

# **NATIONAL ENGINEERING COLLEGE**

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

**K.R.NAGAR, KOVILPATTI – 628 503**

**[www.nec.edu.in](http://www.nec.edu.in)**

**REGULATIONS – 2019**

**CURRICULUM & SYLLABUS**

**B. E. – COMPUTER SCIENCE AND ENGINEERING**

**Accredited by NBA**

**B. E. – COMPUTER SCIENCE AND ENGINEERING**  
CURRICULUM AND SYLLABUS

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

### VISION

To produce globally competent, innovative and socially responsible computing professionals

### MISSION

- To provide world-class teaching - learning and research facilities.
- To stimulate students' logical thinking, creativity, and communication skills effectively.
- To cultivate awareness about emerging trends through self-initiative.
- To instill a sense of societal and ethical responsibilities.
- To collaborate with industries and government organizations.

### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

After 3-4 years of Graduation, our graduates will:

1. Accomplish their professional career and/or pursue higher education by applying knowledge of computer science and engineering.
2. Participate in life-long learning through the successful completion of advanced degrees, continuing education, certifications and/or other professional developments.
3. Perseverance of successful startups through the entrepreneurial initiatives and design thinking capabilities.

### PROGRAMME OUTCOMES (POs)

By the time of graduation, graduates will attain the following programme outcomes:

- 1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

## PREAMBLE OF THE CURRICULUM & SYLLABI

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

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

The curriculum of **CSE programme** is designed with total number of credits **167 (124)** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table-1.

**TABLE – 1 CATEGORY OF COURSES**

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	15
2.	Basic Science courses	23
3.	Engineering Science courses	29.5
4.	Programme Core courses	59.5
5.	Programme Elective courses relevant to chosen specialization / branch	18
6.	Open Elective courses from other technical and /or emerging subject areas	8
7.	Skill Development Courses	14
8.	Mandatory courses	(non – credit)
	<b>TOTAL</b>	<b>167</b>

- i. **Humanities and Social Sciences (HSMC)** include English, Communication Skill laboratory and Management courses
- ii. **Basic Science Courses (BSC)** include Chemistry, Physics, Biology and Mathematics

- iii. **Engineering Science Courses (ESC)** include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering
- iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.
- v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.
- vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.
- vii. **Skill Development Courses (SDC)** include the courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.
- viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

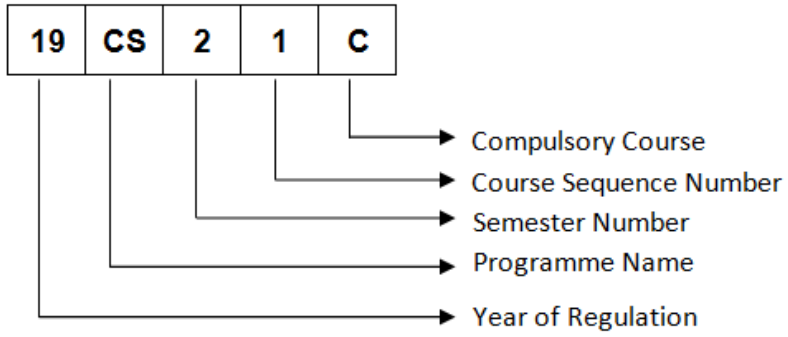
Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

**TABLE – 2 QP - QUESTION PATTERN**

**R-2019 REVISED Question Pattern Format**

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	16 marks	20 marks	Total
Theory (3 / 4 credit)	A	10	5	-	--	5 Qns (either or type)	--	--	100
Theory (2 credit)	B	10	-	-	5 Qns (either or type)	--	--	--	75
Theory (1 credit)	C	5	--	2 Qns (either or type)	--	--	--	--	30
Theory (Trans Disciplinary)	D	-	-	-	-	-	--	5 out of 8	100
Design Oriented / Theory	E	--	-	--	-	-	--	5 Qns (either or type)	100
Theory (3 / 4 credit)	F	10	--	--	--	--	5 Qns (either or type)	--	100

## FORMAT FOR COURSE CODE



## REGULATIONS – 2019 CURRICULUM AND SYLLABUS

### SEMESTER – I

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>®</sup>
<b>THEORY COURSES</b>								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19CS11C	Python Programming	3	0	0	3	A
6.	ESC	19CS12C	Basic Electrical and Electronics Engineering	3	0	0	3	A
<b>PRACTICAL COURSES</b>								
7.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	-
8.	ESC	19CS13C	Python Programming Laboratory	0	0	4	2	-
<b>TOTAL</b>				<b>15</b>	<b>1</b>	<b>7</b>	<b>19.5</b>	

### SEMESTER – II

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>®</sup>
<b>THEORY COURSES</b>								
1	HSMC	19CS21C	Professional English	2	0	0	2	B
2	BSC	19CS22C	Probability and Queueing theory	3	1	0	4	A
3	BSC	19CS23C	Semiconductor Physics	2	0	0	2	B
4	BSC	19CS24C	Biology for Engineers	2	0	0	2	B
5	ESC	19CS25C	Problem Solving Techniques	3	0	0	3	A
6	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
7.	HSMC	19GN02C	Heritage of Tamils (தமிழர் மரபு)	1	0	0	1	C
<b>PRACTICAL COURSES</b>								
8.	BSC	19CS26C	Semiconductor Physics and Biology Laboratory Part A – Semiconductor Physics Laboratory Part B – Biology Laboratory	0	0	3	1.5	-
9.	ESC	19CS27C	Problem Solving Techniques Laboratory	0	0	4	2	-
10.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
<b>TOTAL</b>				<b>16</b>	<b>1</b>	<b>13</b>	<b>23.5</b>	



### SEMESTER – III

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>®</sup>
<b>THEORY COURSES</b>								
1.	BSC	19CS31C	Discrete Mathematics	3	1	0	4	A
2.	PCC	19CS32C	Data Structures	3	0	0	3	A
3.	PCC	19CS33C	Computer Organization and Architecture	3	0	0	3	A
4.	PCC	19CS34C	Object Oriented Programming	3	0	0	3	A
5.	ESC	19CS35C	Digital Principles and System Design	3	0	2	4	A
6.	PCC	19CS36C	Software Engineering Methodologies	3	0	0	3	A
7.	MAC	19MC01C	Environmental Science and Engineering	3	0	0	0	D
8.	HSMC	19GN03C	Tamils and Technology (தமிழரும் தொழில் நுட்பமும்)	1	0	0	1	C
<b>PRACTICAL COURSES</b>								
9.	PCC	19CS37C	Data Structures Laboratory	0	0	4	2	-
10.	PCC	19CS38C	Object Oriented Programming Laboratory	0	0	4	2	-
11.	HSMC	19CS39C	Communication Skills Laboratory	0	0	2	1	-
<b>TOTAL</b>				<b>22</b>	<b>1</b>	<b>12</b>	<b>26</b>	<b>-</b>

### SEMESTER – IV

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>®</sup>
<b>THEORY COURSES</b>								
1.	ESC	19CS41C	Statistics and Numerical methods	3	1	0	4	A
2.	PCC	19CS42C	Design and Analysis of Algorithms	3	1	0	4	A
3.	PCC	19CS43C	Operating Systems	3	0	0	3	A
4.	PCC	19CS44C	Database Management Systems	3	0	0	3	A
5.	PCC	19CS45C	Computer Networks	3	0	0	3	A
6.	HSMC	19CS46C	Finance and Accounting	3	0	0	3	A
<b>PRACTICAL COURSES</b>								
7.	PCC	19CS47C	Operating Systems Laboratory	0	0	3	1.5	-
8.	PCC	19CS48C	Database Management Systems Laboratory	0	0	3	1.5	-
9.	PCC	19CS49C	Networks Laboratory	0	0	3	1.5	-
<b>TOTAL</b>				<b>18</b>	<b>2</b>	<b>9</b>	<b>24.5</b>	

**SEMESTER-V**

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>⊕</sup>
<b>THEORY COURSES</b>								
1.	PCC	19CS51C	Java Programming	3	1	0	4	A
2.	PCC	19CS52C	Theory of Computation	3	1	0	4	A
3.	HSMC	19CS53C	Professional Ethics and Human Values	3	0	0	3	A
4.	ESC	19CS54C	Embedded Systems	3	0	0	3	A
5.	PCC	19CS55C	Cryptography and Network Security	3	0	0	3	A
6.	PEC		Elective-I	3	0	0	3	A
7.	MAC	19MC02C	Constitution of India	3	0	0	0	D
<b>PRACTICAL COURSES</b>								
8.	PCC	19CS56C	Java Programming Laboratory	0	0	3	1.5	-
9.	ESC	19CS57C	Embedded Systems Laboratory	0	0	3	1.5	-
10.	PCC	19CS58C	Cryptography and Network Security Laboratory	0	0	2	1	-
<b>TOTAL</b>				<b>21</b>	<b>2</b>	<b>8</b>	<b>24</b>	

**SEMESTER-VI**

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>⊕</sup>
<b>THEORY COURSES</b>								
1.	PCC	19CS61C	Object Oriented Analysis and Design	3	0	0	3	A
2.	PCC	19CS62C	Principles of Compiler Design	3	0	2	4	A
3.	PCC	19CS63C	Internet and Web Technology	3	0	0	3	A
4.	HSMC	19CS64C	Business Process Management	2	0	0	2	B
5.	PEC		Elective-II	-	-	-	3	-
6.	PEC		Elective -III	3	0	0	3	A
7.	OEC		Elective - IV	3	0	0	3	A
<b>PRACTICAL COURSES</b>								
8.	PCC	19CS65C	Internet and Web Technology Laboratory	0	0	3	1.5	-
9.	PCC	19CS66C	Comprehension	0	0	2	1	-
10.	SDC	19CS67C	Product Development Laboratory	1	0	2	2	-
<b>TOTAL</b>				<b>21</b>	<b>0</b>	<b>9</b>	<b>25.5</b>	

### SEMESTER – VII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>⊕</sup>
<b>THEORY COURSES</b>								
1.	PEC	-	Elective-V	3	0	0	3	A
2.	PEC	-	Elective-VI	3	0	0	3	A
3.	PEC	-	Elective-VII	3	0	0	3	A
<b>PRACTICAL COURSES</b>								
4.	SDC	19CS71C	Research Paper and Patent Review - Seminar	0	0	2	1	-
5.	SDC	19CS72C	Project work - I	0	0	6	3	-
<b>TOTAL</b>				<b>9</b>	<b>0</b>	<b>8</b>	<b>13</b>	

### SEMESTER – VIII

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>⊕</sup>
<b>THEORY COURSES</b>								
1.	OEC	-	Elective - VIII	3	0	0	3	A
<b>PRACTICAL COURSES</b>								
2.	SDC	19CS81C	Project work - II / Industry practice	0	0	12	6	-
3.	SDC	19CS82C	Internship / Inplant Training	0	0	4	2	-
<b>TOTAL</b>				<b>3</b>	<b>0</b>	<b>16</b>	<b>11</b>	

Total Credits: 167

### PROGRAMME ELECTIVE COURSES

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>⊕</sup>
<b>DATA SCIENCE</b>								
1.	PEC	19CS01E	Data Virtualization	3	0	0	3	A
2.	PEC	19CS02E	Big Data Analytics	3	0	0	3	A
3.	PEC	19CS03E	Data Science	3	0	0	3	A
4.	PEC	19CS04E	Data Mining	3	0	0	3	A
5.	PEC	19CS05E	Business Analytics	3	0	0	3	A
6.	PEC	19CS06E	Social Media Analytics	3	0	0	3	A

