2007
5. Singh B.P., Renu Singh “Advanced Microprocessors and Microcontrollers”, New Age International Private Limited, 2009

13EE64 POWER ELECTRONICS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO1: Distinguish various types of power semiconductor devices.

CO2: Analyze the operation of phase controlled rectifiers.

CO3: Discuss the basic topologies of DC-DC switching regulators.

CO4: Describe the different modulation techniques of pulse width modulated inverters.

CO5: Explain the operation of AC voltage controller and Cycloconverter.

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Basic structure and characteristics of SCR, TRIAC, DIAC, Power BJT, Power MOSFET and IGBT – Driver, Snubber circuit and commutation circuit of switching devices.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – Performance parameters – Power factor control – Dual converters.

UNIT III DC TO DC CONVERTER 9

Step-down and step-up chopper – Time ratio control and current limit control – Switching mode regulators - Buck, Boost, Buck-Boost and Cuk regulator - Concept of resonant switching.

UNIT IV INVERTERS 9

Single phase and three phase (both 120º mode and 180º mode) inverters – PWM techniques: Single PWM- Multiple PWM - Sinusoidal PWM, modified sinusoidal PWM — Voltage and harmonic control – Series resonant inverter – Current source inverter- Uninterrupted power supply topologies.

UNIT V AC TO AC CONVERTERS 9

Single phase AC voltage controllers - Introduction to Integral cycle control – Multistage sequence control - Single and three phase cycloconverters.

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.
5. Bimal K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, 2003.

13EE65 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

COURSE OUTCOMES

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

CO1: Use pointers and dynamic memory allocation in C++ classes
CO2: Recognize and use object oriented programming constructs to write object oriented programs
CO3: Describe encapsulation, polymorphism and inheritance
CO4: Create and modify objects using C++ classes
CO5: Determine the appropriate objects required to solve a programming problem
CO6: Practice exception handling mechanisms to handle runtime errors
CO7: Differentiate function templates and class templates
CO8: Explain about the namespaces

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

Streams and formatted I/O – Overloading << and >>. File: File Classes – File Operations.
Namespaces: Namespaces – std namespace. Standard Template Library: Overview – Container Classes – General Theory of Operation – Lists – String Class – Final Thoughts on STL.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Herbert Schildt, "C++: The Complete Reference", 4th Edition, Tata McGraw – Hill Publishers, 2003.
2. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall Publisher, 2011.

REFERENCES

1. Ira Pohl, "Object Oriented Programming using C++", 2nd Edition, Pearson Education, Reprint 2004.
2. Lippman S. B., Josee Lajoie, Barbara E. Moo, "C++ Primer", 4th Edition, Pearson Education, 2005.
3. Stroustrup B., "The C++ Programming language", 3rd Edition, Pearson Education, 2004.
4. Balagurusamy E., "Object Oriented Programming with C++", Tata McGraw-Hill Education, 2008.

13EE67 POWER ELECTRONICS LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

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

CO1: Compare the characteristics of various power semiconductor devices.

CO2: Demonstrate the operation of phase controlled rectifiers based DC drives.

CO3: Analyze the basic topologies of DC-DC converters.

CO4: Employ the different modulation techniques of pulse width modulated inverters.

CO5: Compute the performance of AC voltage controller and Cycloconverter.

LIST OF EXPERIMENTS

1. Characteristics of SCR, TRIAC and DIAC
2. Characteristics of MOSFET and IGBT
3. AC to DC fully controlled converter
4. AC to DC half controlled converter
5. Step down and Step up chopper
6. IGBT based PWM inverter
7. Series and Parallel inverter
8. AC Voltage Controller
9. Cycloconverter
10. AC to DC converter based DC drive
11. DC to AC converter based AC drive

P: 45 TOTAL: 45 PERIODS

13EE68 MICROPROCESSOR AND MICROCONTROLLER LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

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

CO1: Develop basic binary and mathematical operations like Addition, Subtraction, Multiplication, Division using microprocessor and microcontroller

CO2: Describe the fundamental features and operations of contemporary microcontroller and microprocessor

CO3: Develop Assembly Language Program that will provide solutions to real world control problems like Speed control, traffic light control.

CO4: Choose appropriate peripheral interfacing devices with 8085 for specific applications

8-bit Microprocessor

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending /Descending order, Maximum / Minimum of numbers, Rotate instructions Hex / ASCII / BCD code conversions.
3. Interface Experiments:
    1. A/D Interfacing.
    2. D/A Interfacing.
    3. Traffic light controller.
    4. Simple experiments using 8251, 8279, 8254.

8-bit Microcontroller

4. Demonstration of basic instructions with 8051 Microcontroller execution, including:
    1. Conditional jumps, looping
    2. Calling subroutines.
5. Parallel port programming with 8051 using port 1 facility:
    1. Stepper motor and D / A converter.
6. Programming exercise on
    1. RAM Direct Addressing
    2. Bit Addressing
7. Programming Practice using simulation Tools and C Complier
    1. Initialize Timer
    2. Enable Interrupts
8. Study of microcontroller with FLASH memory.
9. Programming Practice on Assembler and Simulator tools in 8051

P: 45 TOTAL: 45 PERIODS

13EE69 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

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

CO1: Design object oriented programs with static members and friend functions using C++
CO2: Implement C++ programs with operator overloading and type conversions
CO3: Develop class templates for various data structures like stack, queue and linked list.
CO4: Apply function templates concepts in standard sorting algorithms such as bubble sort, insertion sort, merge sort and quick sort.
CO5: Create classes with necessary exception handling
CO6: Construct simple test applications using dynamic polymorphism.

LIST OF EXPERIMENTS

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. Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor, and overloading of assignment operator.
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. Overload the new and delete operators to provide custom dynamic allocation of memory.
5. Develop C++ class hierarchy for various types of inheritances.
6. Design a simple test application to demonstrate dynamic polymorphism and RTTI.
7. Develop a template of linked-list class and its methods.
8. Develop templates of standard sorting algorithms such as bubble sort, insertion sort and quick sort.
9. Design stack and queue classes with necessary exception handling.
10. Write a C++ program that randomly generates complex numbers (use previously designed Complex class) and writes them two per line in a file along with an operator (+, -, *, or /). The numbers are written to file in the format (a + ib). Write another program to read one line at a time from this file, perform the corresponding operation on the two complex numbers read, and write the result to another file (one per line).

P:45 TOTAL: 45 PERIODS

LIST OF EQUIPMENTS AND SOFTWARE FOR A BATCH OF 30 STUDENTS

HARDWARE

- 30 Systems with core i5 Processor

SOFTWARE

- Turbo C++/GCC Compiler – to be installed in all PC's.
- OS – LINUX/ Windows 2000/ Windows XP/ NT

13EE71 **PRINCIPLES OF MANAGEMENT**
(Common to all branches)

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.
CO2: Practice the process of planning and decision making in an industrial situations.
Co3: Design the suitable selection process for a particular job description.
Co4: Apply different motivational techniques and leadership skills in the organization.
Co5: Justify the various controlling techniques and tools in the organization.

UNIT I INTRODUCTION 9

Historical developments – approaches to management – Management and Administration – Development of Management Thoughts – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organization, Meaning, features merits and demerits - Social responsibility.

UNIT II PLANNING 9

Nature and Purpose– Steps in Planning Process – Objectives – Setting Objectives – Process of Managing through Objectives – Strategies – Policies and PlanningPremises – Forecasting – Importance, Methods of Forecasting - Decision-making, Decision making Process & Types of Decisions.

UNIT III FUNCTIONAL AREA OF ORGANISATION 9

Formal and Informal organization – Organization Chart – Structure and Process – Departmentation by different strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV DIRECTION 9

Objectives– Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Types of Communication – Barriers and Breakdown - Effective Communication - Electronic Media in Communication.

UNIT V CONTROLLING STRATEGIES 9

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology– Computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Harold Koontz & Heinz Weihrich, "Essentials of Management – An International Perspective", Tata Mcgraw Hill, 8th Edition, 2009.
2. Hellriegel, Slocum & Jackson, "Management – A Competency Based Approach", Thomson South Western, 11th Edition, 2008.

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, 2007.
3. Vijayaraghavan G.K & Sivakumar M. "Principles of Management", Lakshmi Publications, 1st Edition, 2012.
4. Ramachandran. S. "Principles of Management", Air Walk Publications, 1st Edition, 2012.
5. Andrew J. Dubrin, "Essentials of Management", Thomson South western, 9th Edition, 2011.

13EE72 SOLID STATE DRIVES L T P C
3 1 0 4

COURSE OUTCOMES

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

CO1: Describe the concept of motor load dynamics, multi quadrant dynamics, acceleration and deceleration.
CO2: Analyze the operation of single phase fully controlled converter fed separately excited dc drives with continuous and discontinuous conduction.
CO3: Differentiate armature voltage control and field weakening mode control in dc motors.
CO4: Design current and speed controllers for dc drives.
CO5: Compare V/f control in induction and synchronous motor drives.

UNIT I DRIVE CHARACTERISTICS 12

Equations governing motor load dynamics - steady state stability - Multiquadrant dynamics - Acceleration, deceleration, starting and stopping - load torque characteristics of various drives.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 12

Steady state analysis of the single and three phase fully controlled converter fed separately excited DC motor drive - Continuous and discontinuous conduction Time ratio and current limit control - 4 quadrant operation of converter.

UNIT III DESIGN OF CONTROLLERS FOR DRIVES 12

Transfer function for DC motor, load and converter - Closed loop control with current and speed feedback - Armature voltage control and field weakening mode control, Design of controllers: Current controller and speed controller - Converter selection and characteristics.

UNIT IV INDUCTION MOTOR DRIVES 12

Stator voltage control - energy efficient drive - V/f control, constant air-gap flux - field weakening mode - voltage/current fed inverters - block diagram of vector control - closed loop control.

UNIT V SYNCHRONOUS MOTOR DRIVES 12

Constant V/f control and self-control of synchronous motor – Marginal angle control and power factor control - Permanent magnet synchronous motor.

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

TEXT BOOKS

1. Gopal K. Dubey, “Power Semi conductor controlled drives “Prentice Hall Inc., New Jersey, 1989.
2. Bimal K. Bose. “Modern Power Electronics and AC Drives”, PHI / Pearson Education, 2005.

REFERENCES

1. De N. K. and Sen P. K., “Electrical Drives”, Prentice Hall Pvt. Ltd, 2006.
2. Murphy J.M.D. and Turnbull, “Thyristor control of AC Motor”, Pergamon Press Oxford, 1988.
3. Krishnan R., “Electric Motor Drives: Modeling, Analysis, and Control”, Prentice Hall of India, 2001.
4. Dubey.G.K. "Fundamentals of Electrical drives", Narora publications, 1995.
5. VedamSubramanyan, “Thyristor control of Electrical Drives”, Tata McGraw Hill, Publications, 1996.

13EE73 PROTECTION AND SWITCHGEAR 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 various relays.
CO2: Apply proper protection schemes for power apparatus.
CO3: Describe the circuit interruption techniques.
CO4: Discuss different types of circuit breakers.
CO5: Develop microprocessor based numerical relays.

UNIT I OPERATING PRINCIPLES AND RELAY CHARACTERISTICS 9

Electromagnetic relays – over current, directional and non-directional, distance, negative sequence, differential and under frequency relays.

UNIT II APPARATUS PROTECTION 9

Main considerations in apparatus protection - transformer, generator and motor protection - protection of busbars - Transmission line protection - zones of protection - CTs and PTs and their applications in protection schemes - Neutral grounding- System and equipment grounding- grounded and ungrounded transmission system- Solid, Resistance, reactive, Peterson coil grounding systems.

UNIT III THEORY OF CIRCUIT INTERRUPTION 9

Physics of arc phenomena and arc interruption - DC and AC circuit breaking - restriking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current.

UNIT IV CIRCUIT BREAKERS 9

Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparative merits of different circuit breakers – testing of circuit breakers.

UNIT V NUMERICAL RELAYS 9

IC Elements and Circuits for Interfaces – A/D Converter, Analog Multiplier, S/H Circuit – Over current Relays– Impedance Relay – Directional Relay – Reactance Relay – Measurement of R and X – Quadrilateral Relay – Generalized Interface for Distance Relays – Microprocessor Implementation of Digital Distance Relaying Algorithms.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Sunil S. Rao, ‘Switchgear and Protection’, Khanna publishers, New Delhi, 1986.
2. Badri Ram, Vishwakarma, ‘Power System Protection and Switchgear’, Tata McGraw Hill, 2001.

REFERENCES

1. Soni M.L., Gupta P.V., Bhatnagar V.S., Chakrabarti A., ‘A Text Book on Power System Engineering’, Dhanpat Rai & Co., 1998.
2. Wadhwa C.L., ‘Electrical Power Systems’, Newage International (P) Ltd., 2000.
3. Ravindranath B., and Chander N., ‘Power System Protection & Switchgear’, Wiley Eastern Ltd., 1977.
4. Rajput R.K, “A Text book of Power System Engineering” Laxmi Publications, First Edition Reprint 2007.
5. Paithankar Y.G. and Bhide S.R., ‘Fundamentals of Power System Protection’, Prentice Hall of India Pvt. Ltd., New Delhi–110001, 2003.

13EE74 EMBEDDED 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: describe the design process of embedded system.
CO 2: explain the concept of memory management methods and communication protocols.
CO 3: demonstrate the concepts of programming and scheduling techniques.
CO 4: distinguish various Real Time Operating Systems.
CO 5: develop simple applications using PIC Microcontroller.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to embedded systems – Design Process in embedded system, Design metrics – Components of embedded system & its classification, characteristics of embedded system – Introduction to embedded processor, Digital Signal Processor, Application Specific System Processor – Challenges in embedded system design – Design examples: Mobile phone SOC and Model Train Controller.

UNIT II EMBEDDED SYSTEM ORGANIZATION 9

Structural units in processor - selection of processor & memory devices- Types of memory – Memory management methods – DMA – I/O devices: timer & counting devices – Serial communication using I^2C - CAN USB buses –Parallel communication using ISA - PCI - PCI/X buses – Device drivers.

UNIT III PROGRAMMING AND SCHEDULING 9

Intel I/O instructions – Synchronization - Transfer rate, latency; interrupt driven input and output - Nonmaskable interrupts, software interrupts, Preventing interrupts overrun - Disability interrupts. Multithreaded programming –Context Switching, Preemptive and non-preemptive multitasking, semaphores. Scheduling-thread states, pending threads, context switching.

UNIT IV REAL TIME OPERATING SYSTEMS 9

Unix based Real Time operating system - Windows as a Real time operating system – POSIX – RTOS-Interrupt handling - A Survey of contemporary Real time Operating systems: PSOS, VRTX, VxWorks, QNX, micro controller/OS-II, RT Linux – Benchmarking Real time systems.

UNIT V PIC MICROCONTROLLER BASED EMBEDDED SYSTEM DESIGN 9

PIC microcontroller – M-Basic compiler and Development boards –Basic Output and digital input – Applications – Driving LED's – Motor control: Relay, PWM, DC and Stepper Motor – Lighting control.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Rajkamal, "Embedded system-Architecture, Programming, Design", Tata McGraw Hill, 2003.
2. Wayne Wolf," Computers as components: Principles of Embedded computing System Design"

REFERENCES

1. Jack R Smith "Programming the PIC microcontroller with M-Basic" Elsevier , 2007
2. Rajib Mall "Real-Time systems Theory and Practice", Pearson Education 2007
3. Sriram. V.Iyer & Pankaj Gupta, 'Embedded real time systems Programming', Tata McGraw Hill, 2004
4. N. Senthilkumar, M. Saravanan and S. Jeevananthan, "Microprocessors and Microcontollers", 2011.
5. Daniel W. Lewis, "Fundamentals of Embedded Software", Prentice Hall of India, 2004.
6. Muhammad Ali Mazidi, Rolind D. Mckinlay and Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", Pearson Publication, 6th Edition, 2011.

13EE77	POWER SYSTEM SIMULATION AND HIGH VOLTAGE LABORATORY	L T P C 0 0 3 2

COURSE OUTCOMES

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

CO 1: evaluate the parameters of power system using various methods of Load flow analysis
CO 2: estimate the fault current for different type of faults
CO 3: analyze the breakdown mechanism of gaseous dielectrics
CO 4: choose appropriate method to generate High voltage AC, DC and Impulse
CO 5: analyze the field distribution in single and multiple dielectrics

List of Experiments

1. Generation and measurement of AC, DC and Impulse voltage
2. Breakdown measurement of gaseous dielectric under AC Voltage
3. Breakdown measurement of gaseous dielectric under DC Voltage
4. FEM Simulation of single and composite dielectrics field distribution
5. Measurement of dielectric strength of liquid dielectric
6. Simulation of Lightning and Switching Impulse voltage generator
7. Computation of Parameters and Modelling of Transmission Lines
8. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
9. Load Flow Analysis - I: Solution of Load Flow And Related Problems Using Gauss-Seidel Method
10. Load Flow Analysis - II: Solution of Load Flow and Related Problems using Newton-Raphson and Fast-Decoupled Methods
11. Symmetrical and unsymmetrical Fault Analysis
12. Transient stability analysis of single machine infinite bus system (SMIB) using modified Euler's method.

P:45 TOTAL: 45 PERIODS

13EE78 COMPREHENSION L T P C
0 0 3 1

COURSE OUTCOMES

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

CO 1: recognize the Basics of Electrical and Electronics Engineering

CO 2: prepare for Engineering Competitive exams

Electric Circuits and Fields: Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks; sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phase circuits; Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot-Savart's laws; inductance; dielectrics; capacitance.

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; Fourier, Laplace and Z transforms.

Electrical Machines: Single phase transformer – equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers – connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and stepper motors.

Power Systems: Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Control Systems: Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Nyquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

Electrical and Electronic Measurements: Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Analog and Digital Electronics: Characteristics of diodes, BJT, FET; 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; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

Power Electronics and Drives: Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives

P:45 TOTAL: 45 PERIODS

13EE81 UTILIZATION AND CONSERVATION OF ELECTRICAL ENERGY **L T P C**
3 0 0 3

COURSE OUTCOMES

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

CO 1: review the energy conservation and management concepts.
CO 2: describe the economic aspects of generation.
CO 3: explain the illumination scheme.
CO 4: describe the industrial heating and welding.
CO 5: explain the applications of electrical drives in electrical traction.

UNIT I ENERGY CONSERVATION AND MANAGEMENT 9

Introduction- Energy requirements in future- Distribution of energy consumption – Need for energy conservation- Methods of energy conservation- What is Energy Management- Energy management techniques- Energy Audit: Definition – Need and Type of audit – energy audit instruments.

UNIT II ECONOMIC ASPECTS OF GENERATION 9

Economic aspects of power generation –Load and load duration curves –Number and size of units –Cost of electrical energy –tariff –Power capacitors – power quality. Importance of electrical energy conservation – Methods – Energy efficient equipments.

UNIT III ILLUMINATION 9

Importance of lighting –Properties of good lighting scheme –Laws of illumination – Photometry -Types of lamps –Lighting calculations –Basic design of illumination schemes for residential, Commercial, Street lighting, and Sports ground –Energy efficiency lamps - LED, CFL.

UNIT IV INDUSTRIAL HEATING AND WELDING 9

Role of electric heating for industrial applications –Resistance heating –Induction heating – Dielectric heating - Electric arc furnaces. Brief introduction to electric welding –Welding generator, Welding transformer and the characteristics.

UNIT V ELECTRIC TRACTION 9

Merits of electric traction –Requirements of electric traction system –Supply systems –Mechanics of train movement –Traction motors and control –Braking – Recent trends in electric traction.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. C.L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy" New Academic Science, Turnbridge Wells, 2011.
2. B.R. Gupta, "Generation of Electrical Energy", S. Chand & Company Limited, 14th Edition, 2011.

REFERENCES

1. H.Partab, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2nd Edition, 1975.
2. E. Openshaw Taylor, "Utilization of Electrical Energy in SI Units" Orient Longman Pvt. Ltd, 2003.
3. J.B. Gupta, "Utilization of Electric Power and Electric Traction", S.K. Kataria and Sons, 8th Edition, 2009.
4. Gupta, Soni and Bhatnagar, "Course in Electrical Power", Dhanapat Rai and Sons., 1987.
5. Y.P. Abbi and Shashank Jain, "Handbook on Enegry Audit and Environment Management", TERI Publications, 2006.
6. Arora and Domkundwar, "A course in Power Plant Engineering", Dhanpat Rai & Co., Educational & Technical Publishers, 2008.

13EE82 SPECIAL ELECTRICAL MACHINES L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: develop the knowledge in construction, principle of operation and performance of synchronous reluctance motors.

CO 2: Explain the construction, various operating modes, control and performance of stepping motors.

CO 3: Analyze the structure and operation, converters, and controllers of switched reluctance motors.

CO 4: Review the construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.

CO 5: Illustrate the construction, principle of operation and control of permanent magnet synchronous motors.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial flux motors – Operating principles – Reluctance torque – Phasor diagram – Characteristics – Vernier motor.

UNIT II STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions. Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Rotary and Linear SRMs - Principle of operation – Torque equations – Steady state performance prediction - Analytical method. Power Converters and their controllers – Methods of Rotor position sensing – Sensorless operation – Closed loop control of SRM - Characteristics.

UNIT IV PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Permanent Magnet materials – Magnetic Characteristics – Permeance coefficient - Principle of operation – Types – Magnetic circuit analysis. EMF and torque equations –Commutation - Power controllers – Motor characteristics and control

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature reaction MMF – Synchronous Reactance – Sine wave motor with practical windings. Phasor diagram – Torque / speed characteristics - Power controllers - Converter - Volt ampere requirements

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. T.J.E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
2. T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 1984.

REFERENCES

1. R.Krishnan, "Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application", CRC Press, New York, 2001.
2. P.P. Aearnley, "Stepping Motors – A Guide to Motor Theory and Practice", Peter Perengrinus, London, 1982.
3. T. Kenjo and S. Nagamori, ‘"Permanent Magnet and Brushless DC Motors", Clarendon Press, London, 1988.
4. J. Gnanavadivel, J. Karthikeyan, and S. Albert Alexander, “Special Electrical Machine”, Anuradha publications, 3rd Edition,2007.
5. K. Venkataratnam, “Special Electric Machines”, Universities Press, 2009.

13EE87 PROJECT WORK L T P C

0 0 12 6

COURSE OUTCOMES

Upon successful completions of this course, the student will be able to

1. design a system / component / process by applying the acquired technical knowledge to provide solutions to contemporary technical and professional issues
2. analyze the system / component / process and interpret the data
3. adapt the impact of electrical and electronics engineering solutions in a global, economic, environmental, ethical and societal context
4. apply documentation skills, project and finance management skills and communication skills
5. apply the coordinated effort as a part of the team

13EEAA SWITCHED MODE POWER CONVERSIONS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Design the reactive elements for power electronics systems.

CO 2: Discuss the basic concepts of switching converters.

CO 3: Analyze the operation of Resonant Converters.

CO 4: Analyze the operation of Transformerized Switching Converters.

CO 5: Describe the various control scheme and dynamic analysis of switching converters.

UNIT I INTRODUCTION 9

Reactive elements in Power Electronic Systems-Design of Inductor-Design of transformer-Capacitors for Power electronics applications.

UNIT II BASIC SWITCHING CONVERTER TOPOLOGIES 9

Basic concepts of SMPS - DC-DC converters – characteristics - constituent elements - operating principles.

UNIT III RESONANT CONVERTERS 9

Classification of resonant converters - basic resonant circuit concepts - load resonant converters - resonant switches converters - zero voltage switching.

UNIT IV TRANSFORMERIZED SWITCHING CONVERTERS 9

Introduction- Forward converter - push-pull converter - Half-bridge switching converter - Full-bridge switching converter - Flyback converter - Zero-Current-Switching Quasi-Resonant Half-Bridge converter

UNIT V CONTROL SCHEME AND DYNAMIC ANALYSIS OF SWITCHING CONVERTERS 9

Steady state analysis - stress and sizing of elements - control methods - duty ratio - current programmed - frequency programmed - sliding mode control - dynamic analysis - frequency domain models - Standard available controllers (76494 or SG3524).

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Ramanarayanan V., “Course Material On Switched Mode Power Conversion”, IISc Bangalore, 2007
2. Umanand L., Bhat S.R., “Design of magnetic components for switched Mode Power converters” , Wiley Eastern Ltd.,1992

REFERENCES

1. Ned Mohan, Tore M. Undeland, William P.Robbins, “Power Electronics: Converters, Applications and Design”, John Wiley and Sons, 3rd Edition, 2003.
2. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press, 2004.
3. Simon S. Ang, “Power Switching Converter”, Marcel Dekker Inc., 1995.
4. Rashid M.H., “Power Electronics: Circuits, Devices and Applications”, Pearson Education, PHI 3rd Edition, New Delhi 2004.
5. Keng C. Wu, “Switch-Mode Power Converters: Design and Analysis”, Academic Press, 1st Edition, 2005

13EEAB POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS 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 importance of renewable energy and different renewable energy resources.
CO 2: Analyze of wind electrical generators.
CO 3: Design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
CO 4: Analysis of grid integrated wind and pv systems.
CO 5: Develop maximum power point tracking algorithms.

UNIT I INTRODUCTION 9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources ocean, Biomass, Hydrogen energy systems : operating principles and characteristics of: Solar PV, Fuel cells, wind electrical systems-control strategy, operating area.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWERCONVERTERS 9

Solar: Block diagram of solar photo voltaic system - Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS Grid Integrated solar system.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind- PV Maximum Power Point Tracking (MPPT).

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Rashid .M. H “power electronics Hand book”, Academic press, 2001
2. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.