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>®</sup>
7.	PEC	19CS07E	Analytic Computing	3	0	0	3	A
<b>THEORY &amp; ALGORITHMS</b>								
8.	PEC	19CS08E	Algorithmic Game Theory	3	0	0	3	A
9.	PEC	19CS09E	Blockchain Architecture and Design	3	0	0	3	A
10.	PEC	19CS10E	Computational Graph Theory	3	0	0	3	A
11.	PEC	19CS11E	Quantum Computing	3	0	0	3	A
12.	PEC	19CS12E	Multicore Programming	3	0	0	3	A
13.	PEC	19CS13E	Micro service architecture	3	0	0	3	A
<b>AI &amp; DEEP LEARNING</b>								
14.	PEC	19CS14E	Computational Methods of Optimization	3	0	0	3	A
15.	PEC	19CS15E	Artificial Intelligence	3	0	0	3	A
16.	PEC	19CS16E	Machine Learning in healthcare	3	0	0	3	A
17.	PEC	19CS17E	Machine Learning	3	0	0	3	A
18.	PEC	19CS18E	Nature and Bio-inspired Computing	3	0	0	3	A
19.	PEC	19CS19E	Natural Language Processing	3	0	0	3	A
20.	PEC	19CS20E	Computer Vision and Image Processing	3	0	0	3	A
21.	PEC	19CS50E	Statistical Analysis	2	0	2	3	B
22.	PEC	19CS51E	Statistical foundations for Machine Learning	2	0	0	2	B
<b>NETWORKING</b>								
23.	PEC	19CS21E	Storage Area Networks	3	0	0	3	A
24.	PEC	19CS22E	Wireless Adhoc Networks	3	0	0	3	A
25.	PEC	19CS23E	TCP / IP	3	0	0	3	A
26.	PEC	19CS24E	Cyber Forensics and Ethical hacking	3	0	0	3	A
27.	PEC	19CS25E	Software Defined Networks	3	0	0	3	A
28.	PEC	19CS26E	Cloud Computing	3	0	0	3	A
29.	PEC	19CS27E	Robotics Process Automation in Cloud	3	0	0	3	A
30.	PEC	19CS28E	Cloud Security	3	0	0	3	A
31.	PEC	19CS29E	Internet of Things	3	0	0	3	A
<b>APPLICATION DEVELOPMENT</b>								
32.	PEC	19CS30E	Advanced Java Programming	3	0	0	3	A
33.	PEC	19CS31E	Mobile Application Development	3	0	0	3	A
34.	PEC	19CS33E	Software Design Architecture	3	0	0	3	A
35.	PEC	19CS35E	Web Analytics	3	0	0	3	A
36.	PEC	19CS36E	Social Computing	3	0	0	3	A
37.	PEC	19CS37E	Software Testing Techniques	3	0	0	3	A
38.	PEC	19CS38E	Advanced Database Technology	3	0	0	3	A
39.	PEC	19CS39E	SQL Programming	3	0	0	3	A
40.	PEC	19CS52E	Front End Development	3	0	0	3	A
<b>BLOCKCHAIN TECHNOLOGY</b>								
41.	PEC	19CS40E	Blockchain Fundamentals	3	0	0	3	A
42.	PEC	19CS41E	Digital Currencies And Crypto Assets	3	0	0	3	A
43.	PEC	19CS42E	Smart Contract and Solidity	2	0	2	3	B
44.	PEC	19CS43E	Blockchain Frameworks Laboratory	0	0	4	2	-

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question pattern <sup>®</sup>
<b>SKILL DEVELOPMENT COURSE</b>								
45.	SDC	19CS44E	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3	-
<b>AUGMENTED REALITY AND VIRTUAL REALITY</b>								
46.	PEC	19CS32E	UI/UX Design	3	0	0	3	A
47.	PEC	19CS34E	Augmented Reality and Virtual Reality	3	0	0	3	A
48.	PEC	19CS45E	Design of Virtual Reality Systems	2	0	2	3	B
49.	PEC	19CS46E	Visual Effects	2	0	2	3	B
50.	PEC	19CS47E	Game Development	2	0	2	3	B
51.	PEC	19CS48C	Video Creation and Editing	3	0	0	3	A
52.	PEC	19CS49C	Metaverse Development	3	0	0	3	A

### ONE CREDIT ELECTIVE COURSES

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question Pattern <sup>®</sup>
<b>DATA SCIENCE</b>								
1.	PEC	19CS01L	Statistical foundations for data science	1	0	0	1	C
2.	PEC	19CS02L	Data visualization using Tableau	0	0	2	1	-
3.	PEC	19CS03L	Data visualization using Power BI	0	0	2	1	-
4.	PEC	19CS04L	Python for Data Science	0	0	2	1	-
5.	PEC	19CS05L	R programming	0	0	2	1	-
<b>THEORY &amp; ALGORITHMS</b>								
6.	PEC	19CS06L	Proof systems in Cryptography	1	0	0	1	C
7.	PEC	19CS07L	Theoretical Foundations of Cryptography	1	0	0	1	C
8.	PEC	19CS08L	Randomness in Cryptography	1	0	0	1	C
<b>AI &amp; DEEP LEARNING</b>								
9.	PEC	19CS09L	Deep Learning Algorithms	0	0	2	1	-
10.	PEC	19CS10L	Machine learning with Tensorflow	0	0	2	1	-
11.	PEC	19CS11L	Data Exploration using Python	0	0	2	1	-
12.	PEC	19CS12L	Mathematics for Machine Learning	1	0	0	1	C
<b>NETWORKING</b>								
13.	PEC	19CS13L	Cyber security tools and techniques	0	0	2	1	-
14.	PEC	19CS14L	Vehicular Cloud Networking	1	0	0	1	C
15.	PEC	19CS15L	Speckled computing	1	0	0	1	C
16.	PEC	19CS16L	Introduction to Networks	1	0	0	1	C
17.	PEC	19CS17L	Routing and Switching Essential	1	0	0	1	C
18.	PEC	19CS18L	Scaling Networks	1	0	0	1	C
19.	PEC	19CS19L	Connecting Networks	1	0	0	1	C
<b>APPLICATION DEVELOPMENT</b>								
20.	PEC	19CS20L	Server-side Development using Node.js	0	0	2	1	-
21.	PEC	19CS21L	Web Application Development using	0	0	2	1	-

			AngularJS					
22.	PEC	19CS22L	NoSQL on MongoDB	0	0	2	1	-
23.	PEC	19CS23L	Application development using Flutter	0	0	2	1	-
24.	PEC	19CS24L	Application development using Firebase	0	0	2	1	-
25.	PEC	19CS25L	Linux Administration	0	0	2	1	-
26.	PEC	19CS26L	Software testing using Selenium	0	0	2	1	-
27.	PEC	19CS27L	Predictive analytics using Machine Learning	0	0	2	1	-
28.	PEC	19CS28L	Python for Machine Learning	0	0	2	1	-
29.	PEC	19CS29L	Full stack development	0	0	2	1	-
30.	PEC	19CS30L	Microprocessor and Microcontroller	1	0	0	1	C
31.	PEC	19CS36L	Front End Development Laboratory	0	0	2	1	-
<b>BLOCKCHAIN TECHNOLOGY</b>								
31.	PEC	19CS31L	Golang Programming	0	0	2	1	-
32.	PEC	19CS32L	Kotlin Programming	0	0	2	1	-
33.	PEC	19CS33L	Ethical Hacking	0	0	2	1	-
<b>AUGMENTED REALITY AND VIRTUAL REALITY</b>								
34.	PEC	19CS34L	Augmented Reality for Developers	0	0	2	1	-
35.	PEC	19CS35L	3D modeling and Design	0	0	2	1	-

### OPEN ELECTIVE COURSES (OEC)

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question Pattern <sup>⊕</sup>
1.	OEC	19CS01N	Computer graphics and virtual reality	2	0	2	3	A
2.	OEC	19CS02N	Mobile application development	2	0	2	3	A
3.	OEC	19CS03N	Object oriented programming	2	0	2	3	A
4.	OEC	19CS04N	Programming in python	2	0	2	3	A
5.	OEC	19CS05N	Fundamentals of Java programming	2	0	2	3	A
6.	OEC	19CS06N	Programming for robotics	2	0	2	3	A
7.	OEC	19CS07N	Fundamentals of Artificial intelligence	2	0	2	3	A
8.	OEC	19CS08N	Simulation and Modeling	2	0	2	3	A
9.	OEC	19CS09N	Computer Architecture	3	0	0	3	A
10.	OEC	19CS10N	Deep Learning	3	0	0	3	A
11.	OEC	19CS11N	Fundamentals of Machine Learning	3	0	0	3	A
12.	OEC	19CS12N	Blockchain Technology	3	0	0	3	A
13.	OEC	19CS13N	Database Management Systems	3	0	0	3	A
14.	OEC	19CS14N	Structured Query Language	3	0	0	3	A
15.	OEC	19CS15N	Foundations of Machine Learning	2	0	2	3	A
16.	OEC	19CS16N	Essentials of Machine Learning	2	0	2	3	A

## List of courses under verticals

S. No	Course Category	Course Code	COURSE TITLE	L	T	P	C	Question Pattern
<b>ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING</b>								
1.	PEC	19CS10L	Machine learning with Tensorflow	0	0	2	1	-
2.	PEC	19CS11L	Data Exploration using Python	0	0	2	1	-
3.	PEC	19CS12L	Mathematics for Machine Learning	1	0	0	1	C
4.	PEC	19CS14E	Computational Methods of Optimization	3	0	0	3	A
5.	PEC	19CS15E	Artificial Intelligence	3	0	0	3	A
6.	PEC	19CS16E	Machine Learning in healthcare	3	0	0	3	A
7.	PEC	19CS17E	Machine Learning	3	0	0	3	A
8.	PEC	19CS18E	Nature and Bio-inspired Computing	3	0	0	3	A
9.	PEC	19CS19E	Natural Language Processing	3	0	0	3	A
10.	PEC	19CS20E	Computer Vision and Image Processing	3	0	0	3	A
11.	PEC	19CS50E	Statistical Analysis	2	0	0	2	A
12.	PEC	19CS51E	Statistical foundations for Machine Learning	2	0	0	2	B
<b>AUGMENTED REALITY AND VIRTUAL REALITY</b>								
12.	PEC	19CS32E	UI/UX Design	3	0	0	3	A
13.	PEC	19CS34E	Augmented Reality and Virtual Reality	3	0	0	3	A
14.	PEC	19CS45E	Design of Virtual Reality Systems	2	0	2	3	B
15.	PEC	19CS46E	Visual Effects	2	0	2	3	B
16.	PEC	19CS47E	Game Development	2	0	2	3	B
17.	PEC	19CS48C	Video Creation and Editing	3	0	0	3	A
18.	PEC	19CS49C	Metaverse Development	3	0	0	3	A
19.	PEC	19CS35L	3D modeling and Design	0	0	2	1	-
<b>COMPUTATIONAL PROGRAMMING</b>								
20.	OEC	19CS02N	Mobile application development	2	0	2	3	A
21.	OEC	19CS03N	Object oriented programming	2	0	2	3	A
22.	OEC	19CS04N	Programming in python	2	0	2	3	A
23.	OEC	19CS05N	Fundamentals of Java programming	2	0	2	3	A
24.	OEC	19CS06N	Programming for robotics	2	0	2	3	A
25.	OEC	19CS07N	Fundamentals of Artificial intelligence	2	0	2	3	A
26.	OEC	19CS15N	Foundations of Machine Learning	2	0	2	3	A
27.	OEC	19CS16N	Essentials of Machine Learning	2	0	2	3	A

19SH11C

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

**L T P C**  
**2 0 0 2**

**COURSE OUTCOMES**

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

- CO1: apply the basic language skills to understand various aspects of communication skills (K3)
- CO2: express their thoughts with correct usage of language in formal writings (K3)
- CO3: understand various language components and develop the pronunciation skill. (K2)
- CO4: make effective technical writings and interpret any pictorial representation. (K3)
- CO5: frame sentences and write effective reports. (K3)

**UNIT I****6**

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

**UNIT II****6**

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

**UNIT III****6**

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

**UNIT IV****6**

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

**UNIT V****6**

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

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

**L: 30; TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Anderson, Paul V. "Technical Communication: A Reader - Centered Approach", 9<sup>th</sup> Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. "A Comprehensive Grammar of the English Language", Longman Inc., Newyork, 2014.



## REFERENCES

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

19SH12C

**MATHEMATICAL FOUNDATIONS FOR ENGINEERS**  
(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C**  
**3 1 0 4**

## COURSE OUTCOMES

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

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

### UNIT I

#### MATRICES

12

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

### UNIT II

#### DIFFERENTIAL CALCULUS

12

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

### UNIT III

#### FUNCTIONS OF SEVERAL VARIABLES

12

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

### UNIT IV

#### ORDINARY DIFFERENTIAL EQUATIONS

12

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

### UNIT V

#### PARTIAL DIFFERENTIAL EQUATIONS

12

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

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

## TEXT BOOKS

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

**REFERENCES**

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

**19SH13C**

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

**L T P C**  
**2 0 0 2**

**COURSE OUTCOMES**

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

CO1: summarize the properties and structures of crystal solids. (K2)

CO2: understand the principle and propagation of different types of waves (K2)

CO3: choose the appropriate Laser technique for industrial and medical applications (K2)

CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)

CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

**UNIT I CRYSTALLOGRAPHY****6**

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

**UNIT II WAVES****6**

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

**UNIT III LASER****6**

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO<sub>2</sub>), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

**UNIT IV FIBRE OPTICS****6**

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

**UNIT V QUANTUM PHYSICS****6**

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

**L: 30; TOTAL: 30 PERIODS**

**TEXT BOOKS**

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

## REFERENCES

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

19SH14C

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

**L T P C**  
**2 0 0 2**

## COURSE OUTCOMES

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

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

### UNIT I WATER TREATMENT

6

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

### UNIT II SURFACE CHEMISTRY AND CATALYSIS

6

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

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

### UNIT III ELECTROCHEMISTRY AND CORROSION

6

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

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

### UNIT IV ELECTRONIC MATERIALS

6

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerenes-C-60; organic light emitting polymer: polyvinylidene

fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, biosensor - chemical sensors

### **UNIT V ANALYTICAL TECHNIQUES 6**

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

**L: 30; TOTAL: 30 PERIODS**

#### **TEXT BOOKS**

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

#### **REFERENCES**

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

<b>19CS11C</b>	<b>PYTHON PROGRAMMING</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

#### **COURSE OUTCOMES**

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

- CO1: develop simple Python programs. (K3)
- CO2: structure simple Python programs for solving problems and decompose a Python program into functions. (K3)
- CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)
- CO4: understand file management concepts and develop packages in Python Programs. (K3)
- CO5: design and Develop GUI Programming. (K5)

### **UNIT I DATA, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode - values and data types: Variables - expressions - statements – Operators - precedence of operators – Input and Output - comments – Errors: Syntax Errors - Runtime errors - Logical Errors.