REFERENCES

1. S. Rao and Parulekar, Energy Technology – Non Conventional, Renewable and Conventional, NewDelhi, Khanna Publishers, 1999.
2. Mukund R. Patel, Wind and Solar Power System, New York, CRC Press LLC, 1999.
3. Ned Mohan, Tore M. Undeland and William P.Robbins, Power Electronics: Converters, Applicationsand Design, New Jersey, John Wiley and Sons, 2003.
4. S.N.Bhadra, D. Kastha, & S. Banerjee,Wind Electricaal Systems, Oxford University Press, 2009
5. Rashid .M. H, Power Electronics Hand book, Academic press, 2001.
6. Rai. G.D, Solar energy utilization, Khanna publishes, 1993.
7. Gray, L. Johnson, Wind Energy System, Prentice Hall linc, 1995.
8. Non-conventional Energy sources , B.H.Khan Tata McGraw-hill Publishing Company, New Delhi

13EEAC CAD OF ELECTRICAL APPARATUS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Compare the conventional and field analysis based design.
CO 2: Interpret the basic concepts of finite element method.
CO 3: Perceive the procedures of CAD packages.
CO 4: Devise the design of rotating machines.
CO 5: Analyze the design of transformers.

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 PHILOSOPHY OF FEM 9

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method - 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT III CAD PACKAGES 9

Elements of a CAD System –Preprocessing – Modelling – Meshing – Material properties - Boundary Conditions – Setting up solution – Post processing.

UNIT IV DESIGN OF ROTATING MACHINES 9

Analytical study of Magnetic device – Finite element analysis – Synchronous Generators – Computation of the No load Characteristic – Computation of the Direct Axis Inductance and quadrature Axis Inductance - Cylindrical Magnetic Devices.

UNIT V DESIGN OF TRANSFORMERS 9

Single phase transformer – Computation of the No load Inductances – Estimation of Iron Loses - and leakage inductances.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, Yes DEE publishers, Indian reprint, 2007.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. Matthew N. O. Sadiku, 'Principles of Electromagnetics", (English) 4th Edition, Oxford University Press, New Delhi, 2010

13EEAD DESIGN OF POWER CONVERTERS L T P C
0 0 3 2

COURSE OUTCOMES

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

CO 1: Construct a phase controlled rectifiers for various load

CO 2: Demonstrate the operation of various types of DC choppers

CO 3: Design a various types of Inverters

CO 4: Design a AC voltage controller for various load

CO 5: Construct a various types of cycloconverters

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: 45 TOTAL: 45 PERIODS

13EEBA POWER PLANT ENGINEERING L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Outline the operations in thermal power plants.
CO 2: Identify the thermal cycles and performance improvements of diesel and gas power plants.
CO 3: Explain the different components of nuclear power plants.
CO 4: Discriminate renewable energy based power plants.
CO 5: Discuss about economics and environmental issues of power plants.

UNIT I THERMAL POWER PLANTS 9

Rankine cycle – Improvisations; Layout of modern coal power plant – Super Critical Boilers – Fluidized Bed Combustion Boilers – Turbines – Condensers – Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment – Steam and Heat rate – Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual and Brayton Cycle – Analysis and Optimization - Layout and components of diesel, gas and combined cycle power plants – Methods to improve the performance – Reheating, inter cooling and regeneration.

UNIT III NUCLEAR POWER PLANTS 9

Basics of nuclear engineering – Layout and subsystems of nuclear power plants – Nuclear reactors – Breeder – Safety measures for nuclear power plants.

UNIT IV RENEWABLE ENERGY BASED POWER PLANTS 9

Layout - Components and working of hydro, wind, tidal, solar photovoltaic, solar thermal, geothermal, biogas and ocean energy power plants.

UNIT V ECONOMICS AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

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.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Arora and Domkundwar, “A Course in power plant engineering”, 3rd Edition, Dhanpat Rai and Co. Private Limited, 1988.
2. P.K. Nag, “Power Plant Engineering”, 4th Edition, Tata McGraw Hill Publishing Company Limited, 2014.

REFERENCES

1. M.M. El-Wakil, “Power Plant Technology”, 1st Edition, Tata McGraw Hill Publishing Company Limited, 2010.
2. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, “Standard Handbook of Power Plant Engineering”, 2nd Edition, Tata McGraw Hill Publishing Company Limited, 1998.
3. R. K. Rajput, “A Text Book of Power Plant Engineering”, 4th Edition, Laxmi Publications, 2008.
4. A. K. Raja, Amit Prakash Srivastava, “Power Plant Engineering”, New Age International, 2006.
5. G.D. Rai “An Introduction to Power Plant Technology”, Khanna Publishers, 1996.
6. Black and Veatch, “Power Plant Engineering”, Springer, 1996.

13EEBB POWER SYSTEM OPERATION AND CONTROL L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Estimate the load characteristics of generating station.
CO 2: Analyze the load frequency control of single/multi area system.
CO 3: Illustrate different types of reactive power control.
CO 4: Formulate unit commitment and economic dispatch problem.
CO 5: Describe the computer based control of power system.

UNIT I INTRODUCTION 9

System load variation - System load characteristics - load curves - daily, weekly and annual, load duration curve, load factor, diversity factor - Reserve requirements - Installed reserves, spinning reserves, cold reserves, hot reserves - Overview of system operation - Load forecasting, unit commitment, economic dispatch and load dispatch.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Fundamentals of speed governing mechanism and modelling – Speed load characteristics – Load sharing between two synchronous machines in parallel - concept of control area, LFC control of a single-area system - Static and dynamic analysis of uncontrolled and controlled cases - Multi-area systems - Two-area system modelling - static analysis, uncontrolled case - Tie line with frequency bias control of two-area system derivation, state variable model.

UNIT III REACTIVE POWER CONTROL 9

Generation and absorption of reactive power - Relation between voltage, power and reactive power at a node - Injection of reactive power - Tap changing transformer – Numerical problems - System level control using generator voltage magnitude setting – OLTC transformer. Typical Excitation system – Modelling – static and dynamic analysis – Stability compensation – Methods of voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM 9

Statement of Unit Commitment (UC) problem - constraints in UC - UC solution methods – Priority list methods, forward dynamic programming approach, numerical problems only in priority list method using full load average production cost. Incremental cost curve - coordination equations without loss and with loss - solution by direct method and λ-iteration method (No derivation of loss coefficients) - Base point and participation factors.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Energy control centre- Functions – Monitoring, data acquisition and control- System hardware configuration – SCADA and EMS functions - Network topology determination, state estimation, security analysis and control - Various operating states - Normal, alert, emergency, inextremis and restorative - State transition diagram showing various state transitions and control strategies

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Allen.J.Wood and Bruce F.Wollenberg, “Power Generation, Operation and Control”, John Wiley & Sons, Inc., 2012.
2. Prabha Kundur, “Power system stability and control”, Tata McGraw Hill Publishing Limited, New Delhi, 5th Reprint, 2008

REFERENCES

1. Olle.I.Elgerd, “Electric energy systems theory-An introduction”, Tata McGraw Hill publishing Limited, New Delhi, 2008
2. I.J.Nagrath and D.P.Kothari, “Power System Engineering”, 2nd Edition, Tata McGraw Hill Publishing Limited, New Delhi, 2008
3. S.Sivanagaraju, G.Sreenivasan, “Power System Operation and Control”, Pearson Education, 2010
4. Venkatesh P.V.,Manikandan B.V., Charles Raja S and Srinivasan A., “ Electrical Power Systems”, PHI Learning Private Limited, New Delhi, 2012.
5. V.Ramanathan, P.S.Manoharan., “Power system operation and Control”, Charulatha Publications, Chennai, 2008.

13EEBC POWER SYSTEM TRANSIENTS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Review the causes and effects of power system transients.
CO 2: Explain the concept of switching transients.
CO 3: Describe the mechanism of lightning strokes and its effects.
CO 4: Discuss the reflection and refraction of travelling waves.
CO 5: Analyze the impact of transients on integrated power system.

UNIT I INTRODUCTION 9

Review and importance of the study of transients - causes for transients - RL circuit transient with sine wave excitation - double frequency transients – basic transforms of the RLC circuit transients.
Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - Current suppression – current chopping - effective equivalent circuit - Capacitance switching - capacitance switching with a restrike, with multiple restrikes - ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Charge cloud formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke – factors contributing to good line design - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELLING WAVES ON TRANSMISSION LINE 9

Transient response of systems with series and shunt lumped parameters and distributed lines - Travelling wave concept – Bewely's lattice diagram - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

Short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults - switching surges on integrated system - qualitative application of EMTP for transient computation.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Allan Greenwood, "Electrical Transients in Power Systems", Wiley Interscience, New York, 2nd Edition, 1991.
2. R.D.Begamudre, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Limited, 1986.

REFERENCES

1. M.S.Naidu and V.Kamaraju, "High Voltage Engineering", Tata McGraw Hill, 2nd Edition, 2000.
2. C.S.Indulkar, D.P.Kothari and K.Ramalingam, "Power System Transients: A Statistical Approach", PHI, 2 Edition, 2010.
3. Akihiro Ametani, Naoto Nagaoka, Yoshihiro Baba, and Teruo Ohno, "Power System Transients", CRC Press, 2013.
4. Juan A. Martinez-Velasco, "Power System Transients: Parameter Determination", CRC Press, 2009.
5. J.C.Das, "Transients in Electrical Systems: Analysis, Recognition, and Mitigation", McGraw-Hill Professional, 1st Edition2010.
6. Lou van der Sluis, "Transients in Power Systems", Wiley, 1st Edition 2001.

13EEBD	SOLAR PHOTOVOLTAIC FUNDAMENTALS AND APPLICATIONS (Common to MECH, EEE and EIE)	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 fundamentals of solar cells.
CO2: Recognize the various solar PV technologies and their up gradations along with their benefits.
CO3: Design and analyze on-grid and off-grid PV applications
CO4: Realize cost benefit analysis of PV installations

UNIT I ESSENTIAL BASICS OF SOLAR CELL 9

Solar cell – physics - Photovoltaics in Global Energy Scenario - Fundamentals of Semiconductors, Energy band, Charge carriers - Motion, PN Junction diode, Solar cells – Design characteristics, Solar radiation.

UNIT II COMMERCIAL AND DEVELOPING TECHNOLOGIES 9

Commercial technologies - Mono crystalline and Multi crystalline, Silicon - Wafer based Solar cell, Thin film solar cells – A-Si, Cd-Te and CIGS, Concentrated PV cells, Developing technologies – Organic cells, Dye sensitized cells.

UNIT III SOLAR PV FOR ON-GRID APPLICATIONS 9

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.

UNIT IV SOLAR PV FOR OFF-GRID APPLICATIONS 9

Off-Grid stand alone PV system - System sizing – Module and Battery - Storage – Batteries for PV systems – Sun Tracking mechanism – Types of tracking – One-axis, Two-axis - Maximum power point tracking – Design and analysis – Performance evaluation and monitoring - Field visit – Off-grid PV system

UNIT V COST BENEFIT ANALYSIS FOR SOLAR PV INSTALLATIONS 9

Cost and manufacturability – Manufacturing economics – scaling – Pricing – Trends in retail pricing – energy economics – grid tied power plant –solar street lighting system

L:45 TOTAL: 45 PERIODS

TEXT BOOK:

1. "Solar Photovoltaics Fundamentals, Technologies and Applications", 2nd Edition, Chetan Singh Solanki, Prentice Hall of India.

REFERENCES

1. "Photovoltaic Systems", Second Edition by James P. Dunlop, American Technical Publishers
2. Solar Electricity: Engineering of Photovoltaic Systems" by Eduardo Lorenzo, PROGENSA.
3. "SOLAR ENERGY - Renewable Energy and the Environment" Robert Foster, Majid Ghassemi, Alma Cota, CRC Press
4. www.pveducation.org

13EEBE ENERGY AUDITING 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: Analyze the energy economics with energy auditing
CO 2: Estimate the electrical energy calculation.
CO 3: Discuss about the energy conservation methods.
CO 4: Select the proper electrical utilities.
CO 5: Describe the concepts of energy management

UNIT I INTRODUCTION 9

Energy Scenario - Energy monitoring, auditing and targeting – Economics of various Energy Conservation schemes - Total Energy Systems - Energy auditing – Types – Methodologies – Barriers – Energy audit questionnaire – Energy conservation act.

UNIT II ELECTRICAL ENERGY SYSTEMS 9

Captive power generation systems – Biomass, wind and diesel power generation – KVA demand estimation – EB bill detailing - Basics of monitoring and targeting – Elements of monitoring and targeting, data and information analysis – Energy consumption versus production.

UNIT III ENERGY CONSERVATION 9

Refrigeration and Air conditioning - Energy conservation in cooling towers & spray ponds – Energy Efficiency in Lighting – Case studies.

UNIT IV PERFORMANCE EVALUATION AND SELECTION OF ELECTRICAL UTILITIES 9

Performance evaluation of transformers - Energy distribution – Selection of cable, capacitors, electric motors, electrical heating, lighting systems and their losses.

UNIT V ENERGY MANAGEMENT 9

Importance of energy management - Role of Energy Manager - Energy economics – Discount rate - Payback period - Internal rate of return - Life cycle costing risk and sensitivity analysis – Financing - Energy performance.