### **UNIT II CONTROL FLOW, FUNCTIONS 9**

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) – chained conditional (if-elif-else) - Iteration: state – while – for – break – continue - pass - Fruitful functions: Function argument and its types - return values – parameters - local and

global scope - function composition – recursion - Documenting Function – Classes and Inheritance - Object Oriented Programming - Class Instances – Class Methods.

**UNIT III                    LISTS, TUPLES, DICTIONARIES                    9**

Strings: string slices – immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists – list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods - advanced list processing - list comprehension

**UNIT IV                    FILES, MODULES, PACKAGES                    9**

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Name space

**UNIT V                    GRAPHICAL USER INTERFACE PROGRAMMING                    9**

Event driven programming - TkInter introduction - Introducing callbacks - User input - Mini-case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. “Think Python: How to Think Like a Computer Scientist”, by Allen B. Downey, O'Reilly Media, Inc. , 2016
2. “A Practical Introduction to Python Programming”, Brian Heinold, Mount St. Mary’s University, 2012.
3. “Learning to Program with Python”, Richard L. Halterman, 2019, E-book
4. Dive into Python, Mark Pilgrim, Apress, 2012.

**REFERENCES**

1. “Exploring Python”, Timothy A.Budd, Mc-Graw Hill Education (India) Private Limited, 2015.
2. “Introduction to Computer Science using python: A Computational Problem-solving Focus, Charles Dierbach, Wiley India Edition, 2015.
3. “Practical Programming: An Introduction to Computer Science using Python 3.6”, Paul Gries, Jennifer Campbell and Jason Montojo, second edition, Pragmatic Programmers, LLC, 2018.
4. “Introduction to Programming in Python: An Inter-disciplinary Approach”, Robert Sedgewick, Kevin Wayne, Robert Dondero, Pearson India Education Services Pvt. Ltd, 2016.

**19CS12C                    BASIC ELECTRICAL AND ELECTRONICS ENGINEERING                    L T P C**  
**3 0 0 3**

**COURSE OUTCOMES**

- Upon completion of this course, the students will be able to
- CO1: explain the concepts of basic electrical circuits (K2)
  - CO2: describe the working principles of electrical machines and instruments (K2)

CO3: outline the functions of the component of low voltage electrical installations (K2)

CO4: explain the characteristics and applications of semiconductor devices (K2)

CO5: recall the different logic principles used in digital circuits (K2)

**UNIT I CONCEPTS OF DC AND AC ELECTRICAL CIRCUITS 9**

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

**UNIT II ELECTRICAL MACHINES 9**

DC Machines: Types – Construction – Working Principles – Need for Starters - Speed control of DC motors.

AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Starting and Speed Control of Induction Motors.

AC Synchronous Generators: Construction – Working Principle.

Transformers: Single Phase and Three Phase Transformers – Auto Transformers- Construction – Working Principle.

**UNIT III INSTRUMENTS AND ELECTRICAL INSTALLATION 9**

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.

Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

**UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS 9**

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

**UNIT V DIGITAL ELECTRONICS 9**

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

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

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

## REFERENCES

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

**19SH16C**

**ENGINEERING PHYSICS AND ENGINEERING  
CHEMISTRY LABORATORY**

**L T P C  
0 0 3 1.5**

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

## PART A – ENGINEERING PHYSICS LABORATORY

### COURSE OUTCOMES

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

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

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

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

### LIST OF EXPERIMENTS

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

- A minimum of FIVE experiments shall be offered.

### REFERENCES

1. David Loyd, " Physics laboratory" 4<sup>th</sup> Edition, Cengage learning, 2013
2. Sessa Sai Kumar Vemula, "Engineering Physics lab manual" 1<sup>st</sup> Edition, LAP LAMBERT Academic Publishing, 2017

**PART B - ENGINEERING CHEMISTRY LABORATORY****COURSE OUTCOMES**

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

- CO 1: determine various water quality parameters. (K2)
- CO 2: quantify different ions by different analytical techniques. (K2)
- CO3: determine the rate of corrosion of mild steel plate. (K2)
- CO4: verify the freundlich adsorption isotherm. (K2)

**LIST OF EXPERIMENTS**

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron ( $\text{Fe}^{2+}$ ) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.
6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron ( $\text{Fe}^{2+}$ ) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

**P: 45; TOTAL: 45 PERIODS**

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

**REFERENCES**

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

**19CS13C**

**PYTHON PROGRAMMING LABORATORY**

**L T P C**

**0 0 4 2**

**COURSE OUTCOMES**

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

- CO1: solve Simple problems using conditional and control statement in Python.(K3)
- CO2: develop user defined function for solving problems in modular approach. (K3)
- CO3: enhance the program skills with lists and dictionaries. (K3)
- CO4: design and develop packages and GUI application. (K5)

**LIST OF EXPERIMENTS****1. Simple Programs**

- a. To calculate the average of numbers
- b. To read two numbers and print their quotient and remainder



## 2. Programs using control flow

- a. To compute prime factors of an integer
- b. To form an integer that has the number of digits at ten's place and the least significant digit of the entered integer at one's place
- c. To get the marks of students for 5 subjects and display their grade as per the 2019 regulation.
- d. To print all numbers in a range divisible by a given number
- e. To accept three digits and print all possible combinations from the digits

## 3. Programs using functions

- a. To determine all Pythagorean triplets in the range
- b. Given a square matrix with n rows and n columns, you have to write a program to rotate this matrix such that each element is shifted by one place in a clockwise manner.
- c. To check whether a string is a palindrome or not using recursion

## 4. Programs using strings

- a. To detect if two strings are anagrams
- b. To accept a hyphen separated sequence of words as input and print the words in a hyphen-separated sequence after sorting them alphabetically

## 5. Programs using lists

- a. To find the second largest number in a list
- b. To merge two lists and sort it

## 6. Programs using dictionaries

- a. There is a robot which wants to go the charging point to charge itself. The robot moves in a 2-d plane from the original point (0,0). The robot can move toward up, down, left and right with given steps.

The trace of robot movement is shown as the following:

- i. Up 5
- ii. Down 3
- iii. Left 3
- iv. Right 2

Write a program to compute the distance between the current position after a sequence of movement and original point. If the distance is a float, then just print the nearest integer (use round() function for that and then convert it into an integer).

- b. Consider a cricket series containing five matches between india and australia read the scores of individual players of both teams and finally identity the man of the series.

## 7. Programs using files

- a. To count the number of words and number of lines in a text file

- b. That reads a text file and counts the number of times a certain letter appears in the text file

**8. Programs using modules and packages.**

**9. Case study:** GUI programming

**P: 60; TOTAL: 60 PERIODS**

**SOFTWARE REQUIREMENTS**

1. Python 3.x
2. Anaconda Navigator

**19CS21C**

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

**L T P C**  
**2 0 0 2**

**COURSE OUTCOMES**

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

CO 1: integrate and apply the acquired skills in real life situation. (K3)

CO 2: write effectively in any professional contexts. (K3)

CO 3: enhance the vital sub-functions of communication in any formal situation. (K3)

CO 4: participate actively in any informal and formal discussion. (K3)

CO 5: recall the acquired skills and apply them in their work place. (K2)

**UNIT I**

**6**

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

**UNIT II**

**6**

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

**UNIT III**

**6**

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

**UNIT IV**

**6**

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

**UNIT V**

**6**

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

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

**L: 30 TOTAL: 30 PERIODS**

**TEXT BOOKS**

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

**REFERENCES**

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

**19CS22C**

**PROBABILITY AND QUEUEING THEORY**

**L T P C**

**3 1 0 4**

**COURSE OUTCOMES**

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

CO1: grasp the basic concepts of probability and random variables.(K2)

CO2: find the correlation and regression of two dimensional random variables.(K2)

CO3: characterize the phenomena which evolve with respect to time in a probabilistic manner. (K3)

CO4: interpret the basic characteristic features of Markovian queues. .(K3)

CO5: utilize the concepts of Non Markovian queues and Networks.(K3)

**UNIT I**

**RANDOM VARIABLES**

**12**

Random Variable – Discrete and continuous random variables - Moments - Moment generating functions and their properties; Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions .

**UNIT II**

**TWO DIMENSIONAL RANDOM VARIABLES**

**12**

Joint distributions – Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

**UNIT III**

**CLASSIFICATION OF RANDOM PROCESSES**

**12**

Random process - Classification - Stationary process – WSS and SSS - Markov process - Markov chains – Transition probabilities - Limiting distributions - Poisson process

**UNIT IV**

**QUEUEING THEORY**

**12**

Markovian models – Birth and Death Queueing models- Steady state results: Single and multiple server queueing models- Queues with finite waiting rooms- Finite source models- Little's Formula

**UNIT V**

**NON-MARKOVIAN QUEUES AND QUEUE NETWORKS**

**12**

M/G/1 queue- Pollaczek- Khintchine formula, series queues - Open and closed networks.

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

**TEXT BOOKS**

1. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, 1<sup>st</sup> Indian Reprint, 2007.
2. D. Gross and C.M. Harris, "Fundamentals of Queueing Theory", Wiley and Sons Publication Limited, 4<sup>th</sup> Edition, 2008.

**REFERENCES**

1. A.O. Allen, "Probability, Statistics and Queueing Theory with Computer Applications", Elsevier, 2<sup>nd</sup> Edition, 2005.
2. H.A. Taha, "Operations Research", Pearson Education, Asia, 10<sup>th</sup> Edition, 2017.
3. K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2<sup>nd</sup> Edition, 2016.

**19CS23C****SEMICONDUCTOR PHYSICS****L T P C  
2 0 0 2****COURSE OUTCOMES**

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

CO1: infer the principles of quantum physics to understand the properties of electronic materials. (K2)

CO2: explain the basics of semiconductors. (K2)

CO3: gain the knowledge of the quantum-mechanical interaction between light and semiconductor. (K2)

CO4: understand the working of various instruments used for the measurement of various electrical engineering parameters. (K2)

CO5: express the characteristics and working principles of semiconductor devices (K2)

**UNIT I ELECTRONIC MATERIALS 6**

Free electron theory- Density of states and energy band diagrams- Kronig-Penny Model- Energy bands in solids-Direct and indirect bandgaps- Types of electronic materials: metals, semiconductors and insulators- Density of states-Occupation, probability, Fermi level.

**UNIT II SEMICONDUCTORS 6**

Intrinsic and extrinsic semiconductors- Dependence of Fermi level on carrier-concentration and temperature-Carrier generation and recombination-Carrier transport.

**UNIT III LIGHT-SEMICONDUCTOR INTERACTION 6**

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission- Joint density of states- Density of states for photons- Transition rates -Fermi's golden rule- Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

**UNIT IV MEASUREMENTS 6**

Four-point probe and Van der Pauw measurements for carrier density- resistivity and hall mobility- Hot-point probe measurement- capacitance-voltage measurements- parameter extraction from diode –V-I characteristics.

**UNIT V ENGINEERED SEMICONDUCTOR MATERIALS AND DEVICES 6**

PN junction diode- Transistors- Types of semiconductor Photodetectors – PIN and Avalanche, their structure, materials, working principle and characteristics- LED, LCD, OLED- device structure, materials, characteristics.

**L: 30; TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Charles Kittel, "Introduction to Solid State Physics", John Wiley and Sons, 8<sup>th</sup> Edition, Singapore, 2013.
2. Jasprit Singh, "Electronic and optoelectronic properties of semiconductor structures", McGraw-Hill Inc., 1<sup>st</sup> Edition, 2003

**REFERENCES**

1. B.E.A. Saleh and M.C.Teich, "Fundamentals of Photonics", John Wiley & Sons, Inc., 2<sup>nd</sup> Edition, 2013.
2. S.M.Sze, "Semiconductor Devices: Physics and Technology", Wiley, 2<sup>nd</sup> Edition, 2008.
3. Online course: "Semiconductor Optoelectronics", M R Shenoy on NPTEL.
4. Online course: "Optoelectronic Materials and Devices", Monica Katiyar and Deepak Gupta on NPTEL.

**19CS24C**

**BIOLOGY FOR ENGINEERS**

**L T P C**

**2 0 0 2**

**COURSE OUTCOMES**

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

- CO1: describe and comprehend the fundamental concepts of cell biology. (K2)
- CO2: understand the various bimolecular interactions in living organisms. (K2)
- CO3: familiar with biological database. (K2)
- CO4: understand the thermodynamic concepts in living organisms. (K2)
- CO5: apply the molecular modeling methods in the drug design. (K2)

**UNIT I CELL BIOLOGY 6**

Cell as a basic unit of life-Cell organization of prokaryotic and eukaryotic cells-Structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus - Cell cycle - cell division: mitosis and meiosis.

**UNIT II BIO MOLECULAR INTERACTIONS 6**

DNA and RNA-hydrophobicity and hydrophilicity-Molecular interactions: covalent and non covalent interactions – Spectroscopic methods to measure the interactions.

**UNIT III BIOLOGICAL DATABASES 6**

Primary and secondary sequence databases – Composite protein sequence databases - General concepts of sequence analysis - Identification of functional sequences PDB (Protein Data Bank) and NDB (Nucleic Acid Data Bank).

**UNIT IV                    BIOCHEMICAL THERMODYNAMICS                    6**

First and Second laws of thermodynamics, Details of thermodynamic variables and functions. Application of thermodynamic laws in Life Science with examples.

Bioenergetics: Energy rich bonds - Coupled reactions-Group transfer - Autotrophic and Heterotrophic principle of energy transductions - Gibbs free-energy calculation for Bio-redox reactions – Thermodynamics of ligand binding – Association and dissociation constant.

**UNIT V                    DRUG DESIGN AND MOLECULAR MODELING                    6**

Principles of drug development – partition coefficient (Log p): octanol - Water system - Lipinski's rule of five - structure based drug designing approaches - target identification and validation - semi-empirical calculations - single point calculations - full-geometry optimization methods - Molecular docking programs: AutoDock.

**L: 30; TOTAL: 30 PERIODS****TEXT BOOKS**

1. Y. Nelson, L. David, Lehninger Principles of Biochemistry, International Edition, W.H.Freeman, Macmillan Learning, New York, 7<sup>th</sup> Edition, 2017.
2. Nagata, Kazuhiro, Real-Time Analysis of Biological Interactions, Springer, Japan, 3<sup>rd</sup> Edition, 2015.
3. I. Bertini, H. B Gray, Bioinorganic Chemistry, Viva Books Private Limited, New Delhi, 4<sup>th</sup> Edition, 2014.

**REFERENCES**

1. B.A. Bunin, B. Siesel, G. Morales, J. Bajorath, Chemoinformatics: Theory, Practice, & Products, Springer, 2<sup>nd</sup> Edition, 2014.
2. A. Nag and B. Dey , Computer aided drug design and delivery system, McGraw-Hill, ISBN: 978-0-07-170125-9, 2011.
3. B. Wang, E.V. Anslyn, Chemosensor: Principles, Strategies, and Applications, a John Wiley & Sons, inc., Publication, 2011.

**19CS25C                    PROBLEM SOLVING TECHNIQUES                    L T P C**  
**3 0 0 3**

**COURSE OUTCOMES**

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

- CO 1: develop algorithmic solutions to simple computational problems. (K3)
- CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
- CO 3: solve problems using array and functions. (K3)
- CO 4: implement various sorting techniques. (K3)
- CO 5: implement various searching techniques. (K3)

**UNIT I                    BASICS OF PROBLEM SOLVING                    9**

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with

Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

**UNIT II BASIC TECHNIQUES 9**

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

**UNIT III ARRAYS AND FUNCTIONS 9**

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

**UNIT IV SORTING TECHNIQUES 9**

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

**UNIT V SEARCHING TECHNIQUES 9**

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

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Maureen Sprankle and Jim Hubbard, "Problem Solving and Programming Concepts", Prentice Hall, 9<sup>th</sup> Edition, 2012.
2. Harsha Priya, R. Ranjeet, — "Programming and Problem Solving Through C Language", Firewall/Laxmi Publications (P) Ltd., New Delhi, 2015.

**REFERENCES**

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, Oxford University Press, 2<sup>nd</sup> Edition, 2013.
2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner's Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

**19SH15C ENGINEERING GRAPHICS L T P C**  
**(Common to all B.E. / B.Tech. Degree Programmes) 2 0 4 4**

**COURSE OUTCOMES**

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

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

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

**INTRODUCTION** **5**

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

**UNIT I ENGINEERING CURVES** **17**

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

**UNIT II ORTHOGRAPHIC PROJECTIONS** **17**

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

**UNIT III PROJECTIONS OF SOLIDS** **17**

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

**UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES** **17**

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

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

**UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING** **17**

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

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

**TEXT BOOKS**

1. Bhatt N.D, “Engineering Drawing”, 53<sup>rd</sup> Edition, Charotar Publishing House, 2014.
2. Shah M.B and Rana B.C, “Engineering Drawing”, Pearson Education, 2<sup>nd</sup> Edition, 2009.

**REFERENCES**

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2<sup>nd</sup> Edition, 2013
2. Narayana K.L. & Kanniah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, “Engineering Drawing”, Subhas Publications, 32<sup>nd</sup> Edition, 2017.



19GN02C

HERITAGE OF TAMILS (தமிழர் மரபு)

LT P C  
1 0 0 1

**UNIT I LANGUAGE AND LITERATURE 3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART-SCULPTURE 3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV THINAI CONCEPT OF TAMILS 3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**L: 15; TOTAL: 15 PERIODS**

**REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**19GN02C****HERITAGE OF TAMILS (தமிழர் மரபு)****LT P C****1 0 0 1****அலகு I மொழி மற்றும் இலக்கியம்****3**

இந்திய மொழிக்கும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II மரபு பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை****3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்****3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்****3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு****3**

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த

மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

**L: 15; TOTAL: 15 PERIODS**

### REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies.)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**19CS26C**

**SEMICONDUCTOR PHYSICS AND  
BIOLOGY LABORATORY**

**L T P C  
0 0 3 1.5**

### **PART A SEMICONDUCTOR PHYSICS LABORATORY**

#### **COURSE OUTCOMES**

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

- CO 1: demonstrate the properties of optical materials. (K2)
- CO 2: illustrate the characteristics of semiconducting materials (K2)
- CO 3: analyze the characteristics of semiconductor devices (K2)

#### **LIST OF EXPERIMENTS**

1. (a) Determination of wave length of Laser source.  
(b) Particle size determination using Laser source.
2. Determination of Band Gap of a semiconducting material.
3. Determination of Hall coefficient

4. V - I Characteristics of PN junction diode.
5. V - I Characteristics of Zener diode.
6. V - I Characteristics of LED/Photo diode
7. Characteristics of NPN Transistor – CE configuration

- A minimum of FIVE experiments shall be offered.

## REFERENCES

1. P.R.Sasikumar, "Practical Physics" PHI Learning Pvt Ltd,2011
2. David Loyal, " Physics laboratory" 4<sup>th</sup> Edition, Cengage learning, 2013
3. Sesa Sai Kumar Vemula, "Engineering Physics lab manual" 1<sup>st</sup> Edition, LAP LAMBERT Academic Publishing, 2017

## PART B BIOLOGY LABORATORY

### COURSE OUTCOMES

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

CO 1: identify the various biomolecules by suitable chemical analysis. (K3)

CO 2: quantify the amount of acid by pH metric method. (K3)

CO3: estimate the retention factor and log P value of paracetamol and aspirin. (K2)

CO4: draw the structure of different types of drugs using Gaussian and Chem Draw software. (K3)

CO5: identify the molecular interactions of drug with biomolecules.(K3)

### LIST OF EXPERIMENTS

1. Qualitative analysis of biomolecules.
2. Estimation of acid by pH metric method.
3. Calculation of retention factor of amino acids.
4. Determination of (log P) value for paracetamol and aspirin.
5. Low energy conformation of medicinally important compounds using Gaussian soft ware.
6. Draw the chemical structure of important drugs using Chem Draw software.
7. Identification of interactions between drug and biomolecules using Auto Dock software.

**P: 45; TOTAL: 45 PERIODS**

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

## REFERENCES

1. P.Worsfold, A.Townshend, C.Poole, M.Miro, Encyclopedia of Analytical science Elsevier, 3<sup>rd</sup> Edition, 2018.
2. A.I. Vogel, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education Limited, England, 8<sup>th</sup> Edition, 2015.

**19CS27C PROBLEM SOLVING TECHNIQUES LABORATORY**

**L T P C  
0 0 4 2**

## **COURSE OUTCOMES**

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

CO 1: solve simple and Complex problems. (K3)

CO 2: solve sorting and searching problems. (K3)

## **LIST OF EXERCISES**

### **Programs using simple logics and switch cases**

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

### **Programs using Control Structures**

5. Perform the following operations:
  - a. Generate Pascal's triangle.
  - b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.
7. Compute Sine series and Cosine series.
8. Find the 2's complement of a binary number.

### **Programs using Arrays**

9. Perform the following operations:
  - a. Matrix addition.
  - b. Transpose of a matrix.
  - c. Matrix multiplication by checking compatibility

### **Programs to manipulate Strings**

10. Perform the following operations on a string:
  - a. Insert a sub-string into main string at a given position.
  - b. Delete n characters from a given position in a string.
  - c. Check whether the given string is palindrome or not.
  - d. Replace a character of string either from beginning or ending or at a specified location.

### **Programs using Functions**

11. Perform the following operations: (Use recursive functions)
  - a. Find the factorial of a given integer.
  - b. Find the GCD (Greatest Common Divisor) of two given integers.
  - c. Solve the Towers of Hanoi problem.

### **Programs using sorting and searching techniques**

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

**P: 60; TOTAL: 60 PERIODS**

**Software Requirement:** Turbo C / Python

<b>19GN01C</b>	<b>INNOVATION THROUGH DESIGN THINKING</b>	<b>L T P C</b>
		<b>1 0 2 2</b>

**COURSE OUTCOMES**

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

CO1: To discuss the design thinking process and innovation. (K2)

CO2: Practice design thinking process through a multidisciplinary task. (K3)

<b>UNIT I</b>	<b>BASICS OF DESIGN THINKING PROCESS</b>	<b>15</b>
---------------	--	-----------

Design thinking process basics-Ideation tools-case studies.

<b>UNIT II</b>	<b>PRACTICING DESIGN THINKING PROCESS</b>	<b>30</b>
----------------	---	-----------

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

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

**REFERENCES**

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, "Design Thinking: The Handbook", WS Professional, 2020
2. Pavan Soni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving", Penguin Random House, 2020
3. D.M. Arvind Mallik, "Design Thinking for Educators", Notion Press, 2019
4. Michael Lewrick, "The Design Thinking Playbook", Wiley, 2019
5. Kathryn Christopher, "Design Thinking in Engineering", Kendall Hunt Publishing Company, 2019
6. Robert Curedale, "Design Thinking Process & Methods" 5<sup>th</sup> Edition, Design Community College Inc, 2019
7. David Lee, "Design Thinking in the Classroom", Ulysses Press, 2018
8. Jimmy Jain, "Design Thinking for Startups", Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, "The Little Booklet on Design Thinking: An Introduction", 2<sup>nd</sup> Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, "Design Thinking: New Product Development Essentials", Wiley-Blackwell, 2016
11. Thomas Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2009

**MENTOR ACTIVITIES:**

Educating the design thinking process: basics, Ideation tools and 10 Hours empathy map through case studies - presentation

Forming multidisciplinary batches among the students- Guide the 20 Hours batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions

Evaluating the students' activities through their presentations

End semester Assessments can be made through:

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

### Other points:

This course is for all department students

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

**19CS31C**

**DISCRETE MATHEMATICS**

**L T P C QP**

**3 1 0 4 A**

### COURSE OUTCOMES

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

CO1: check the validity of the arguments.(K2)

CO2: understand the concepts of Sets, Relations and Functions.(K2)

CO3: perform the principles of counting and solve recurrence relations. (K3)

CO4: interpret the basic concepts of graphs.(K2)

CO5: find all Spanning Trees of a graph and understand the concepts of colouring of graphs (K3)

#### **UNIT I MATHEMATICAL LOGIC**

**12**

Propositional Logic – Equivalences and Implications – Normal forms –Predicate Calculus and Quantifiers - Rules of inference – Proof methods and Strategies - Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

#### **UNIT II SETS, RELATIONS AND FUNCTIONS**

**12**

Basic Definitions - Set operations – Laws of set theory – Relations – Properties of relations - Partial Ordering Relation - Equivalence Relation - Matrices of relations - Closure of relations – Functions - Bijective functions - Inverse and Compositions of functions.

#### **UNIT III COMBINATORICS**

**12**

Mathematical induction - Strong induction and well ordering -The basics of counting –The pigeonhole principle - Permutations and combinations – Recurrence relations - Solving linear recurrence relations – Generating functions - Inclusion and exclusion principle.

#### **UNIT IV GRAPH THEORY**

**12**

Graphs and their properties - Special types of graphs – Matrix representation of graphs and graph isomorphism- connectivity, Cut vertex and cut edge - Euler and Hamiltonian graphs.

#### **UNIT V GRAPH COLOURING AND TREES**

**12**

Graph Colouring - Colouring Vertices, Colouring Edges - Perfect Graph, properties - Trees – Some properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree – Rooted and Binary Trees - Spanning Trees.

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

### TEXT BOOKS

1. Kenneth H.Rosen, “Discrete Mathematics and its Applications (with Combinatory and Graph Theory)”, Special Indian Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 7<sup>th</sup> Edition, 2017.