L:45, TOTAL: 45 PERIODS

TEXT BOOKS

1. F. Kerith, D.Y. Goswami, “Energy Management and Conservation Handbook”, CRC Press, 2008.
2. Hamies, Energy Auditing and Conservation; Methods, Measurements, Management and Case Study, Hemisphere, Washington, 1980.

REFERENCES

1. CB Smith, Energy Management Principles, Pergamon Press, New York, 1981
2. Trivedi, P. R. and Jolka, K. R., Energy Management, Common Wealth Publication, New Delhi, 1997.
3. Steve Doty and Wayne C. Turner, “Energy Management Handbook”, 7th Edition, the Fairmont Press, Inc., 2009.
4. Y.P. Abbi and Shashank Jain, “Handbook on Energy Audit and Environment Management”, TERI Publications, 2006.
5. Bureau of Energy Efficiency, Guide book for National certification Examinations for Energy Manager and Energy Auditors, 2002.

13EEBF POWER QUALITY L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Review the characterization of power quality in electric power system
CO 2: Categorize the causes of power quality problems
CO 3: Describe the estimation techniques and mitigation methods of voltage sag and interruptions
CO 4: Explain the concept of over voltages and harmonic controlling methods
CO 5: Outline the power quality monitoring and improvement techniques

UNIT I INTRODUCTION 9

Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation - Harmonics Vs transients - Effect of harmonics – Harmonic distortion - Harmonic indices - Inter harmonics – Resonance - Harmonic distortion evaluation - Power acceptability curves.

UNIT II SOURCES OF POWER QUALITY PROBLEMS 9

Single phase static and rotating AC/DC converters, Three phase static AC/DC converters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulated devices, Adjustable speed drives.

UNIT III VOLTAGE SAG AND INTERRUPTIONS 9

Estimating voltage sag performance - Thevenin's equivalent source - Analysis and calculation of various fault condition - Voltage sag due to induction motor starting - Estimation of sag severity - Mitigation of voltage sag using active series compensators - Static transfer switches and fast transfer switches.

UNIT IV OVERVOLTAGES 9

Sources of overvoltage - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swells - Surge arresters - Power conditioners - Devices for controlling harmonic distortion - Passive and active filters.

UNIT V POWER QUALITY MONITORING & IMPROVEMENT 9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems- Power line disturbance analyzer – Quality measurement equipment - Harmonic spectrum analyzer - Flicker meters - Disturbance analyzer – Load compensation using DSTATCOM, Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, "Electrical Power Systems Quality", McGraw Hill, 2012.
2. Arrillaga, N.R. Watson, S. Chen, "Power System Quality Assessment", New York: Wiley, 1999.

REFERENCES

1. G.T. Heydt, "Electric Power Quality", 2nd Edition, West Lafayette, IN, Stars in Circle Publications, 1994.
2. M.H.J Bollen, "Understanding Power Quality Problems: Voltage Sags and Interruptions", New York: IEEE Press, 1999.
3. C. Sankaran, "Power Quality", CRC Press, 2001.
4. Alexander Kusko and Marc. T. Thompson, "Power Quality in Electrical Systems", Tata McGraw Hill, 2007.
5. Angelo Baggini, "Handbook of Power Quality", John Wiley & Sons, 2008

13EEBG ENERGY LABORATORY L T P C
0 0 3 2

COURSE OUTCOMES

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

CO 1: Analyze the performance characteristics study of solar water heater, solar photovoltaic devices, solar air heater, solar concentric collectors and solar still.
CO 2: Demonstrate the refrigeration and air conditioning systems.
CO 3: Compute testing performance of gasifier, biogas plant and fuels.
CO 4: Compare energy consumption of different lighting systems.
CO 5: Choose appropriate method for solar radiation measurement.

LIST OF EXPERIMENTS

1. Performance testing of solar water heater
2. Characteristics of solar photovoltaic devices
3. Testing of gasifier
4. Testing of biogas plant
5. Measurement of solar radiation
6. Performance testing of solar air heater
7. Performance testing of solar still
8. Performance study on concentric collectors
9. Properties of fuels
10. Energy consumption measurement of lighting systems
11. Study on refrigeration and air conditioning systems

P: 45 TOTAL: 45 PERIODS

13EECA ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY

L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Describe the characteristics and design of electromagnetic compatibility.

CO 2: Discuss the methods of coupling and grounding.

CO 3: Summarize filtering, shielding and coating methods.

CO 4: Explain the digital logic noise and ground noise.

CO 5: List the standard and laboratory techniques.

UNIT I INTRODUCTION **9**

Sources of EMI - Conducted and radiated interference - Characteristics - Designing for electromagnetic compatibility (EMC) - EMC regulation - typical noise path - use of network theory - methods of eliminating interferences.

UNIT II METHOD OF HARDENING **9**

Cabling – capacitive coupling - inductive coupling - shielding to prevent magnetic radiation - shield transfer impedance - Grounding – safety grounds – signal grounds - single point and multipoint ground systems- hybrid grounds - functional ground layout – grounding of cable shields- ground loops - guard shields.

UNIT III BALANCING, FILTERING AND SHIELDING **9**

Power supply decoupling - decoupling filters-amplifier filtering – high frequency filtering shielding – near and far fields - shielding effectiveness - absorption and reflection loss - Shielding with magnetic material - conductive gaskets - windows and coatings - grounding of shields.

UNIT IV DIGITAL CIRCUIT NOISE AND LAYOUT **9**

Frequency versus time domain - analog versus digital circuits - digital logic noise- internal noise sources - digital circuit ground noise – power distribution - noise voltage objectives measuring noise voltages - unused inputs - logic families.

UNIT V ELECTROSTATIC DISCHARGE, STANDARDS AND LABORATORY TECHNIQUES **9**

Static Generation - human body model - static discharges -ED protection in equipment design - ESD versus EMC - Industrial and Government standards – FCC requirements – CISPR recommendations - Laboratory techniques - Measurement methods for field strength.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Henry W.Ott, “Noise reduction techniques in electronic systems”, John Wiley & Sons, 2011.
2. Bernhard Keiser, “Principles of Electro-magnetic Compatibility”, Artech House, Inc., 1987.

REFERENCES

1. Bridges J.E., Milleta J. and Ricketts L.W., “EMP Radiation and Protective techniques”, John Wiley and sons, 1976.
2. IEEE National Symposium on “Electromagnetic Compatibility”, IEEE, 445, Hoes Lane, Piscataway, 2007.
3. G. S. N. Raju, “EMP Radiation and Protective techniques”, Pearson Education, 1st Edition 2005.
4. W. Prasad Kodali, “Engineering Electromagnetic Compatibility: Principles, Measurements, Technologies, and Computer Models”, Wiley-Blackwell, 2nd Edition, 2001.
5. Henry W. Ott, “Electromagnetic Compatibility Engineering”, Wiley-Blackwell, 2009.
6. Christos Christopoulos, “Principles and Techniques of Electromagnetic Compatibility”, CRC Press; 2nd Edition, 2007.

13EECB INSULATION TECHNOLOGY L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Describe the properties of insulating materials.
CO 2: Explain the concept of various breakdown mechanism in gaseous dielectrics.
CO 3: Analyse the concept of various breakdown mechanism in solid dielectrics.
CO 4: Discuss the concept of various breakdown mechanism in liquid dielectrics.
CO 5: List out the application of different insulating materials in electrical equipments.

UNIT I GENERAL PROPERTIES OF INSULATING MATERIALS 9

Requirements of insulating materials – electrical properties – molecular properties of dielectrics – dependence of permittivity on temperature, pressure, humidity and voltage, permittivity of mixtures, practical importance of permittivity – behavior of dielectric under alternating fields – complex dielectric constants – bipolar relaxation and dielectric loss - dielectric strength.

UNIT II BREAKDOWN MECHANISMS IN GASEOUS DIELECTRICS 9

Behavior of gaseous dielectrics in electric fields – gaseous discharges – different ionization Processes – effect of electrodes on gaseous discharge – Townsend's theory - Streamer theory – Electronegative gases and their influence on gaseous discharge – Townsend's criterion for spark Breakdown, gaseous discharges in non-uniform fields – breakdown in vacuum insulation.

UNIT III BREAKDOWN MECHANISMS IN SOLID DIELECTRICS 9

Intrinsic breakdown of solid dielectrics – electromechanical breakdown-Streamer breakdown, thermal breakdown and partial discharges in solid dielectrics - electrochemical breakdown – tracking and treeing – classification of solid dielectrics, composite insulation and its mechanism of failure.

UNIT IV BREAKDOWN MECHANISMS IN LIQUID DIELECTRICS 9

Liquids as insulators - conduction and breakdown in pure and commercial liquids – Cryogenic insulation. Characteristics of insulating fluids.

UNIT V APPLICATION OF INSULATING MATERIALS 9

Application of insulating materials in transformers, rotating machines, Insulators, Isolators/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 Private Limited, New Delhi, 1979.
2. Alston L.L, "High Voltage Technology", Oxford University Press, London, 1968 (B.S Publications, 1st Indian Edition 2006).

REFERENCES

1. Kuffel E., Zaengl W.S. and Kuffel J., "High Voltage Engineering Fundamentals", Elsvier India Private Limited, 2005.
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 Limited, New Delhi, 2009.
4. Ushakov V.Y., "Insulation of High Voltage Equipment", Springer, ISBN.3-540-20729- 5,
5. Rod V. Latham, "High Voltage Vacuum Insulation: Basic Concepts and Technological Practice", Academic Press, 1st Edition, 1995.

13EECC FUNDAMENTALS OF NANO TECHNOLOGY 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 crystal lattice structures.
CO 2: Memorize the heterostructures and quantum structures.
CO 3: Discuss the fabrication of nano structures.
CO 4: Describe the characterization techniques.
CO 5: Apply the nano technology in science and engineering.

UNIT I CRYSTALLINE PROPERTIES OF SOLID 9

Crystal lattice and seven crystal systems - Unit cell concept - Weigner-Seitz cell - Bravais lattices - Space and point groups - Miller indices - Reciprocal lattice - Brillouin zone.

UNIT II SEMICONDUCTOR HETEROSTRUCTURES AND LOW DIMENSIONAL QUANTUM STRUCTURES 9

Energy bands, Application of model solid theory, Anderson model for hetero junctions, Multiple quantum wells (MQWs) and super lattices, Two-dimensional nanostructure: quantum well, One dimensional nanostructure: quantum wire, Zero-dimensional nanostructure: quantum dot, Optical properties of low-dimensional structures, Examples and applications in real world.

UNIT III FABRICATION OF NANO STRUCTURES 9

Basic compound semiconductors, Bulk single crystal growth techniques, Epitaxial growth techniques, Physical vapour deposition and sputtering, Thermodynamics and kinetics of growths, Nano scale growth modes.

UNIT IV CHARACTERIZATION TECHNIQUES (Qualitative Treatment only) 9

Structural X-ray diffraction, Electron microscopy, Energy dispersive analysis using X-rays, X-ray photoelectron spectroscopy, Scanning probe microscopy, Optical, Photoluminescence spectroscopy, Absorbance measurement, Raman spectroscopy, Fourier transform spectroscopy.

UNIT V APPLICATIONS OF NANO TECHNOLOGY 9

Future of semiconductor device and research - Necessity of innovative technology and prospect for future - Applications in food, energy, transportation, communication, entertainment, health and medicine.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. M. Razeghi, "Fundamentals of Solid State Engineering", 2nd Edition Springer, 2006.
2. K.K.Chattopadhyay, A.N. Banerjee, "Introduction to Nanoscience and Nanotechnology" PHI Learning Private Limited, 2011.

REFERENCES

1. W. R. Fahrner, "Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques" Springer-Verlag Berlin Heidelberg, 2005
2. R. W. Kelsall, I. W. Hamley, and M. Geoghegan, "Nanoscale Science and Technology" John Wiley & Sons Limited, England, 2005
3. M.A.Shah, Tokeer Ahmad, "Principles of Nanoscience and Nanotechnology", Narosa Publishing Home Private Limited, 2010.
4. B.Viswanathan, "Nanomaterials", Narosa Publishing Home Private Limited, 2009.
5. William Illsey Atkinson, "Nanotechnology", Jaico Publishing Home, 2008.

13EECD FLEXIBLE AC TRANSMISSION 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 idea about FACTS controllers
CO 2: Design of SVC voltage regulator using TCR-TSC logic
CO 3: Describe Transient stability model of TCSC
CO 4: Explain about basic principle of operation of STATCOM
CO 5: Explain controller interactions & its type

UNIT I INTRODUCTION 9

The concept of flexible AC transmission - reactive power control in electrical power transmission lines - uncompensated transmission line – series and shunt compensation. Overview of FACTS devices - Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified Power Flow controller (UPFC) - Integrated Power Flow Controller (IPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – advantages of slope in dynamic characteristics – influence of SVC on system voltage. Applications - enhancement of transient stability – steady state power transfer – enhancement of power system damping – prevention of voltage instability.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC - different modes of operation – modeling of TCSC – variable reactance model – modeling for stability studies. Applications -improvement of the system stability limit – enhancement of system damping – voltage collapse prevention.