2. Tremblay J.P and Manohar.R. "Discrete Mathematical Structures with Applications to Computer Science", 1<sup>st</sup> Edition, Tata McGraw-Hill Pub. Company Limited, New Delhi, 2017.
3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", 1<sup>st</sup> Edition, Dover Publications Inc., 2016.

## REFERENCES

1. Ralph .P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2003.
2. J.A.Bondy U.S.R.Murty, "Graph Theory", Springer, 2008.

**19CS32C**

**DATA STRUCTURES**

**L T P C QP  
3 0 0 3 A**

## COURSE OUTCOMES

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

- CO1: impart the basic concepts of data structures and implementation of stacks and different types of queues using arrays. (K3)
- CO2: implement different types of list, stack and queue using pointers. (K3)
- CO3: Construct different types of trees. (K3)
- CO4: recognize the various indexing techniques and distinguish various hashing and collision resolution techniques. (K2)
- CO5: realize the basic concepts and applications of graphs to solve different real time problems. (K4)

### **UNIT I                    LINEAR DATA STRUCTURES                    9**

Data Structures: Definition – Types – Applications of Data Structures – Basic Terminologies: Elementary data organizations – Data structures operations - Abstract Data Types. Stacks and Queues: Stack and its operations - Applications of Stacks - Expression Conversion and evaluation. Queue and its types: Simple Queue -Circular Queue - Priority Queue - Operations on each types of Queues – Complexity Analysis.

### **UNIT II                    LINKED LISTS                    9**

Singly linked lists: Representation in memory - Algorithms of various operations: Traversing - Searching - Insertion into linked list - Deletion from linked list; Linked list representation of Stack and Queue - Header nodes. Doubly linked list: Representation and its operations. Circular Linked Lists: Representation. Applications of linked list – Complexity Analysis

### **UNIT III                    TREES                    9**

Basic Tree Terminologies - Different types of Trees: Binary Tree - Binary Search Tree - Threaded Binary Tree- Expression tree –Tree traversal - Operations on each of the trees and their Algorithms. AVL Tree: Single and double rotations. Applications of Trees – Complexity Analysis – Tries-Ternary search tree.

### **UNIT IV                    INDEXING AND HASHING                    9**

Indexing: B Tree and B+ Tree: Definitions- algorithms. Splay tree – Rotations. Hashing: Hash Function – Separate chaining – Open Addressing – Rehashing – Extendible hashing



– Complexity Analysis. Dictionary: Dictionary ADT – Implementation – Applications. Case study on data structures in social media.

**UNIT V                  GRAPHS    9**

Graphs: Basic Terminologies and Representations, Graph traversal algorithms - Topological sort — Shortest Path Algorithms – Network Flow Problems - Minimum Spanning Tree – Prim's and Kruskal's Algorithms – Bi-connectivity.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", 2<sup>nd</sup> Edition, Pearson, 2002.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C, 2<sup>nd</sup> Edition, Universities Press, 2008.

**REFERENCES**

1. A.V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", 1<sup>st</sup> Edition, Pearson Education, Reprint 2003.
2. R. F. Gilberg, B. A. Forouzan, "Data Structures – A Pseudo code approach with C, 2<sup>nd</sup> Edition, Thomson India Edition, 2005.
3. M. A. Weiss, —Data Structures and Algorithm Analysis in C In C++, 3<sup>rd</sup> Edition, Pearson, 2014.
4. [http://web.engr.oregonstate.edu/~sinisa/courses/OSU/CS261/CS261\\_Textbook/Chapter12.pdf](http://web.engr.oregonstate.edu/~sinisa/courses/OSU/CS261/CS261_Textbook/Chapter12.pdf)
5. <http://cse01-iith.vlabs.ac.in/List%20of%20experiments.html?domain=Computer%20Science>

**19CS33C                  COMPUTER ORGANIZATION AND ARCHTECTURE    L T P C QP  
3 0 0 3 A**

**COURSE OUTCOMES**

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

- CO1: realize the role of functional units and various architectural features (K2)
- CO2: examine data representation and execution procedure of an ALU (K2)
- CO3: categorize the pipelining techniques and recognize the I/O mechanism for high speed devices. (K3)
- CO4: know the different I/O Interfaces and categorize the different memory systems. (K2)
- CO5: distinguish the operational functions of symmetric and distributed architectures. (K2)

**UNIT I                  BASIC STRUCTURE OF COMPUTERS    9**

Functional Units – Basic Operational Concepts – Bus Structures – Performance– Processor Clock- Performance Equation- Clock Rate- Instruction Set –CISC And RISC – Performance Measurement – Multiprocessors and Multicomputers- Memory Locations and Addresses- Memory Operations - Instructions and Instruction Sequencing – Addressing Modes - Basic Input / Output Operations.

**UNIT II ARITHMETIC AND PROCESSING UNIT 9**

Addition and Subtraction of Signed Numbers – Multiplication of Positive Numbers- Signed Operand Multiplication - Fast Multiplication – Restoring and Non Restoring Division Algorithm - Floating Point Numbers and Operations. Processing Unit- Fundamental Concepts – Execution of a Complete Instruction – Multiple Bus Organization – Hardwired Control – Micro Programmed Control.

**UNIT III PIPELINING AND I/O ORGANIZATION 9**

Basic Concepts – Data Hazards – Instruction Hazards – Influence on Instruction Sets – Data Path and Control Considerations – Superscalar Operations – Accessing I/O Devices – Interrupts – Direct Memory Access- Buses

**UNIT IV I/O INTERFACES AND MEMORY SYSTEM 9**

Interface Circuits - Standard I/O Interfaces – Memory System Basic Concepts – Semiconductor RAM – ROM – Speed, Size and Cost – Cache Memories – Performance Considerations – Virtual Memory – Memory Management Requirements – Secondary Storage.

**UNIT V MULTI-CORE PROCESSORS 9**

Single Core to Multi-Core Architectures – SIMD And MIMD Systems – Interconnection Networks – Symmetric and Distributed Shared Memory Architectures – Cache Coherence – Performance Issues – Parallel Program Design.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5<sup>th</sup> Edition, Tata McGraw Hill, 2011. (UNIT I to IV)
2. Peter S. Pacheco, —An Introduction to Parallel Programming, Morgan-Kauffman / Elsevier, 2011.(UNIT- V)

**REFERENCES**

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, 3<sup>rd</sup> Edition, Elsevier, 2005.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6<sup>th</sup> Edition, Pearson Education, 2003.
3. John P. Hayes, “Computer Architecture and Organization”, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2002.
4. V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, 2<sup>nd</sup> Edition, Pearson Education, 2004.
5. Kai Hwang, ZhiWeiXu, “Scalable Parallel Computing”, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2003.
6. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

**19CS34C****OBJECT ORIENTED PROGRAMMING****L T P C QP****3 0 0 3 A****COURSE OUTCOMES**

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

- CO1: recognize and use object oriented programming constructs to write object oriented programs. (K3)
- CO2: adopt appropriate constructor and overloading mechanisms to develop the application. (K3)
- CO3: understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code. (K3)
- CO4: demonstrate exception handling mechanisms to handle runtime errors and generic programming design. (K3)
- CO5: implement rich data handling through files and streaming. (K2)

**UNIT I BASIC CONCEPTS 9**

Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism. Introduction to C++ - Classes and objects: classes - structures and classes - unions and classes - friend functions – friend classes - inline functions - parameterized constructors - static class members - scope resolution operator - nested classes - local classes - passing objects to functions - returning objects – object assignment. Arrays, Pointers, References and Dynamic Allocation Operators: Arrays of Objects – Pointers to Objects – Type Checking – This Pointer – Pointers to Derived Types – Pointers to Class Members – References – Dynamic Allocation Operators.

**UNIT II FUNCTION OVERLOADING AND CONSTRUCTORS 9**

Function Overloading – Overloading Constructors – Copy Constructors – Finding the Address of Overloaded Functions – Overload Anachronism – Default Function Arguments – Function Overloading and Ambiguity. Operator overloading: Creating a member Operator Function – Operator Overloading Using Friend Function – Overloading New and Delete – Overloading Special Operators – Overloading Comma Operator.

**UNIT III INHERITANCE AND POLYMORPHISM 9**

Inheritance: Base-Class Access Control – Inheritance and Protected Members – Inheriting Multiple Base Classes – Constructors, Destructors and Inheritance – Granting Access – Virtual Base Classes. Polymorphism: Virtual Functions – Virtual Attribute and Inheritance – Virtual Functions and Hierarchy – Pure Virtual Functions – Using Virtual Functions – Early vs. Late Binding. Run-Time Type ID and Casting Operators: RTTI – Casting Operators – Dynamic Cast.

**UNIT IV TEMPLATES AND EXCEPTION HANDLING 9**

Templates: Generic Functions – Applying Generic Functions – Generic Classes – Type name and Export Keywords – Power of Templates. Exception Handling: Fundamentals – Handling Derived Class Exceptions – Exception Handling Options – Understanding terminate() and unexpected() – uncaught exception() Function – Exception and bad exception Classes – Applying Exception Handling.

**UNIT V I/O STREAMS 9**

File I/O-<fstream> and the File Classes-Opening and Closing a File-Reading and Writing Text Files-Unformatted and Binary I/O. Namespaces: Namespaces – std namespace.

Standard Template Library: Overview – Container Classes – General Theory of Operation  
–Vectors- Lists-Maps – String Class

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Herbert Schildt, "C++: The Complete Reference", 5<sup>th</sup> Edition, Tata Mc-Graw Hill Publishers, 2014.
2. Paul Deitel, Harvey Deitel, "C++ How to Program", 8<sup>th</sup> Edition, Prentice Hall Publisher, 2016.
3. Trivedi, Bhushan "Programming with ANSI C++", 2<sup>nd</sup> Edition, Oxford University Press NASW Press, 2013.

### REFERENCES

1. Ira Pohl, "Object Oriented Programming using C++", 2<sup>nd</sup> Edition, Pearson Education, Reprint, 2004.
2. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Primer", 4<sup>th</sup> Edition, Pearson Education, 2012.
3. Bjarne Stroustrup, "The C++ Programming language", 4<sup>th</sup> Edition, Pearson Education, 2013.

**19CS35C**

**DIGITAL PRINCIPLES AND SYSTEM DESIGN**

**L T P C QP**

**3 0 2 4 A**

### COURSE OUTCOMES

Upon completion of this course, the students are able to:

CO1: simplify Boolean functions and realize the importance of logic circuits. (K3)

CO2: design combinational logic circuits for various applications and implement using logic gates and simulate them using Hardware Description Language(HDL) (K3)

CO3: design sequential logic circuits like counters and sequence detectors and implement them using different flip flops. (K3)

CO4: design asynchronous sequential circuits. (K3)

CO5: understand the memory and programmable logic circuits. (K2)

#### UNIT I **BOOLEAN ALGEBRA AND LOGIC GATES (Practical)**

**15**

Review of Number Systems –Number representation: Signed, Unsigned, Fixed point, Floating point. Computer codes –BCD, Gray code, Excess 3 code, Error detection and correction codes, Parity, Hamming codes. Boolean algebra – Basic Postulates and theorems, Switching functions, Canonical forms, Logic gates. Simplifications of Boolean functions using Karnaugh map and tabulation methods. Introduction to Hardware Description Language (HDL).

#### UNIT II **COMBINATIONAL LOGIC (Practical)**

**17**

Analysis and design procedures of Combinational circuits -Arithmetic Circuits: Binary / BCD adders and subtractors, Carry look ahead adder, Magnitude comparator, Code conversion Decoders, Encoders, Multiplexers and Demultiplexers - HDL for combinational circuits.

**UNIT III SYNCHRONOUS SEQUENTIAL LOGIC (Practical) 17**

Sequential Devices: General model of sequential circuits –Latch, Design of Flip Flops, Master slave configuration. Mealy/Moore models -Sequence detector –Concept of state, State diagram, State table, State reduction procedures using Implication chart. Design of synchronous sequential circuits – Updown / Modulus counters, Serial adder, Binary counters - HDL for Sequential Circuits.

**UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC (Practical) 17**

Introduction to Asynchronous Sequential Circuits – Fundamental mode and Pulse mode circuits, Analysis and design of asynchronous sequential circuits -Reduction of state and flow tables – Race Free State assignment -Hazards.

**UNIT V MEMORY AND PROGRAMMABLE LOGIC 9**

Introduction to PLDs – ROM, PAL, PLA - Implementation of digital functions using PLDs. Introduction to Hardware Description Language – Behavioral, Dataflow and gate level modeling

**L: 45; P: 30; TOTAL: 75 PERIODS**

**TEXT BOOKS**

1. M.Morris Mano, “Digital Design”, 5<sup>th</sup> Edition, Pearson Education, 2013.
2. D.A.Godse, A.P.Godse, “Digital Electronics”, 3<sup>rd</sup> Revised Edition, Technical Publications, 2008.

**REFERENCES**

1. Thomas L.Floyd, “Digital Fundamentals”, 11<sup>th</sup> Edition, Global Edition, Pearson Education, 2015.
2. Charles H.Roth, Jr. “Fundamentals of Logic Design”, 7<sup>th</sup> Edition, Jaico Publishing House, 2015.
3. Donald D.Givone, “Digital Principles and Design”, Tata McGraw-Hill, 2003.

**19CS36C SOFTWARE ENGINEERING METHODOLOGIES L T P C QP  
3 0 0 3 A**

**COURSE OUTCOMES**

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

- CO1: understand the importance of software engineering practices. (K2)
- CO2: effectively participate in software requirement analysis and design. (K2)
- CO3: realize the value and challenges in software testing. (K3)
- CO4: identify the necessitate for configuration and Maintenance concepts (K2)
- CO5: realize the importance of Agile process and DevOPS models (K2)

**UNIT I INTRODUCTION 9**

Definition of terms - The evolving role of Software – Software characteristics - Software applications. Software process models – Waterfall model-RAD model-The prototyping model.

**UNIT II SOFTWARE MODELING 9**

Requirement elicitation - Requirement analysis and negotiation - Requirement validation - Requirement management. Elements of the analysis model - Data modeling - Data objects, attributes and relationships - Cardinality and modality - Entity/Relationship diagram - Data flow diagrams. Software design –Design process and concepts, case study.

### **UNIT III TESTING 9**

Software testing fundamentals - Test case design: White box testing - Basis path testing - Control structure testing. Black box testing - Testing strategies - Unit testing - Integration testing - System testing – Acceptance Testing – case study.

### **UNIT IV SOFTWARE CONFIGURATION MANAGEMENT AND MAINTENANCE 9**

Baselines - Software configuration items -The SCM process - Version control - Change control - Configuration audit - SCM standards. Software Maintenance - Software Supportability – Reengineering - Software Reengineering - Reverse Engineering – Restructuring - Forward Engineering - Economics of Reengineering.

### **UNIT V AGILE AND DEVOPS MODEL 9**

Agility - Agile process models: extreme programming –adaptive software development- scrum – DevOps, case study.

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOK**

1. Roger S.Pressman, "Software Engineering: A Practitioner's Approach", 8<sup>th</sup> Edition, Tata McGraw Hill Edition, 2015.

#### **REFERENCES**

1. Ian Sommerville, "Software Engineering", 10<sup>th</sup> Edition, Pearson, 2016.
2. Shari Lawrence Pfleeger, "Software Engineering: Theory and Practice", 4<sup>th</sup> Edition, Pearson Education, New Delhi, 2014.
3. Pankaj Jalote, "Integrated Approach to Software Engineering", 3<sup>rd</sup> Edition, Springer, New York, 2010.
4. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", 1<sup>st</sup> Edition, Pearson Education, 2016.

### **19MC01C ENVIRONMENTAL SCIENCE AND ENGINEERING**

**L T P C QP  
3 0 0 0 D**

#### **COURSE OUTCOMES**

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

- CO 1: explain the structure and function of ecosystem. (K2)
- CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)
- CO 3: explain the causes and effects of pollution. (K2)
- CO 4: describe social issues related to the environment and the environment act. (K2)
- CO 5: identify the nutrients in food and impact of metals on human health. (K2)

**UNIT I ENVIRONMENT AND ECOSYSTEMS 9**

Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

**UNIT II BIODIVERSITY AND NATURAL RESOURCES 9**

Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over - exploitation – deforestation – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

**UNIT III ENVIRONMENTAL POLLUTION 9**

Causes, effects and control measures of air pollution, water pollution, noise pollution and nuclear hazards – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

**UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9**

Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; Environment laws: environmental (protection) act 1986-the wild life (protection) act 1972.

**UNIT V FOOD AND HUMAN HEALTH 9**

Carbohydrates, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, cadmium, mercury and chromium on human health.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Miller G. and Spoolman S, “Environmental Science”, 14<sup>th</sup> Edition, Brooks/Cole Publishing Co., 2014.
2. Maczulak A.E., “Environmental Engineering”, Facts on file Inc., 2009.
3. Han D, “Concise Environmental Engineering”, Ph.D & Ventus Publishing ApS, 2012.

**REFERENCES**

1. Weller K. “Environmental Science and Biological Engineering”, 1<sup>st</sup> Edition, WIT Press, 2015
2. Strange C., “Environmental Science and production”, NasonTrest Publisher, 2014.

**19GN03C TAMILS AND TECHNOLOGY (தமிழரும் தொழில்நுட்பமும்) LT P C  
1 0 0 1**

- UNIT I WEAVING AND CERAMIC TECHNOLOGY 3**  
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.
- UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3**  
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.
- UNIT III MANUFACTURING TECHNOLOGY 3**  
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.
- UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**  
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoempu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.
- UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**  
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**L: 15; TOTAL : 15 PERIODS**

**REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies.)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)



9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**19GN03C TAMILS AND TECHNOLOGY (தமிழரும் தொழில்நுட்பமும்) LT P C  
1 0 0 1**

**அலகு I நெசவு மற்றும் பாணைத் தொழில்நுட்பம் 3**  
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

**அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3**  
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக்கலை.

**அலகு III உற்பத்தித் தொழில்நுட்பம் 3**  
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3**  
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

**அலகு V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் 3**  
அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

**L: 15; TOTAL: 15 PERIODS**

**REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணிணித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

## 19CS37C DATA STRUCTURES LABORATORY

LT PC  
0 0 4 2

### COURSE OUTCOMES

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

CO 1: implement linear data structures to solve simple problems. (K3)

CO 2: solve real world problems using non linear data structures and hashing. (K4)

### LIST OF EXPERIMENTS

1. Array Implementation of stack and queue ADT.
2. Linked list Implementation of stack and queue ADT
3. Applications of stack, queue and linked list,
4. Implementation of Heap using priority queue.
5. Implementation of Binary(expression) Trees and operations of Binary Trees
6. Implementation of binary search tree ADT
7. Implementation of AVL tree.
8. Implementation of hash table ADT.
9. Applications of hash table.
10. Applications of Graphs

### SOFTWARE REQUIREMENTS

- Codeblocks

- OS – LINUX/ Windows 8.1

**P: 60; TOTAL: 60 PERIODS**

**Sample Question Bank (Exercises not limited to this)**

1. Using Stack ADT, write a program to convert infix expression into postfix expression which includes '(', ')', '+', '-', '\*', and '/' .
2. Create a deque with 3 elements. Insert two elements at the rear end (Inject) and insert two elements at the front end (Push). Delete an element from the front end (Pop) and rear end (Eject). Display the queue after each operation and number of elements in the queue.
3. Write a program to implement the priority queue using binary heap. Compare the running time for sorted, reverse-ordered and random inputs.
4. a. Create two lists L1 and L2. While creating, the new nodes should be added in the front of the list by default.
  - i. Find the intersection of the two lists L1 and L2 and display the resultant list.
  - ii. Find the union of two lists L1 and L2 eliminates the duplicates and display the resultant list.
- b.
  - i. Create a list with n nodes
  - ii. Display the list in the reverse order and number of nodes in the list.
  - iii. Delete the specified node from the list and display the resultant list.
5. Represent a polynomial as a linked list and write functions to add the following polynomial and display the resultant polynomial  $4X^4+3X^3+X+5, 3X^3-2X^2+X+3$ .
6. Write a program to implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
7. a.
  - i. Implement basic binary search tree operations.
    - ii. While deleting the node with two children, replace it with either in-order successor or in-order predecessor based on choice.
- b. Create a tree with nodes containing hit count information of various engineering college sites. Display the count in ascending order. The tree's height should be optimum. ie. It should not exceed  $1.44 \cdot \log_2 n$ . Find the height of the tree after each insertion.
8. Implement basic operations of Dictionary ADT using hash table assuming that the user does not attempt to insert entries with the same key.
9. The ABC Company has its branches in several cities in India. The company wants to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. They want to connect all the branches with a minimum total cost. Help them to fix their problem.

10. The XYZ Logistics wants to deliver goods from Madurai to Tirumangalam, Virudhunagar, Sivakasi, Sathur, Rajapalayam and Kovilpatti through Lorry. The transport charges between each pair of cities vary. The XYZ Logistics wants to cut down on the total distance travelled to save transport charge and it wants to know the route with minimum distance from Madurai to all other cities. Help them to find the route.

**19CS38C            OBJECT ORIENTED PROGRAMMING LABORATORY            L T P C**  
**0 0 4 2**

### **COURSE OUTCOMES**

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

- CO1: demonstrate the use of various OOPs concepts (Class and Objects, Abstraction, Encapsulation, Inheritance and Polymorphism) with the help of C++ program (K3)
- CO2: demonstrate the usage of exception handling mechanisms to handle runtime errors and to demonstrate the design of generic programming. (K3)
- CO3: implement rich data handling through files and streaming. (K3)

### **LIST OF EXPERIMENTS**

1. Implement C++ Program for passing arguments to a function(by value and by reference) and returning value from a function
2. Implement C++ Program for function overloading, constructor overloading, default arguments and use of non-inline functions
3. Build a C++ Program for Overloading unary operators and Overloading binary operators
4. C++ Program for passing arrays and objects as arguments to function and returning arrays and objects from functions
5. Demonstrate the dynamic memory allocation for the working of the new and the delete operator.
6. Execute C++ program for inheritance and Virtual function.
7. Implement C++ program for abstract base classes and pure virtual functions.
8. Construct a program for RTTI
9. Construct a program for class and function templates
10. Implement C++ program for Exception handling and File handling.

The course instructor may specify a problem statement for a team or individual. It must be focus towards above topics. The course instructor may assign a mini project for the team (contains 4 or 5 members) concentrating on each of the above topics as modules integrated into the project.

### **SOFTWARE REQUIREMENTS**

- Code base/ Code blocks/Visual studio / GCC Compiler
- OS - LINUX/ Windows 7/ 8

**P: 60; TOTAL: 60 PERIODS**

## **Sample Question Bank (Exercises not limited to this)**

1. Design C++ classes with static members, methods with default arguments, friend functions. (For example, design matrix and vector classes with static allocation, and a friend function to do matrix–vector multiplication).
2. Write a class Time which represents time. The class should have three fields for hours, minutes and seconds. It should have constructor to initialize the hours, minutes and seconds.
  - A method printTime() to print the current time.
  - Overload the following operators:  
plus operator (+) (add two time objects based on 24 hour clock) and < (compare two time objects)
3. Implement complex number class with necessary operator overloading and type conversions such as integer to complex, double to complex, complex to double etc.
4. Consider an example of a banking system. Design a class called 'Bank' that has data members such as those representing account number, name, account type, branch, and balance amount. Derive a 'Deposit' class from Bank for depositing the amount into that account and to maintain the balance. Also derive a 'Withdrawal' class from Bank for withdrawing the amount from that account and to maintain the balance. Now, derive a 'Statement' class from both Deposit and Withdrawal to print the complete bank statement of the specific account holder with all transactions. Write an interactive C++ program for N customers using appropriate inheritance mechanism.
5. Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instance variable, named department, of type string. Supply a method to string that prints the manager's name, department and salary. Make a class Executive inherit from Manager. Supply a method to String that prints the string Executive followed by the information stored in the Manager superclass object. Supply a test program that tests these classes and methods.
6. Write a discount system for a beauty saloon, which provides services and sells beauty products. It offers 3 types of memberships: Premium, Gold and Silver. Premium, gold and silver members receive a discount of 20%, 15%, and 10%, respectively, for all services provided. Customers without membership receive no discount. All members receive a flat 10% discount on products purchased (this might change in future). Your system shall consist of three classes: Customer, Discount and Visit,. It shall compute the total bill if a customer purchases Rs.x of products and Rs.y of services, for a visit. Also write a test program to exercise all the class behaviors.
7. Consider a class called MyTime, which models a time instance which contains the following private instance variables:
  - hour: between 0 to 23.
  - minute: between 0 to 59.
  - Second: between 0 to 59.

You are required to perform *input validation*.

It contains the following public methods:

- ✓ setTime(int hour, int minute, int second): It shall check if the given hour, minute and second are valid before setting the instance variables. (Advanced: Otherwise, it shall throw an IllegalArgumentException with the message "Invalid hour, minute, or second!".)
- ✓ Setters setHour(int hour), setMinute(int minute), setSecond(int second): It shall check if the parameters are valid, similar to the above.
- ✓ Getters getHour(), getMinute(), getSecond().
- ✓ toString(): returns "HH:MM:SS".
- ✓ nextSecond(): Update this instance to the next second and return this instance. Take note that the nextSecond() of 23:59:59 is 00:00:00.
- ✓ nextMinute(), nextHour(), previousSecond(), previousMinute(), previousHour(): similar to the above.
- ✓ Write the code for the MyTime class. Also write a test driver (called TestMyTime) to test all the public methods defined in the MyTime class.