UNIT IV EMERGING FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM) – operating principle – V-I characteristics – Unified Power Flow Controller (UPFC) – Principle of operation - modes of operation – applications – modeling of UPFC for power flow studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9

FACTs Controller interactions – SVC–SVC interaction - co-ordination of multiple controllers using linear control techniques – Control coordination using Genetic algorithm.

L: 45, TOTAL: 45 PERIODS

TEXT BOOK

1. Mohan Mathur, R., Rajiv. K. Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc.

REFERENCES

1. A.T.John, "Flexible AC Transmission System", Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. Narain G.Hingorani, Laszio. Gyugyl, "Understanding FACTS Concepts and Technology of Flexible AC Transmission System", Standard Publishers, Delhi 2001.
3. Xiao-Ping Zhang, "Flexible AC Transmission Systems: Modelling and Control (Power Systems)", Springer; 2nd Edition, 2012.
4. Yong-Hua Song, and Allan Johns, "Flexible Ac Transmission Systems (FACTS)", IET, 1999.
5. Narain G. Hingorani, Laszlo Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Wiley-IEEE Press, 1st Edition, 1999.

13EECE EHV POWER TRANSMISSION **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 role of EHVAC Transmission and Mechanical considerations.
CO 2: Calculate the line parameters for multiconductor lines.
CO 3: Estimate the voltage gradients of conductors.
CO 4: Discuss the concepts of corona and radio interference.
CO 5: Illustrate the effect of electrostatic field on humans and vehicles.

UNIT I INTRODUCTION **9**

EHVAC Transmission - line trends and preliminary aspects - standard transmission voltages – power handling capacities and line losses – mechanical aspects.

UNIT II CALCULATION OF LINE PARAMETERS **9**

Calculation of resistance, inductance and capacitance for multiconductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation – resistance and inductance of ground return.

UNIT III VOLTAGE GRADIENTS OF CONDUCTORS **9**

Charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – gradient factors and their use – distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

UNIT IV CORONA EFFECTS **9**

Power losses and audible losses: I^2R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level- radio interference - corona pulse generation and properties - limits for radio interference fields.

UNIT V ELECTROSTATIC FIELD OF EHV LINES **9**

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines - effect of high field on humans, animals, and plants – electrostatic induction in un-energized circuit of a D/C line - induced voltages in insulated ground wires.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International Private Limited, 2nd Edition, 2011.
2. Power Engineer’s Handbook, TNEB Engineers Association, Revised and Enlarged 6th Edition, October 2002.

REFERENCES

1. Microtran Power System Analysis Corporation, Microtran Reference Manual, Vancouver Canada. (Website: www.microtran.com)
2. R.K. Rajput, “Power System Engineering”, Laxmi Publications, 2006.
3. Xiao-Ping Zhang, “Restructured Electric Power Systems”, Wiley Publications, 2010.
4. Shobhit Gupta, and Deepak Gupta, “EHV AC/DC Transmission”, Genius Publications, 2012.
5. 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.

13EECF HIGH VOLTAGE DC TRANSMISSION L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Describe the DC power transmission technology
CO 2: Analyze HVDC converters
CO 3: Describe the various types, control and protection of MTDC systems
CO 4: Analyze harmonics and filters
CO 5: Discuss the simulation tools and Modelling of HVDC system

UNIT I HVDC POWER TRANSMISSION TECHNOLOGY 9

Introduction– Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system– Planning for HVDC transmission – Modern trends in DC transmission.

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuit– Converter bridge characteristics – Characteristics of a 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 – Current margin method – Voltage limiting control – Decentralized current balancing – Two ACR method - Study of MTDC systems.

UNIT IV HARMONICS AND FILTERS 9

Introduction – Generation of harmonics – Characteristics and non characteristics harmonics – Design of AC filters – Single tuned filters – High pass filters – Protection of filters - Design of DC filters – Carrier frequency and Radio Interference noise.

UNIT V SIMULATION OF HVDC SYSTEMS 9

Introduction to system simulation – Philosophy and tools – HVDC system simulation – Modelling of HVDC systems for digital dynamic simulation – Transient simulation of DC and AC systems.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. K.R.Padiyar, “HVDC Power Transmission Systems: Technology and system Interactions”, New Age International (P) Limited, and Publishers, 1990.
2. Edward Wilson Kimbark, “Direct Current Transmission”, Vol. I, Wiley Inter Science, New York, London, Sydney, 1971.

REFERENCES

1. Colin Adamson and Hingorani N G, “High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
2. Arrillaga, J., “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
3. Erich Uhlmann, “Power Transmission by Direct Current”, BS Publications, 2004.
4. Sood V.K., “HVDC and FACTS controllers – Applications of Static Converters in Power System”, Kluwer Academic Publishers, April 2004.
5. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age Interantional (P) Ltd., New Delhi, 1990.

13EEDA ROBOTICS AND AUTOMATION L T P C

(Common to EIE, EEE) **3 0 0 3**

COURSE OUTCOMES

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

CO 1: Explain the basics of the robotics
CO 2: Design the robot manipulator kinematics
CO 3: Analyze the robot trajectory control
CO 4: Analyze the robot motion and actuators
CO 5: Describe about the robot application

UNIT I INTRODUCTION 9

Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system. Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges.

UNIT II MANIPULATOR KINEMATICS 9

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems. Differential transformation and manipulators, Jacobians – problems.Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

UNIT III TRAJECTORY CONTROL 9

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

UNIT IV ROBOT ACTUATORS AND MOTION ANALYSIS 9

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors. Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

UNIT V ROBOT APPLICATION IN MANUFACTURING 9

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection – Clean room robotics (SCARA).

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Groover M P, “Industrial Robotics”, Tata Mc Graw Hill Edition ,2008.
2. Mittal R K & Nagrath I J , “Robotics and Control”, Mc Graw hill,2003.

REFERENCES

1. Fu K S, “Robotics”, McGraw Hill,2008
2. Richard D. Klafter , “Robotic Engineering”, Prentice Hall,1989
3. Mark W. Spong and M. Vidyasagar , “Robot Dynamics & Control”, John Wiley & Sons (ASIA) Private Limited, 2004
4. Karl Mathia, “Robotics for Electrronics Manufacturing”, Cambridge University press, 2010
5. R.K. Rajput, “Robotics and Industrial Automation”, S. Chand Publishing, 2008.
6. A.K. Gupta, “Industrial Automation and Robotics”, Laxmi Publications, 3rd Edition, 2013.

13EEDB LINEAR AND NONLINEAR CONTROL SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Formulate the state model of system.
CO 2: Design of state feedback and observer
CO 3: Construct phase trajectory for nonlinear system
CO 4: Analyze the nonlinear control system using describing function.
CO 5: Apply Lyapunov stability theorem.

UNIT I FORMULATION AND SOLUTION OF STATE MODEL 9

Basic concepts of state, State variables and state model – State model for linear continuous time systems - State space representation using physical variable – Phase variable – Canonical variable – Transfer function from state model – Diagonalization – Solution of state equation - State variable for linear discrete time systems .

UNIT II DESIGN AND ANALYSIS OF STATE SPACE MODEL 9

Concept of Controllability – Controllable phase variable form – Concept of observability – Observable phase variable form – Gilbert's test - Kalman's test – Pole placement by state feedback for Single input Single output system – State observer.

UNIT III NONLINEAR SYSTEMS 9

Behaviour of non linear system – Common physical non linearities - Basic concept of phase plane method – Phase trajectory - phase portrait – Singular point – Stability of non linear system - Limit cycles – Construction of phase trajectories – Analytical method – Graphical methods.

UNIT IV DESCRIBING FUNCTION 9

Basic concept of Describing function – Describing function of dead zone and saturation, relay with dead zone and hysteresis, ON OFF controller with dead zone, backlash non linearities – Stability analysis of describing function – Ideal relay – Relay with dead zone – Relay with hysteresis – Stability analysis of gain phase plot - Jump resonance.

UNIT V LYAPUNOV STABILITY 9

Lyapunov stability definition – Lyapunov stability theorem – Lyapunov functions for non linear system - Krasovskii method – Variable gradient method - Lyapunov Linearisation method and local stability – Direct method of Lyapunov's and linear systems.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. I.J. Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 2003
2. M. Gopal, "Digital Control and State variable method", TATA Mcgraw hill, 4th Edition, 2012.

REFERENCES

1. K. Ogatta, "Modern Control Engineering", PHI, 2001.I
2. Benjamin C. Kuo Automatic Control Systems, 3rd Edition, Prentice-Hall Inc. 1975
3. Hasan Khalil, "Nonlinear systems and control", Prentice Hall, 2001.
4. M. Gopal, "Modern Control System Theory", New Age International, 2005.
5. M. Gopal, "Control Systems Principles and Design", TATA Mcgraw hill, 3rd Edition, 2010.
6. J.E.Slotine &W.P.Li," Applied non-linear control", Prentice Hall, USA, 2012.
7. George J. Thaler, "Automatic Control Systems", Jaico Publishers, 1993.

13EEDC PLC, DCS and SCADA L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Describe the functionality of various components of PLC

CO 2: Distinguish the functional difference between the relay and PLC

CO 3: Develop a Ladder program for a given industrial process

CO 4: Design the Input/output module of PLC

CO 5: Compare the different control architecture such as Central computer, Hybrid and DCS

CO 6: Recognize the operator and engineering interfaces

CO 7: Describe the functionality of SCADA

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9

Evolution of PLC's – Components of PLC – Advantages over relay logic – Architecture of PLC– Programming devices - Discrete and Analog I/O modules – Programming languages - Ladder diagram – Programming timers and counters – Design of PLC - PLC Installation Practices - Editing and Troubleshooting.

UNIT II INSTRUCTION IN PLC 9

Instructions in PLC – Program control instructions, math instructions, Data manipulation instructions, sequencer instructions – Use of PC as PLC – PLC to PC interfacing – PLC to PLC interfacing - Application of PLC, traffic light control system, bottle filling system - PLC in Cement industry - Programming concept in Allen Bradely PLC and Siemens PLC.

UNIT III DISTRIBUTED CONTROL SYSTEM 9

Terminologies in DCS – Evolution of Architectures – Comparison – Local control unit Architecture (CENTUM CS1000) – Process interfacing issues - Communication facilities – DCS Configuration and Installation.

UNIT IV INTERFACES IN DCS 9

Operator interface requirement - Low level and high level operator interfaces – Operator displays - Engineering interfaces – Low level and high level engineering interfaces – Computer interface design issue.

UNIT V SCADA 9

Introduction and brief history of SCADA – Comparison of the terms SCADA, PLC and DCS – Remote Terminal Unit - Components of a SCADA system – SCADA Software package – SCADA protocol – Error detection – Distributed network protocol.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Petruzella, "Programmable Logic Controller", McGraw Hill, 3rd Edition, 2009.
2. Michael P. Lukas, "Distributed Control System", Van Nostrand Reinhold Co., Canada, 1986.
3. David Bailey and Edwin Wright, "Practical SCADA for Industry", ELSEIVER, 2003

REFERENCES

1. T. Hughes, "Programmable Logic Controllers", ISA press, 2007.
2. Krishna Kant, "Computer based Industrial Control", Prentice Hall, New Delhi, 2006.
3. Considine D. M., "Process/Industrial Instruments and control Handbook", McGraw Hill, 5th Edition 2009.
4. Liptak B.G., "Instrument Engineers Handbook", Volume II, 2005.

WEB RESOURCES

http://www.industry.usa.siemens.com/automation/us/en/process-control-system/pas-white-papers/Documents/dcsand-plc-cement.pdf
https://www.yokogawa.com/rd/pdf/TR/rd-tr-r00026-001.pdf

13EEDD MEDICAL INSTRUMENTATION L T P C

3 0 0 3

COURSE OUTCOMES

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

CO 1: Outline the function of human physiology system.
CO 2: Make use of electrodes, amplifiers & transducers in biomedical measurement system.
CO 3: Describe the various non electrical parameter measurements.
CO 4: Summarize the imaging techniques and therapeutic devices.
CO 5: Illustrate the electrical safety measures in bio medical measurement.

UNIT I PHYSIOLOGY AND TRANSDUCERS 9

Cell and its structure - Resting and Action Potential - Propagation of action potential – Nervous System- Physiology of Heart & Lungs – Cardiovascular & Respiratory system- Transducers - Types - Selection Criteria- Introduction to biosensor and types.

UNIT II ELECTRO-PHYSIOLOGICAL MEASUREMENT 9

General block diagram of Biomedical Instrumentation system – 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.

UNIT III NON-ELECTRICAL PARAMETER MEASUREMENT 9

Measurement of blood pressure –blood flow- Cardiac output – Heart rate – phonocardiography - Pulmonary function measurements – Spirometer – Photo Plethysmography, Body Plethysmography – pH of blood – Measurement of blood pCO2, pO2,

UNIT IV MEDICAL IMAGING AND THERAPEUTIC DEVICES 9

Radiographic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Pacemakers – Defibrillators – Ventilators — Diathermy – Heart - Lung machine — Dialyzers

UNIT V PATIENT SAFETY AND ELECTROMEDICAL EQUIPMENT 9

Physiological effects of electrical currents, macro shock and micro shock - preventive measures to reduce shock hazards - Leakage current - Isolation of patient circuit - Safety of electrically susceptible patients - Radiation hazards and safety – Shielding - Open ground problem and earthing methods.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. R.S.Khandpur, “Hand Book of Bio-Medical instrumentation”, Tata McGraw Hill Publishing Company Limited, 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, “Bio-Medical Instrumentation and Measurements”, 2nd Edition, Pearson Education, PHI 2002.

REFERENCES

1. M.Arumugam, “Bio-Medical Instrumentation”, Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, “Principles of Applied Bio-Medical Instrumentation”, John Wiley & Sons, 1989
3. J.Webster,“Medical Instrumentation application and design”, 4th Edition, Wiley, 2009.
4. Joseph D.Bronzino, “The Biomedical Engineering handbook”, CRC Press.
5. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson

13EEDE ADVANCED CONTROL THEORY L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Construct discrete model of system
CO 2: Design of digital compensator
CO 3: Develop optimal control law
CO 4: Design robust controller for simple application
CO 5: Apply model reference adaptive control

UNIT I SAMPLED DATA SYSTEM 9

Configuration of digital control scheme – Time domain models of discrete time systems - Transfer function models – Frequency response - Stability of sampled data system – Jury stability criterion - Sample and hold system – Sampled spectra and aliasing – Reconstruction of analog signal - Practical aspect of choice of sampling rate – Principle of discretisation – Impulse invariance – Step invariance – Bilinear transformation.

UNIT II DESIGN OF DIGITAL CONTROL ALGORITHMS 9

Z plane specifications of control system design - Steady state accuracy – Transient accuracy – Nyquist stability criterion of Z plane – Disturbance rejection – Insensitivity and robustness – Digital compensator design using frequency response plot – Lead, Lag, Lag-Lead compensation – Z plane synthesis.

UNIT III OPTIMAL CONTROL 9

Parameter optimization: Servomechanism – Optimal control problems: Transfer function approach – State variable approach – State regulator problem – Infinite time regulator problem – Output regulator and Tracking problem - Parameter optimization : regulators.

UNIT IV ROBUST CONTROL 9

Robust control system and system sensitivity – Analysis of robustness – Systems with uncertain parameters – Design of robust control systems – PID controller - Design of robust PID controller – Design of robust internal model control system – Pesudo quantitative feedback system.

UNIT V ADAPTIVE CONTROL 9

Model reference adaptive control - MIT rule – MRAC using Lyapunov theory – First order systems – General higher order SISO systems – MRAC for a single link manipulator – Self tuning control – Recursive least square estimation.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. M.Gopal, “Digital Control & State Variable Methods”, Tata McGraw Hill, 4th Edition, 2012.
2. I.J. Nagrath and M.Gopal, “Control Systems Engineering”, New Age International Publishers, 5th Edition 2010.

REFERENCES

1. K.Ogatta, “Discrete time control system”, PHI, 2010.
2. B.C.Kuo,” Digital Control Systems”, SRL Publication, 1997.
3. M. Gopal, “Control Systems Principles and Design”, TATA Mcgraw hill, 3rd Edition, 2010.
4. M.Gopal,” Modern control system theory”, New Age International Publishers, 2002.
5. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, “Feedback Control of Dynamic Systems”, 4th Edition, Pearson Education, 2002.
6. Richard C. Dorf, “Modern control systems”, 8th Edition, Addison Wesley, 2012.

13EEDF SOFT COMPUTING FOR ELECTRICAL ENGINEERING 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 components of fuzzy logic system.

CO 2: Distinguish various structures of ANN.

CO 3: Describe the basic concepts of genetic algorithms.

CO 4: Apply ANN and FLC to various electrical applications.

CO 5: Employ GA to power system optimization and control applications.

UNIT I FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning - Fuzzification, inferencing and defuzzification - Fuzzy knowledge and rule bases - Fuzzy logic modelling.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Basic concepts - Biological Neuron - Types of activation functions –Concept of Artificial Neural McCulloch-Pitts neuron model - Adaline and Madaline, Applications – Architecture - Feed forward and Feedback – Multilayer Perceptron– Hopfield network – Self organizing network and Recurrent network - Back Propagation Algorithm - Limitations of Back Propagation Algorithm

UNIT III GENETIC ALGORITHM 9

Basic concept of Genetic algorithm and detail algorithmic steps - Adjustment of free parameters – Functional evaluation and constraint handling - Representation – Integer, Binary, Real and Gray coding – Cross over – Single point, multi point, uniform and arithmetic crossover – Mutation – Binary and real mutation - Selection schemes – Roulette wheel and Tournament selection – Stopping criteria.

UNIT IV APPLICATIONS OF FLC AND ANN 9

Identification and control of linear and nonlinear dynamic systems using Neural Network – ANN application to short term load forecasting - Implementation of fuzzy logic controller for motor drives .

UNIT V APPLICATIONS OF GA 9

GA application to power system optimization problem - Economic dispatch, load scheduling and unit commitment problems - Solution of typical control problems using genetic algorithm – System Identification and PID controller tuning.

L:45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. Kosko,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCES

1. S.N.Sivanandam & S.N.Deepa, “Principles of Soft Computing”, Wiley India Private Limited, 2008.
2. Klir G.J. & Folger T.A. "Fuzzy sets, uncertainty and Information", Prentice- Hall of India Private Limited, 1993.
3. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
4. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.
5. Samir Roy, “Introduction to Soft Computing: Neuro - Fuzzy and Genetic Algorithms”, Pearson Education, 1st Edition, 2013.
6. Fakhreddine O. Karray, “Introduction to Soft Computing: Neuro - Fuzzy and Genetic Algorithms”, Pearson Education, 1st Edition, 2009.
7. Devendra K. Chaturvedi, “Soft Computing: Techniques and its Applications in Electrical Engineering”, Springer, 2008.

13EEDG FIBRE OPTICS AND LASER INSTRUMENTS L T P C
(Common to EIE, EEE) **3 0 0 3**

COURSE OUTCOMES

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

CO1: To describe the basic concepts of optical fibres and laser with their properties
CO2: To illustrate the applications of optical fibres and lasers in industries
CO3: To explain the applications of laser in Hologram and medical field

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics - Absorption losses - Scattering losses - Dispersion - Connectors and splicers – Fibre termination - Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. J. Wilson and J.F.B. Hawkes, “Introduction to Opto Electronics”, Prentice Hall of India, 2009.
2. J.M. Senior, “Optical Fibre Communication – Principles and Practice”, Prentice Hall of India, 2009.

REFERENCES

1. G. Keiser, “Optical Fibre Communication”, McGraw Hill, 2008.
2. John F. Ready, “Industrial Applications of Lasers”, Academic Press, second edition 1997.
3. Colin E.Webb, “Handbook of laser technology and applications”, CRC Press, 2004.

13EEDH PLC AND DCS LABORATORY

L	T	P	C
0	0	3	2

COURSE OUTCOMES

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

CO 1: Demonstrate on-off controller using relay logic
CO 2: Articulate the Ladder program for Industrial processes
CO 3: Implement the performance of controller in DDC and DCS
CO 4: Complete an analog and digital interfacing with DCS

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. Study of Distributed Control System – Simulation of analog and digital functions
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: 45 TOTAL: 45 PERIODS

13EEDJ SOFT COMPUTING FOR ELECTRICAL ENGINEERING LABORATORY **L T P C 0 0 3 2**

COURSE OUTCOMES

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

CO 1: Write program to implement various structures of ANN.

CO 2: Develop program for fuzzy relationship.

CO 3: Demonstrate ANN to system identification and control of linear and nonlinear systems.

CO 4: Apply FLC to motor with electrical drives.

CO 5: Employ GA to power system optimization and control problems.

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: 45 TOTAL: 45 PERIODS

13EEEA	VLSI DESIGN	L	T	P	C
	(Common to EIE, EEE)	3	0	0	3

COURSE OUTCOMES

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

CO 1: Describe the general principles of MOS Technology
CO 2: Describe the design process of MOS Technology
CO 3: Outline subsystem design and layout principles of VLSI circuits.
CO 4: Summarize basic Programming Concepts of HDL.
CO 5: Develop system design for various FPGA applications.

UNIT I MOS TECHNOLOGY 9

Introduction to IC Technology- MOS and VLSI Technology -MOS transistors: Enhancement and Depletion mode transistor actions- Fabrication of NMOS, CMOS and BiCMOS transistors-Thermal aspects of processing - BiCMOS Technology- Production of E beam Masks-MOS electrical properties:IDSVsVDS relationships, Threshold voltage- Transconductance Vs Output conductance and Pull up to pull down ratio determination- BiCMOS Inverters-Latch up in CMOS circuits

UNIT II DESIGN PROCESSES AND SCALING EFFECTS 9

MOS and BiCMOS circuit design: Stick diagrams- Lambda based design rules-Layout diagrams-Symbolic diagrams-Scaling models-Scaling factors for device parameters-Limitations of scaling-Limits due to sub threshold currents-Limits on logic levels and supply voltage due to noise

UNIT III SUBSYSTEM DESIGN AND LAYOUT 9

Switch logic-GATA logic: Two input nMOS,CMOS and BiCMOS nand gates-Two input nMOS, CMOS and BiCMOS nor gates - Combinational logic: Parity generator- Multiplexers-Clocked sequential circuits: Two phase clocking-Charge storage-Register elements and Shift register-System considerations: Bus lines arrangements-Pre-charged bus concepts-Power dissipation and Power distribution buses.

UNIT IV SPECIFICATION USING VERILOG HDL 9

Basic concepts- identifiers- gate primitives- gate delays- operators- timing controls-procedural assignments conditional statements-Data flow and RTL- structural ,gate level, switch level modeling- Design hierarchies-Behavioral and RTL modeling- Test benches-Structural, gate level description of decoder- equality detector-comparator- priority encoder- half adder- full adder- Ripple carry adder- D latch and D flip flop.

UNIT V SYSTEM DESIGN AND FPGA 9

System Design Examples: Design of eight inputs signed parallel adder/multiplier-Traffic Light Controller-Real Time Clock-Digital Input/ Output Card-FPGA –System design applications using FPGA- Case Studies: FPGA technology for UAV communications and control- FPGA PID Controller

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2008.
2. Bhasker, J., VHDL Primer, Prentice Hall ,2009

REFERENCES

1. Weste and Harris, CMOS VLSI DESIGN, 3rd Edition, Pearson Education, 2010
2. Ciletti Advanced Digital Design with the Verilog HDL, Prentice Hall of India, 2010

E-LEARNING RESOURCES

1. http://mil-embedded.com/articles/case-enables-uav-communications-control/
   http://www.embedded.com/design/configurable-systems/4212241/
   Case-Study-of-PID-Control-in-an-FPGA-

13EEEB DSP BASED SYSTEM DESIGN L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Summarize the instruction sets of C2xx DSP Controller.
CO 2: Discuss the various peripheral functions of DSP Controller.
CO 3: Explain the Event Managers in DSP Controller.
CO 4: Demonstrate DSP Controllers based power electronics applications.
CO 5: Employ DSP Controllers for electromechanical applications.

UNIT I INTRODUCTION 9

Overview of TMSLF2407 DSP controller- Brief Introduction to Peripherals -Types of Physical Memory - Software Tools - C2xx DSP Core and Code Generation- C2xx DSP CPU and Instruction Set - Components of C2xx DSP Core - Mapping - Interface System Configuration Registers-Memory - Memory Addressing Modes - Assembly Programming Using C2xx DSP Instruction Set.

UNIT II PERIPHERALS 9

General purpose Input/output (GPIO) Functionality-Multiplexing and General Purpose I/O Control Registers - Interrupts -Interrupt Hierarchy and Control Registers-Initializing and Servicing Interrupts in Software - Interrupt Usage Exercise - A/D converter-Overview, Operation of the ADC- Analog to Digital Converter Usage Exercise- PWM signal generation.

UNITIII EVENT MANAGERS 9

Overview of the Event Manager (EV) - Event Manager 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-Converter Structure - Continuous Conduction Mode - Discontinuous Conduction Mode - Connecting the DSP to the Buck-Boost Converter - Controlling the Buck-Boost Converter - Main Assembly Section Code Description - Interrupt Service Routine - Regulation Code Sequences - Space Vector PWM Technique–Principle of constant V/f control of induction motor – DSP implementation.

UNIT V ELECTROMECHANICAL APPLICATIONS 9

Stepper Motors – Implementation - Subroutine of Speed Control Module - Permanent Magnet Brushless DC Machines - Torque Generation – Implementation - Switched Reluctance Motor Drives - Open Loop & Closed Loop Torque Control - Closed Loop Speed Control - Algorithm for Running SRM Drive using an Optical Encoder.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Hamid A.Toliyat, Steven Campbell, 'DSP based electromechanical motion control', CRC Press, 2004.
2. Sen M Kuo, Woon .Seng. Gan, Digital signal Processors-Architecture, implementation and applications, Pearson, 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 -1997
3. B. K. Bose, Adjustable Speed ac Drive Systems, IEEE Press, New York, 1987
4. N. Mohan, T.M. Undeland, and W.P. Robbins, Power Electronics: Circuits, Devices, and Applications - 2nd Edition, John Wiley & Sons, New York, 1995
5. Digital Signal Processing: A practical approach, Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002

13EEEC MEMS AND NEMS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Outline the design concepts of MEMS.
CO 2: Describe the processes in micromachining.
CO 3: Summarize the various types of sensors and actuators.
CO 4: Demonstrate the application of MEMS.
CO 5: Discuss the processes of NEMS and its applications.