8. Demonstrate the dynamic memory allocation or the working of the new and the delete operator.

9. Create a simple "shape" hierarchy: a base class called Shape and derived classes called Circle, Square, and Triangle. In the base class, make a virtual function called draw(), and override this in the derived classes. Make an array of pointers to Shape objects that you create on the heap (and thus perform upcasting of the pointers), and call draw() through the base-class pointers, to verify the behavior of the virtual function.

10. Design a Book class. Assume that a book is written by one (and exactly one) author. The Book class contains the following members:

- Four private member variables: name (String), author (an *instance* of the Author class assuming that each book has exactly one author), price (double), and qty (int).
- The public getters and setters: getName(), getAuthor(), getPrice(), setPrice(), getQty(), setQty().
- A toString() that returns "'book-name' by author-name (gender) at email". You could reuse the Author's toString() method, which returns "author-name (gender) at email".

11. Define a sort() that takes its comparison criterion as a template argument. Define a class Record with two data members count and price. Sort a vector<Record> on each data member.

12. Write a singly-linked list class template that accepts elements of any type derived from a class Link that holds the information necessary to link elements. This is called an intrusive list. Using this list, write a singly-linked list that accepts elements of any type (a non-intrusive list). Compare the performance of the two list classes and discuss the tradeoffs between them

13. Add an exception handler (try/catch/throw) to the class that throws an error message (e.g. "value out of range") in the getValue function that is caught and handled in the main program. Implement two version of the program. In version 1, throw the error in getValue, catch the error in the main, display an error message in the main, and then allow the program to terminate. In the second version, perform the same basic actions (throw and catch) but keep re-invoking the getValue function from the main program until the user enters a valid value

14. Write a C++ program to keep records and perform statistical analysis for a class of 20 students. The information of each student contains ID, Name, DOB, quizzes Scores (2 quizzes per semester), mid-term score, final score, and total score.

15. Given two text files "f1.txt" and "f2.txt", in which each line is a series of numbers separated by ".", and assuming that the lines are in ascending order by the first number, make a function to read both files line by line writing in the file "f3.txt" the common lines, like in the following example:

F1.txt	F2.txt	F3.txt
10:4543:23	10:334:110	10:4543:23:334:110
15:1:234:67	12:222:222	15:1:234:67: 12:222:222
17:188:22	15:881:44	17:188:22: 15:881:44
20:111:22	20:454:313	20:111:22:454:313

16. Write a C++ program to create a class called 'PhoneBook' which consists of name, std\_code and phone\_number as data members. Perform the following functions.

- Get input for the PhoneBook object by overloading the operator >>
- Display the PhoneBook object by overloading the operator <<

### Mini Project:

Design and build the following applications using C++

- Bike Race Game (using SDL)
- Banking Record System
- Bookshop Management System
- Bus Reservation System
- Hotel Management System
- Payroll Management System
- Phonebook Management System
- Fortune Teller (Predict Future)
- Helicopter Game (using SDL)
- Airlines Reservation System

19CS39C

**COMMUNICATION SKILLS LABORATORY**  
(Common to all B.E. / B.Tech., Degree Programmes)

**L T P C**  
**0 0 2 1**

### COURSE OUTCOMES

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

CO 1: listen and respond effectively to interact at different situations fluently (K2)

CO2: excel appropriately in professional contexts.(K3)

CO3: acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3)

### UNIT I

*Lab session:* Listening and responding to audio files

*Practice session:* Mini Presentation related to Business English & Picture description.

**UNIT II**

*Lab session:* Role Play – News Reader

*Practice session:* Resume Preparation

**UNIT III**

*Lab session:* Listening to audio files related to soft skills.

*Practice session:* Practicing Power point presentation, Group discussion.

**P: 30; TOTAL: 30 PERIODS**

**REFERENCES**

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

**19CS41C STATISTICS AND NUMERICAL METHODS**

**L T P C QP**  
**3 1 0 4 A**

**COURSE OUTCOMES**

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

- CO1: Calculate the various measures of dispersion.(K3)
- CO2: Apply the concept of testing of hypothesis for small and large samples (K3)
- CO3: Apply the basic concepts of classifications of design of experiments (K3)
- CO4: Use numerical techniques to interpolate, solve algebraic equation, differentiation and integration. (K3)
- CO5: Solve differential equations using numerical methods. (K3)

**UNIT I STATISTICS 12**  
Central tendencies - Mean, median, mode - Measures of Dispersion –Mean deviation, and Quartile deviation–Moments– Skewness –Kurtosis - Correlation and Regression.

**UNIT II TESTING OF HYPOTHESIS 12**  
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table for independent of attributes – Goodness of fit.

**UNIT III DESIGN OF EXPERIMENTS 12**  
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design –  $2^2$  factorial design.

**UNIT IV NUMERICAL SOLUTION OF EQUATIONS, NUMERICAL DIFFERENTIATION AND INTEGRATION 12**  
Solution of Algebraic and transcendental linear equations - Newton - Raphson Method - Solution of simultaneous equations – Gauss Elimination method – Gauss Seidel method – Interpolation – Newton’s forward and backward formulae - Numerical Differentiation –



Newton's forward difference and backward difference formula – Numerical integration - Single and double integration using Trapezoidal and Simpson's rules.

**UNIT V NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS 12**

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

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

**TEXT BOOKS**

1. Richard A. Johnson, Irwin Miller, John Freund, "Miller & Freund's Probability and Statistics for Engineers," 9<sup>th</sup> Edition, Pearson Education Limited, Global Edition, 2017. (unit 1& 2).
2. Grewal, B.S., "Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB", 10<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2014.(unit 3,4,5)

**REFERENCES**

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9<sup>th</sup> Edition, 2016.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill Edition, 2017.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7<sup>th</sup> Edition, Tata McGraw - Hill, New Delhi, 2016.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7<sup>th</sup> Edition, Pearson Education Asia, New Delhi, 2007.

**19CS42C DESIGN AND ANALYSIS OF ALGORITHMS**

**L T P C QP  
3 1 0 4 A**

**COURSE OUTCOMES**

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

- CO1: Understand and apply algorithm analysis techniques to solve real time problems. (K4)
- CO2: Understand and apply divide-and-conquer and greedy technique to solve a given problem. (K4)
- CO3: Solve the combinatorial problem using dynamic programming techniques. (K3)
- CO4: Demonstrate backtracking and branch & bound algorithms. (K4)
- CO5: Understand and solve problems using approximation and randomization algorithmic techniques. (K3)

**UNIT I INTRODUCTION 12**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Recurrence equations –Solving recurrence equations: Substitution method, Recursion tree method and Masters' theorem.

**UNIT II DIVIDE-AND-CONQUER AND GREEDY TECHNIQUE 12**

Divide and conquer methodology – Merge sort – Binary search – Multiplication of Large Integers – Stassen’s Matrix Multiplication - Greedy Technique – Container loading problem – Prim’s algorithm and Kruskal’s Algorithm – Knapsack problem – Huffman Trees.

**UNIT III DYNAMIC PROGRAMMING 12**

Dynamic Programming: Principle of optimality – Coin changing problem - Computing a Binomial Coefficient – Warshall and Floyd’s algorithm - Multistage Graphs – Knapsack Problem and Memory functions.

**UNIT IV BACKTRACKING AND BRANCH AND BOUND 12**

Backtracking: n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem - Graph coloring – Branch and Bound: Knapsack Problem – Traveling Salesman Problem.

**UNIT V APPROXIMATION ALGORITHMS 12**

Approximation Algorithms - Travelling Salesman problem – Knapsack problem – Set cover, Vertex cover - Bin packing - Introduction to NP-Hard and NP-Completeness

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

**TEXT BOOKS**

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3<sup>rd</sup> Edition, Pearson Education, 2017. (UNIT I to UNIT IV)
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, “Computer Algorithms / C++”, 2<sup>nd</sup> Edition, Universities Press, 2008. (UNIT I to UNIT V)
3. Vijay V. Vazirani, “Approximation Algorithms”, Springer, 1<sup>st</sup> Edition, 2003. (UNIT-V)

**REFERENCES**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest and Clifford Stein, “Introduction to Algorithms”, 3<sup>rd</sup> Edition, PHI Learning Private Limited, 2010.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D.Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
3. Harsh Bhasin, “Algorithms Design and Analysis”, Oxford university press, 2016.
4. S. Sridhar, “Design and Analysis of Algorithms”, Oxford university press, 2014.

**19CS43C OPERATING SYSTEMS**

**L T P C QP  
3 0 0 3 A**

**COURSE OUTCOMES**

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

- CO1: acquire knowledge on basic working principles of operating systems. (K2)  
 CO2: realize the mechanisms of OS involved in process scheduling and synchronization. (K2)  
 CO3: detect deadlock and apply the solutions for handling deadlocks. (K3)  
 CO4: acquire knowledge on mechanisms of memory management. (K2)  
 CO5: apply file management and I/O management techniques. (K3)

**UNIT I INTRODUCTION 9**

Concept of operating systems - Types of operating system - structure of OS – operations of OS - system calls and its types – system programs – Processes : Concept – Process scheduling – operations on processes – Threads : concept – multithreading models - Inter process communication – Processes and threads in Linux os

**UNIT II PROCESS SCHEDULING 9**

CPU Scheduling – basic concepts – scheduling criteria – Preemptive and non preemptive scheduling algorithms: FCFS, SJF, Priority, Round Robin – scheduling in Real Time Operating System (RTOS) – Rate Monotonic (RM) scheduling algorithm – Least Laxity First (LLF) scheduling algorithm - case study of process scheduling on linux os.

**UNIT III SYNCHRONIZATION AND DEADLOCK 9**

Process Synchronization – The Critical – Section problem – Peterson’s solution – Mutex locks – Semaphores – Classic problems of synchronization – monitors. Deadlock: System model – deadlock characterization – Methods for handling deadlock – deadlock prevention – deadlock avoidance – banker’s algorithm – deadlock detection – recovery from deadlock.

**UNIT IV STORAGE MANAGEMENT 9**

Memory management – Background – Swapping – Contiguous memory allocation – Segmentation – Paging – Segmentation with paging - Virtual memory: Background – Demand paging – page replacement – algorithms: FIFO, LRU, Optimal-allocation of frames – thrashing.

**UNIT V FILE SYSTEMS AND DISK SCHEDULING 9**

File concept – Access methods – directory and disk structure – file system mounting – protection – File system implementation: Directory implementation – Allocation methods – Free space management. Disk scheduling – Algorithms: FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK – disk management.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, “Operating System Concepts”, Enhanced eText, 10<sup>th</sup> Edition , Wiley Asia Student Edition, 2018.

**REFERENCES**

1. William Stallings, “Operating Systems: Internals and Design Principles”, 9<sup>th</sup> Edition, Prentice Hall of India, 2018.
2. Daniel P. Bovet, Marco Cesati, O'Reilly and Associates, “Understanding the Linux Kernel”, 3<sup>rd</sup> Edition, 2005.
3. Rajib Mall, “Real - Time Systems: Theory and Practice”, Pearson Education India, 2009

3 0 0 3 A

**COURSE OUTCOMES**

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

- CO1: apply the SQL concepts and operations in a relational database design (K3)
- CO2: apply the Sub-Queries and Join concept in relational database design (K3)
- CO3: illustrate the use of T-SQL and stored procedures in real time scenarios (K3)
- CO4: demonstrate the normalization design concept for effective query processing.(K3)
- CO5: acquire knowledge about No-SQL databases in emerging applications (K3)

**UNIT I RELATIONAL DATABASES 9**

Introduction to Database System --Views of data --Database System Architecture – ER Models – Enhanced-ER Model - Relational Model- ER-to-Relational Mapping - SQL : SQL Syntax – Data types – Operators - SQL Keys - DDL Statements - DML Statements- SQL Aliases – Operators - SQL Aggregate Functions

**UNIT II ADVANCED QUERY STRUCTURES 9**

SQL Clauses - Group By – Having - Sub Query – Nested Sub Query –Data Control Language -Null Functions –Indexes - Sequences – Clone tables – SQL Joins – Basics - Types: Self Join -Inner Join - Outer Join - Left Join – Right Join-Full outer Join – views - SQL Injections

**UNIT III T-SQL AND STORED PROCEDURES 9**

T-SQL: Scripts and Batches Declaring Variables - Using Statements - Error Handling - Global Variables Using Dynamic SQL - Stored Procedures : PL/SQL Functionalities - Control statements –Functions –Triggers – ODBC/JDBC connectivity – ODBC/JDBC Implementation - Case Study: Banking / University database system.

**UNIT IV NORMALIZATION AND TRANSACTION MANAGEMENT 9**

Functional Dependencies –Non loss Decomposition–Normalization: First, Second, Third Normal Forms, Dependency Preservation –Boyce/Codd Normal Form – Transaction: Basic Concepts -Transaction Recovery –ACID Properties - Concurrency - Deadlock - RAID - B+ Tree Indexing.

**UNIT V NO-SQL DATABASES 9**

Introduction - Four types of No-SQL databases : Document-oriented, Key/Value Pairs, Column-oriented and Graph - CRUD Operations - MongoDB, Cassandra, HBASE, Neo4j use and deployment - Use Cases: Event Logging - Content Management Systems - Ecommerce Applications.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth, S.Sudharshan, "Database System Concepts", Tata McGraw Hill, 6<sup>th</sup> Edition, 2013.
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education, 8<sup>th</sup> Edition, 2012.
3. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, 7<sup>th</sup> Edition, 2016.