UNIT I INTRODUCTION TO MEMS 9

Microelectromechanical systems - Micro sensors - Micro actuation - Single crystal and Poly crystalline silicon - Silicon compounds – Silicon Piezoresistor – Quartz – Piezoelectric crystal – Polymers – SU8 photoresists - Scaling in Geometry - Scaling in Rigid-Body Dynamics - Scaling in Electrostatic Forces - Scaling in Electromagnetic Forces - Scaling in Electricity.

UNIT II MICROMACHINING 9

Photolithography – Structural and Sacrificial Materials – Lithography methods - Thin Film Deposition – Impurity Doping – Etching – Problems with Bulk Micromachining – Surface Micromachining – Wafer Bonding – LIGA process.

UNIT III SENSORS AND ACTUATORS 9

Mechanical - Principle of sensing and actuation – Beam and Cantilever – Capacitive effect – Piezoelectric – Pressure measurement by microphone – MEMS Gyroscopes – Thermal – Micromachined thermocouple probe - Peltier effect Heat pumps – Thermal flow sensors thermally activated MEMS relay – Shape Memory Alloys.

UNIT IV RF MEMS and MOEMS 9

RF based communication system – MEMS inductors –Varactors – Tuners – Filter – Resonator – MEMS Switches – Phase shifter – Principle of MOEMS – Micro mirrors – Light detectors.

UNIT V NEMS 9

Nano electro mechanical systems - fabrication and process techniques - integration of nano systems and devices – applications - Single Electron Transistor – Carbon Nano tube Devices.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata Mcraw Hill,2002.
2. Nitaigour Premchand Mahalik, "MEMS", McGraw-Hill, 2005.

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, 2000.
3. Stephen Santuria," Microsystems Design", Kluwer publishers, 2000.
4. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002
6. W.R.Fahrner, "Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques", Springer, 2005.

13EEED REAL TIME OPERATING SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Review the processes of general Operating systems
CO 2: Describe the basics concepts of RTOS
CO 3: Explain the Real time models and scheduling
CO 4: Distinguish the various RTOS
CO 5: Demonstrate the applications of RTOS in various domains

UNIT I REVIEW OF OPERATING SYSTEMS 9

Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Distributed scheduling.

UNIT II OVERVIEW OF RTOS 9

RTOS Task and Task state - Process Synchronization- Message queues – Mail boxes - pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks

UNIT III REAL TIME MODELS AND LANGUAGES 9

Event based, Process based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

UNIT IV REAL TIME KERNEL 9

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and study of various RTOS like QNX – VX works – PSOS – C Executive – Case studies.

UNIT V RTOS APPLICATION DOMAINS 9

RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

L: 45, TOTAL: 45 PERIODS

TEXT BOOKS

1. Raj Kamal, “Embedded Systems- Architecture, Programming and Design” Tata McGraw Hill, 2006.
2. Herma K., “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 1997.

REFERENCES

1. Charles Crowley, “Operating Systems-A Design Oriented approach” McGraw Hill 1997.
2. C.M. Krishna, Kang, G.Shin, “Real Time Systems”, McGraw Hill, 1997.
3. Raymond J.A.Bhur, Donald L.Bailey, “An Introduction to Real Time Systems”, PHI 1999.
4. Mukesh Sighal and N G Shi “Advanced Concepts in Operating System”, McGraw Hill 2000.
5. Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2007.

13EEEE EMBEDDED SYSTEM LABORATORY **L T P C**
0 0 3 2

COURSE OUTCOMES

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

CO 1: Develop assembly language program to sort the numbers.
CO 2: Write Embedded C Program to interface display devices.
CO 3: Develop embedded C coding for keyboard interfacing.
CO 4: Demonstrate Real Time Clock, ADC and DAC.
CO 5: Practice stepper motor control and serial communication.

LIST OF EXPERIMENTS

1. Study of architecture and integrated development environment
2. Pick the smallest among a given set of numbers
3. Pick the largest among a given set of numbers
4. Arrange a given set of numbers in ascending order
5. Arrange a given set of numbers in descending order
6. Generate a rectangular wave form at a specified port terminal
7. Interface switches and LEDs
8. Interface seven segment LED
9. Interface keyboard and LCD
10. i. Interface real time clock
    ii. Interface ADC and DAC
11. Interfacing stepper motor and temperature sensor
12. Serial communication using UART to display “Hello World” in PC

P: 45 TOTAL: 45 PERIODS

13EEFA PRINCIPLES OF COMMUNICATION SYSTEMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO 1: Understand the basic concepts of AM and FM radio transmission and reception.
CO 2: Understand the fundamental concepts of Digital Communication.
CO 3: Understand the fiber optic and Power line communications concepts.

UNIT I AMPLITUDE MODULATION **9**

Principles of amplitude modulation – AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM power distribution, AM modulator circuits – low level AM modulator, medium power AM modulator, AM transmitters – low level transmitters, high level transmitters, Receiver parameters. AM reception: AM receivers – TRF, Superheterodyne receivers, Double Conversion AM receivers.

UNIT II ANGLE MODULATION **9**

Angle Modulation – FM and PM waveforms, phase deviation and modulation index, frequency deviation, phase and frequency modulators and demodulators, frequency spectrum of a angle modulated waves, Bandwidth requirement, Broadcast band FM, Average power FM and PM modulators – Direct FM and PM, Direct FM transmitters, Indirect transmitters, Angle modulation Vs. amplitude modulation. FM receivers: FM demodulators, PLL FM demodulators, FM noise suppression, Frequency Vs. phase Modulation.

UNIT III PULSE MODULATION **9**

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding: PCM, DM, slope overload error. ADM, DPCM

UNIT IV DIGITAL MODULATION **9**

Introduction, Binary PSK, DPSK, Differentially encoded PSK, QPSK, M-ary PSK, QASK, Binary FSK, MSK, Duobinary encoding – Performance comparison of various systems of Digital Modulation.

UNIT V OPTICAL FIBER- POWER LINE SCADA **9**

Optical fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Wayne Tomasi, “Electronic Communication Systems: Fundamentals through Advanced”, Pearson Education, 5th Edition, 2003.
2. Simon Haykin, “Digital Communications”, John Wiley & Sons, 5th Edition, 2003.

REFERENCES

1. John G. Proakis, “Digital communications”, Tata McGraw-Hill, 5th Edition, 2008.
2. Taub and Schilling, “Principles of Communication Systems”, Tata McGraw-Hill, 2nd Edition, 2003.
3. Martin S. Roden, “Analog and Digital Communication System”, PHI, 3rd Edition, 2002.
4. Blake, “Electronic Communication Systems”, Thomson Delman, 2nd Edition, 2002.

13EEFB OPERATING SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

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

CO 1: Identify the functions of Operating Systems.
CO 2: Discuss the concepts of process management.
CO 3: Predict and analyze deadlocks.
CO 4: Describe the importance of storage management.
CO 5: Understand the basics of file systems and I/O systems.

UNIT I PROCESSES 9

Introduction to operating systems – operating system structures – system calls – system programs – system structure - Processes: Process concept – Process scheduling – Operations on processes – Cooperating processes – Interprocess communication – Communication in client-server systems.

UNIT II THREADS, PROCESS SCHEDULING AND SYNCHRONIZATION 10

Threads: Multi-threading models – Threading issues - CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple processor scheduling – Real time scheduling – Algorithm Evaluation. Process Synchronization: The critical-section problem – Semaphores – Classic problems of synchronization – critical regions – Monitors.

UNIT III DEADLOCK 8

Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT IV STORAGE MANAGEMENT 9

Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging - Virtual Memory: Background – Demand paging – Process creation – Page replacement – Allocation of frames –Thrashing.

UNIT V FILE SYSTEMS AND I/O SYSTEMS 9

File System Interface: File concept – Access methods – Directory structure – File system mounting – Protection - File-System Implementation: Directory implementation – Allocation methods – Free space management – efficiency and performance - I/O Systems – kernel I/O subsystem – streams – performance. Mass Storage Structure: Disk scheduling – Disk management – Swap space management.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne “Operating System Principles”, 6th Edition, John Wiley & Sons (Asia) India Private Limited, 2009.

REFERENCES

1. Andrew S. Tanenbaum, “Modern Operating Systems”, 2nd Edition, Pearson Education, 2004.
2. Gary Nutt, “Operating Systems”, 3rd Edition, Pearson Education, 2004.
3. Harvey M. Deitel, “Operating Systems”, 3rd Edition, Pearson Education, 2004.
4. Dhananjay M.DhamDhere, “Operating Systems A Concept – Based Approach”, 3rd Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2003.

13EEFC CLOUD COMPUTING

(Common to CSE, IT, EEE and ECE)

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO 1: Know the fundamentals of cloud computing

CO 2: Distinguish the various cloud services

CO 3: Explore some important cloud computing driven commercial systems such as GoogleApps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.

UNIT I UNDERSTANDING CLOUD COMPUTING 9

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II DEVELOPING CLOUD SERVICES 9

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

UNIT III CLOUD COMPUTING FOR EVERYONE 9

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV USING CLOUD SERVICES 9

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

UNIT V OTHER WAYS TO COLLABORATE ONLINE 9

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online”, Que Publishing, August 2008.

REFERENCE

1. Haley Beard, “Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs”, Emereo Pty Limited, July 2008.

13EEFD COMPUTER ARCHITECTURE L T P C
3 0 0 3

COURSE OUTCOMES

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

CO Recognize the role of instruction sets and assembly language programming.
CO 2: Interpret the execution procedure.
CO 3: Analyze the hardwired and programmed ALU design techniques.
CO 4: Identify the factors that degrade pipeline performance and its counter measure.
CO 5: Depict the role of each memory in the memory hierarchy.

UNIT I INSTRUCTION SET ARCHITECTURE 9

Introduction to computer architecture - Review of digital design – Instructions and addressing – Procedures and data – Assembly language programs – Instruction set variations.

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 - floating point numbers and operations. Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control.

UNIT III PIPELINING 9

Basic concepts – Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – superscalar operations- Performance considerations.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories –Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices.

UNIT V MULTIPROCESSOR 9

Symmetric shared memory and Distributed shared memory multiprocessors – Performance issues of symmetric and distributed shared memory – Synchronization – Models of memory consistency: An introduction – Snoopy bus protocols – Directory based protocols.

L:45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5th Edition, Tata McGraw Hill, 2002.
2. B. Parhami, “Computer Architecture”, Oxford University Press, 2005.

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 McGraw- 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 McGraw Hill, 2003.
6. John L. Hennessey, David A. Patterson, “Computer Architecture A Quantitative Approach”, 4th Edition, Morgan Kaufmann, 2007.

13EEFE MOBILE COMPUTING L T P C
(Common to IT, ECE and EEE) 3 0 0 3

COURSE OUTCOMES

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

CO1: explain the basic concepts of mobile computing.
CO2: describe the various schemes in MAC protocols.
CO3: explain the functionalities of Mobile IP protocols
CO4: discuss on routing and security issues in Ad hoc and Sensor networks.
CO5: explain the architecture and components of Mobile Operating Systems.

UNIT I INTRODUCTION 9

Mobile Computing – Applications – Characteristics – Structure of Cellular Mobile Communication – GSM – services – Architecture – GPRS – services – Architecture services – UMTS .

UNIT II MAC PROTOCOLS 9

Properties – Wireless MAC – Taxonomy – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes – 802.11 MAC standards.

UNIT III MOBILE INTERNET PROTOCOL 9

Mobile IP – Terminologies of Mobile IP – Packet Delivery – Features of Mobile IP – Key Mechanism – Route optimization DHCP – Significance of DHCP .

UNIT IV MOBILE ADHOC NETWORKS &WIRELESS SENSOR NETWORKS 9

MANET : Characteristics – Routing Protocols- VANET –Security issues in MANET – Attacks on Adhoc Networks – Sensor Networks: Characteristics - Routing Protocols.

UNIT V MOBILE APPLICATION DEVELOPMENT AND OPERATING SYSTEMS 9

Responsibilities of OS in Mobile device – Mobile O/S-Windows Mobile-Palm OS-Symbian OS-Android and Blackberry OS-Mobile Devices as Web clients-WAP-Android Software Development Kit-M-Commerce-B2C and B2B applications-Security Issues.

L: 45 ; TOTAL: 45 PERIODS

TEXT BOOKS

1. Jochen H. Schller, “Mobile Communications”, Pearson Education, Second Edition, New Delhi, 2007.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi ,2012.

REFERENCES

1. Rappaport T.S., “Wireless Communications; Principles and Practice “, Prentice Hall, NJ, 1996.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
3. C.K.Toh, “AdHoc Mobile Wireless Networks”, Pearson Education, First Edition, 2002. Android Developers: http://developer.android.com/index.html

13TD01 INDIAN BUSINESS LAWS L T P C
0 0 0 3

COURSE OUTCOMES

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

CO 1: explain the elements of a valid contract.
CO 2: discuss main provisions relating to Sale of Goods Act and Negotiable Instruments Act.
CO 3: explain provisions relating to incorporation and functioning of company and partnership firm.
CO 4: understand the fundamentals of Consumer Protection Act and Foreign Exchange Management Act.
CO 5: understand the basic knowledge of Information Technology Act and RTI Act.

UNIT I THE INDIAN CONTRACT ACT, 1872

Definition of a Contract and its essentials - Formation of a valid Contract - Offer and Acceptance, Consideration - Capacity to Contract - Free consent - Legality of object - Discharge of a Contract by performance - Impossibility and Frustration - Breach, Damages for breach of a contract - Quasi contracts - Special Contracts - Contract of Indemnity and Guarantee - Contract of Bailment and Pledge - Contract of Agency.

UNIT II THE SALE OF GOODS ACT, 1930

Definition of a Contract of Sale - Conditions and Warranties - Passing of Property - Right of Unpaid Seller against the Goods - Remedies for Breach - The Negotiable Instrument Act, 1881
Definition and characteristics - Kinds of negotiable instruments - Promissory Note - Bill of Exchange and Cheques - Holder and Holder in due course - Negotiation, Presentment, Discharge from Liability - Noting and Protest – Presumption - Crossing of Cheques - Bouncing of Cheques.

UNIT III THE COMPANIES ACT, 1956

Nature and Definition of a Company - Registration and Incorporation - Memorandum of Association - Articles of Association – Prospectus - Kinds of Companies - Directors: Their powers and duties – Meetings - Winding up - The Indian Partnership Act, 1932 - Definition of Partnership and its essentials - Rights and Duties of Partners: Types of Partners - Minor as a partner - Doctrine of Implied Authority - Registration of Firms - Dissolution of firms - Limited Liability Partnership Act, 2000.

UNIT IV THE CONSUMER PROTECTION ACT, 1986

Aims and Objects of the Act - Redressal Machinery and Procedure for complaints under the Act – Remedies – Appeals - Enforcement of orders and Penalties - Foreign Exchange Management Act 2000 - Definition and Main Provisions.

UNIT V THE INFORMATION TECHNOLOGY ACT

Definition, Digital Signature - Electronic Governance – Attribution - Acknowledgment and Dispatch of Electronic Records - Sense Electronic Records and Sense Digital Signatures - Regulation of Certifying Authorities Digital Signature Certificates - Duties of Subscribers - Penalties and Offences - The Right to Information Act, 2005 - Right to know - Salient Features of the Act - Obligation of Public Authority - Designation of Public Information Officer - Request for obtaining information - Duties of a PIO - Exemption from Disclosure of Information - Partial Disclosure of Information - Information Commissions - Powers of Information Commissions - Appellate Authorities – Penalties - Jurisdiction of Courts.

TEXT BOOKS

1. Kuchhal M.C, "Business and Industrial Laws", 3rd Edition, JBA Publishers, New Delhi, 2013.
2. Gulshan S.S, "Merchantile Law", 3rd Edition, JBA Publishers, New Delhi, 2007.

REFERENCES

1. Mulla D.F, "The Sale of Goods Act and the Indian Partnership Act", 10th Edition, LexisNexis Ltd., India, 2012.
2. Dabas J, "Negotiable Instruments Act", 2nd Edition, JBA Publishers, New Delhi, 2013.
3. Avtar S, "The Principles of Mercantile Law", 9th Edition, Eastern Book Company, India, 2011.

13TD02 LEADERSHIP AND PERSONALITY DEVELOPMENT L T P C
0 0 0 3

COURSE OUTCOMES

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

CO 1: identify the various leadership skills.
CO 2: understand group dynamics and factors influencing the team performance.
CO 3: describe the personality dimensions based on personality theories.
CO 4: explain personality determinants and personality types.
CO 5: apply effective training program for personality development.

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 – Cattele and Big Five - Psychodynamic Theories - Carl Jung and MBTI - Transactional Analysi - 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 Ltd., England, 2013.
2. Lall M, Sharma S, “Personal Growth Training & Development”, Kindle Edition, USA, 2009.

REFERENCES

1. Janakiraman B, “Training and Development”, Wiley Dream tech, Biztantra, 2005.
2. Pareek U, “Understanding Organizational Behaviour”, 2nd Edition, Oxford University Press, USA, 2007.

13TD03 INTERNATIONAL BUSINESS MANAGEMENT L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.

13TD04 BASICS OF MARKETING L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.

13TD05 RETAILING AND DISTRIBUTION MANAGEMENT L T P C
0 0 0 3

COURSE OUTCOMES

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

CO 1: explain the concepts of retailing and distribution management.
CO 2: analyze and solve retailers' problems to make decisions in retail organizations.
CO 3: plan and formulate strategy for retail management process.
CO 4: discuss about various distribution technology and stores management.
CO 5: analyze the issues and challenges in Logistic Management

UNIT I INTRODUCTION

Meaning and Nature of Distribution and Retail Industry - Future of Retailing and Distribution in India - Distribution Channels – Concept, Role and Types - Factors Affecting Choice of Distribution Channel.

UNIT II TYPES OF RETAILING

Stores Classified by Owners - Stores Classified by Merchandising Categories - Wheel Of Retailing - Traditional Retail Formats Vs. Modern Retail Formats in India - Store and Non-Store Based Formats - Cash and Carry Business - Retailing Models – Franchiser Franchisee, Directly Owned - Wheel of Retailing and Retailing Life Cycle – Issues in Retailing.

UNIT III MANAGEMENT OF RETAILING OPERATIONS

Meaning - Functions of Retail Management - Strategic Retail Management Process - Retail Planning - Importance and Process - Developing Retailing Strategies.

UNIT IV TECHNOLOGY IN DISTRIBUTION

Bar-Coding – RFID – Electronic Payment Systems - Store Administration - Floor Space Management – Managing Store Inventories and Display Action Plans - Pricing Strategies and Location Strategies.

UNIT V LOGISTICS OF RETAIL MANAGEMENT

Components and Functions; Distribution Related Issues and Challenges - Gaining Competitive Advantage through Logistics Management.

TEXT BOOKS

1. Agrawal D. K., “Distribution & Logistics Management: A Strategic Marketing Approach”, Macmillan Publishers India Limited, New Delhi, 2007.
2. Berman B, Evans J.R, “Retail Management – A Strategic approach”, 12th Edition, Pearson Education Ltd., England, 2013.
3. Cox R, Brittan P, “Retailing an introduction, Financial Times Management”, 5th Edition, Pearson Education Limited, England, 2004.

REFERENCES

1. Rushton A, Croucher P, Baker P, “The Handbook of Logistics & Distribution Management”, Kogan Page Limited, London, 2006.
2. Coughlan A.T, Anderson E, Stern L.W, El-Ansary A.I, “Marketing Channels", 7th Edition, Prentice Hall, New Jersey, 2006.
3. Sinha P. K, Uniyal D.P, “Managing Retailing”, Oxford University Press, India, 2007.

13TD06 **INTERNATIONAL ECONOMICS** **L T P C**
0 0 0 3

COURSE OUTCOMES

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

CO 1: discuss the impact of globalization.
CO 2: identify and analyze different theoretical models of international economics in light of 'real world' situations.
CO 3: examine the consequences of trade policies.
CO 4: explain the importance of international financial markets.
CO 5: discuss the important aspects of international banking.

UNIT I INTRODUCTION

Background of International Business Economics - Globalization and International Business – The Emergence of Global Institutions – Drivers of Globalizations - The Globalization Debate.

UNIT II THE INTERNATIONAL TRADE THEORY

The Law of Comparative Advantage – The Demand and Supply, Offer Curves - The Terms of Trade – Factor Endowments and the Heckscher – Ohlin Theory – Implications of Trade Theories - Economics of Scale - Imperfect Competition.

UNIT III INTERNATIONAL TRADE POLICY

Trade Restrictions - Tariffs, Non –Tariff Trade Barriers - Tariff Vs. Quota - The New Protectionism – Economic Integration - Custom Unions and Free Trade Areas - Major Regional Trade Agreements - Foreign Exchange Market – Types of Foreign Exchange Transactions – Reading Foreign Exchange Quotations – Forward and Futures Market – Foreign - Currency Options – Exchange Rate Determination – Arbitrage – Speculation and Exchange - Market Stability.

UNIT IV WORLD FINANCIAL ENVIRONMENT

Global Foreign Exchange Markets – Economic Theories of Exchange - Rate Determination - International Regime for FDI and MNC - Consequences of Economic Globalization.

UNIT V INTERNATIONAL BANKING

Reserves, Debt and Risk - Nature of International Reserves – Demand for International Reserves – Supply of International Reserves – Gold Exchange Standard – Special Drawing Rights – International Lending Risk – The Problem of International Debt – Financial Crisis and The International Monetary Fund – Eurocurrency Market.

TEXT BOOKS

1. Krugman P.R, Obstfeld M, "International Economics Theory and Policy", 8th Edition, Prentice Hall, Boston, 2008.
2. Carbaugh R.J, "International Economics", 15th Edition, South Western College publication, USA, 2014.

REFERENCES

1. Daniels J, Radebaugh L, Sullivan D, Salwan P, "International Business", 12th Edition, Pearson Education, New Delhi, 2010.
2. Suranovic S, "International Economics: Theory and Policy", Flat World Knowledge, USA, 2010.

13TD07 INDIAN ECONOMY L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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).

13TD08 RURAL ECONOMICS L T P C
0 0 0 3

COURSE OUTCOMES

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

CO 1: discuss the role and importance of agriculture in economic development of India.
CO 2: describe the impact of agricultural forming in rural employment, wage policy, technological change and green revolution.
CO 3: analyze the relationship between rural and urban society.
CO 4: recognize the formation and system of rural social institutions.
CO 5: compare the social changes in the rural society after modernization and globalization.

UNIT I INTRODUCTION

Nature and Scope of Rural Economy - Importance of Agriculture in Economic Development of India - Nature of Land Problems - Evolution of Policy – Land Tenure System - Land Reform Measures.

UNIT II AGRICULTURE AND FARMING

Agricultural Holdings - Fragmentation and Sub-Division of Holdings, Cooperative Farming-Rural Labour Problems - Nature of Rural Unemployment - Employment and Wage Policy - Sources of Technological Change and Green Revolution.

UNIT III RURAL SOCIETY

Rural Society Structure and Change - Village and its Social Organization - Indian Village and its Types - Rural-Urban Continuum and Rural-Urban Relationships.

UNIT IV RURAL SOCIAL INSTITUTIONS

Rural Social Institutions - Family, Property, Caste, Class, Agrarian Structure - Indebtedness and Poverty - Jajmani System - Religion, Village, Panchayat Raj and Community Development Programmes – Problems.

UNIT V SOCIAL CHANGES

Social Change in Rural India-Impact of Westernization - Secularization, Urbanisation, Industrialisation, Migration, Transportation, Modernization of Indian Rural Society - Post Modernization and Globalization and Indian Villages.

TEXT BOOKS

1. Carver T.N, “The Principles of Rural Economics”, Ginn and company, USA, 1911.
2. Desai A.R, “Rural Sociology in India”, 5th Edition, Popular Prakashan Ltd., Mumbai, 2011.

REFERENCES

1. Dube S.C., “India’s changing villages”, Psychology Press, UK, 2003.
2. Datt R, Sundharam K.P.M, Datt G, Mahajan A,“Indian Economy”, 72nd Edition, S.Chand & Co., New Delhi, 2016.
3. Chaudhari, C.M., “Rural Economics”, Sublime Publication, Jaipur, 2009.

13TD09 INTERNATIONAL TRADE L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.

13TD10 GLOBAL CHALLENGES AND ISSUES L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.

13TD11 INDIAN CULTURE AND HERITAGE L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.

13TD12 INDIAN HISTORY L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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

13TD13 SUSTAINABLE DEVELOPMENT AND PRACTICES L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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", Earthscan 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.

13TD14 WOMEN IN INDIAN SOCIETY L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.

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13TD15 INDIAN CONSTITUTION L T P C
0 0 0 3

COURSE OUTCOMES

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

CO1: describe the basic understanding of the Indian Constitution.
CO2: understand the structure and functions of parliament.
CO3: demonstrate the organization and working of the Judiciary.
CO4: understand the structure and functions of state legislature.
CO5: understand the 73rd and 74th Constitutional Amendments.

UNIT I INDIAN CONSTITUTION

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

UNIT II PARLIAMENTARY SYSTEM

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 THE JUDICIARY

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

UNIT IV STATE GOVERNMENTS

Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

UNIT V LOCAL GOVERNMENTS

73rd and 74th Constitutional Amendments – Federalism - Center – State Relations.

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.

13TD16 BIO MECHANICS IN SPORTS L T P C
0 0 0 3

COURSE OUTCOMES

Upon Successful 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.