**REFERENCES**

1. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach

to Design, Implementation and Management”, Pearson Education, 5<sup>th</sup> Edition, 2009.

2. Shashank Tiwari, "Professional NoSQL", John Wiley and Sons, 2011.
3. Peter Membrey, "MongoDB Basics", Apress; 1<sup>st</sup> Edition, 2014.
4. <https://docs.microsoft.com/en-us/sql/?view=sql-server-ver15>.
5. <https://www.w3schools.com>
6. <https://www.geeksforgeeks.org>

**19CS45C**

**COMPUTER NETWORKS**

**L T P C QP**  
**3 0 0 3 A**

### **COURSE OUTCOMES**

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

- CO 1: Understand the division of network functionalities into layers. (K2)
- CO 2: Enumerate different medium access control mechanisms.(K2)
- CO 3: Apply various flow, congestion and routing algorithms for a network and determine the optimal path. (K3)
- CO 4: Integrate the working of protocols in higher level layers. (K3)

### **UNIT I INTRODUCTION 9**

Data Communications- Networks – Networks Type – Protocol Layering – TCP/IP Suite – OSI Model - Transmission medium – Switching Networks – Bridges.

### **UNIT II DATA LINK LAYER 9**

Introduction – Link Layer Addressing – Error Detection and Correction – Block Coding – Cyclic Codes – Checksum –Data Link Layer Protocols: HDLC& PPP – Media Access Control - Wired LANs – Wireless LAN – IEEE 802.11 – Bluetooth.

### **UNIT III NETWORK LAYER 9**

Introduction - IPV4 & IPV6 Addresses – Address Mapping - ARP, RARP, and DHCP - Unicast Routing Protocols –Multicast Routing Protocols.

### **UNIT IV TRANSPORT LAYER 9**

Introduction - Transmission Control Protocol: Connections – Flow control - Error Control - Congestion control - Congestion avoidance-User Datagram Protocol: Datagram - Services- Applications.

### **UNIT V APPLICATION LAYER 9**

Traditional applications: DNS-E-Mail (SMTP, MIME, POP3, IMAP, Web Mail) - FTP- HTTP – SNMP - Cryptography Techniques.

**L: 45; TOTAL: 45 PERIODS**

### **TEXT BOOKS**

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5<sup>th</sup> Edition, Morgan Kaufmann Publishers, 2011.
2. Behrouz A. Forouzan, “Data Communication and Networking”, 5<sup>th</sup> Edition, Tata McGraw- Hill, 2013.

**REFERENCES**

1. William Stallings, "Data and Computer Communications", 10<sup>th</sup> Edition, Pearson Education, 2017.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5<sup>th</sup> Edition, Prentice Hall 2010.
4. James F Kurose, Keith W Ross, "Computer Networking -A Top-Down Approach Featuring the Internet", Pearson Education, New Delhi, 6<sup>th</sup> Edition, 2012.

**19CS46C****FINANCE AND ACCOUNTING****L T P C QP  
3 0 0 3 A****COURSE OUTCOMES**

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

- CO 1: Explain the basic concepts and process of accounting and finance. (K2)
- CO 2: Describe the financial status of an organization. (K2)
- CO 3: Identify the concepts and operations of CVP analysis for decision making. (K3)
- CO 4: Apply techniques like budgetary control and capital budgeting for planning and Controlling in an organization. (K3)
- CO 5: Explain the application of accounting software. (K2)

**UNIT I INTRODUCTION TO ACCOUNTING****9**

Introduction and Definition - Accounting concepts and conventions - Final Accounts - Preparation of Trading, Profit and Loss Account and Balance Sheet.

**UNIT II ANALYSIS AND INTERPRETATION OF FINANCIAL STATEMENTS** **9**

Meaning and importance - Comparative statement, Common size statement - Trend analysis and accounting ratios - latest trend in presenting financial data.

**UNIT III ACCOUNTING FOR DECISION MAKING****9**

CVP Analysis - Relevant Costs and Revenue for Decision Making - Pricing Decisions - Operational Decisions - Exploring New markets - Make or buy decisions.

**UNIT IV ACCOUNTING FOR PLANNING AND CONTROLLING****9**

Budgets, Budgetary Control – Meaning – Importance and applications - Capital budgeting - Meaning – Importance - steps in capital budgeting - Information needed - Methods of evaluating capital budgeting decisions.

**UNIT V COMPUTERIZED ACCOUNTING SYSTEM****9**

Meaning - Concept - Comparison between Manual and Computerized Accounting - Sourcing of Accounting Software - Accounting Packages.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. V.K.Gupta, R.L.Gupta, "Financial Accounting", 3<sup>rd</sup> Edition, S.Chand, New Delhi, 2016.
2. Dr.V.R.Palanivelu, "Accounting for Management", 3<sup>rd</sup> Edition, University science press New Delhi, 2013.
3. Manoj Bansal, Ajay Sharma, "Computerized Accounting System", 1<sup>st</sup> Edition, Sahitya Bhawan Publications, Agra, 2019.

### REFERENCES

1. S.N.Maheshwari, Suneel K.Maheshwari, Sharad K.Maheshwar, "Financial Accounting", Second Edition, Vikas Publishing House, 2018.
2. Peter Atrill, Eddie McLaney "Financial Accounting for Decision Makers", Seventh Edition, Pearson Education, 2013.
3. Dr.Alok Dwivedi, Prof.C.M.Tembhurnekar, "Computerized Accounting", First Edition, Sai Jyoti Pulication, Nagpur, 2016.

**19CS47C**

**OPERATING SYSTEMS LABORATORY**

**L T P C**  
**0 0 3 1.5**

### COURSE OUTCOMES

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

- CO1: identify the system calls to display the system information. (K2)
- CO2: evaluate the process scheduling algorithms FCFS, SJF, Priority and Round robin.(K3)
- CO3: simulate the process communication through various techniques (K2)
- CO4: simulate memory management schemes (K2)
- CO5: implement file allocation techniques (K3)

### LIST OF EXPERIMENTS

1. Study and practice of basic commands, editors, shell programming in Linux Operating System.
2. Implementation of System calls in UNIX operating Systems
3. Execution of I/O system calls in Unix operating System
4. Execution of system Information in UNIX operating System
5. Implementation of CPU scheduling algorithms : i) FCFS ii) SJF iii) Priority iv) Round Robin
6. Implementation of producer-consumer problem using semaphores
7. Implementation of memory allocation techniques
8. Simulate bankers algorithm for the purpose of deadlock avoidance.
9. Simulate page replacement algorithms (FIFO, LRU and Optimal Strategies).
10. Simulate memory management schemes: paging and segmentation.
11. Simulate file allocation techniques (Linked, Indexed or Contiguous).
12. Implement any one client server applications using inter process communication, multithreading, synchronization and generate report.

**P: 45; TOTAL: 45 PERIODS**

### SOFTWARE REQUIREMENTS

Linux: Ubuntu / OpenSUSE / Fedora / Red Hat

**Sample Question Bank (Exercises not limited to this)**

1. Implement the C program to create a new process and display its id using appropriate system call
2. Implement the C Program to get and set environment variables using appropriate system calls
3. Write a C Program to get the attribute of a file or directory on Linux using system calls
4. Implement the C Program to Display process information using process related system calls
5. Write a C program to display the files in the given directory
6. Implement the a C program to simulate the system call that blocks the calling process until one of its child processes exist or a signal is executed
7. Implement the C program SystemInfo.c that will read the /proc file system and print out the following (with an appropriate message in each case):
  - a) The number of CPUs in your machine and their clock speed (note that different cores are counted as different CPUs)
  - b) The version of Linux kernel running on your system
  - c) The time in day:hr:min:sec when the system was last booted
  - d) The average load on the system in the last 5 minutes
  - e) The total usable and currently free memory in the system
  - f) The swap partitions and their sizes
  - g) The time did the CPU spend (over all processes) in the user mode, kernel mode, and in servicing interrupts.
  - h) The number of context switches made by the system so far.
8. Consider three processes (process id 0, 1, 2 respectively) with compute time burst 2,4 and 8 time units. All processes arrive at time zero. Compute and print the waiting time and turnaround times of all the given processes and also print the average waiting time and turnaround time of this scheduling algorithm. Execute the program and record the observations.
9. Write a C program ProcessInfo.c that gets the following information specific to a process. The program takes the pid of the process as a command line argument.
  - a) The command line with which the process was started
  - b) The time spent by the process in running and in waiting
  - c) The time spent by the process in the user mode, kernel mode, and in servicing interrupts
  - d) Can you print out the contents of the address space of the process?
10. Implement two-process communication through Echo server application using pipes.
11. Write a multi-process message-passing utility. The messages are stored in a shared memory segment. A static library is created which provides a set of functions to send / receive messages; every user process links with this library and uses these functions for passing messages to other processes. Every access (read or write) to this shared-memory segment is to be guarded by semaphores to effect mutual exclusion. Named processes can transfer messages among each other using this interface.  
Data Structures: A message consists of the following fields:
  - a. A sender name (a string of maximum length 10)
  - b. A recipient name (a string of maximum length 10)
  - c. A sending time (in whatever format you would like to store)
  - d. A text message (a string of maximum length 100)



e. A registered process consists of the following two fields:

- A name (a string of maximum length 10)
- A process ID

12. Implement the FCFS and Round Robin scheduling algorithm (quantum of 2 time units) for the given scenario. Consider the 3 processes, P1, P2 and P3 shown in the table. Compute and print the average waiting time and average turnaround time

Process	Arrival time	Time Units Required
P1	0	5
P2	1	7
P3	3	4

13. Implement the pre-emptive shortest job first scheduling algorithm for the given scenario. Consider the following table of arrival time and burst time for three processes P0, P1 and P2. compute and print the average waiting time and average turnaround time

Process	Arrival time	Burst Time
P0	0 ms	9 ms
P1	1 ms	4 ms
P2	2 ms	9 ms

14. Implement the First come First served (FCFS), Non Preemptive Shortest Job First (SJF), Round Robin (RR) (quantum=10ms) for the given scenario. Consider the following five processes, with the length of the CPU burst time given in milliseconds, Process p1 burst time 10, Process p2 burst time 29, Burst time Process p3 burst time 3, Process p4 burst time 7, and Process p5 burst time 12. compute and print the average waiting time and average turnaround time
15. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.(2 sessions)
16. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 Sessions).
17. Implement Producer-Consumer problem using semaphores. Let the producer have bounded buffer for storing the produced data. Design a suitable consumer to utilize the data which is produced by the consumer. The producer can produce only when the buffer is having space for accommodation and the consumer can consume only when the buffer has data items in it.
18. Develop a mini project for any one application using producer consumer concepts.
19. Implement the banker's algorithm for Deadlock Avoidance for the given scenario. Let n be the number of processes in the system and m be the number of resource types to be allocated

Available system resources:

Resource types	A	B	C	D
Instances	3	0	1	2

Processes (currently allocated resources):

Processes	Resource Types			
	A	B	C	D
P1	1	2	2	1
P2	1	1	3	3
P3	1	2	1	0

Processes (maximum resources):

Processes	Resource Types			
	A	B	C	D
P1	3	3	2	2
P2	1	2	3	4
P3	1	3	5	0

20. Implement the banker's algorithm for Deadlock Avoidance for the given scenario. Consider there are 5 processes P1, P2, P3, P4 and P5 and four resources ABCD. A has 6 instances, B has 3 instances, C has 4 instances and D has 2 instances.

Process	Allocation	Max	Available
	ABCD	ABCD	ABCD
P1	3011	4111	1020
P2	0100	0212	
P3	1110	4210	
P4	1101	1101	
P5	0000	2110	

- Is the current state safe? If yes then find the safe sequence.
  - If P5 requests for (1, 0, 1, 0), can this be granted?
21. Simulate a memory allocation policy using C or OS simulator. The requirements of this simulated system is given, which is needed to be used for the simulation task. At one large batch processing computer installation the management wants to decide what storage placement strategy will yield the best possible performance. The installation runs a large real storage computer under fixed partition multiprogramming. Each user program runs in a single group of contiguous storage locations. Users state their storage requirements and time units for CPU usage on their job control card. The operating system allocates to each user the appropriate partition and starts up the user's jobs. The jobs remain in memory until completion. A total of 50,000 memory locations are available, divided into block. An instance of the scene is indicated in the below table.

Job list			Memory list	
Job stream number	Time	Job Size	Memory Block	Size
1	5	5760	1	9500
2	4	4190	2	7000
3	8	3290	3	4500
4	2	2030	4	8500
5	2	2550	5	3000

Design suitable User interface to get the required data and present the simulated result in a pleasant form of your choice

22. Simulate and Compare page replacement algorithms using OS simulator. Consider the following page reference string A,B,C,D,B,A,E,F,A,B,C,G,F,C,F. How many page faults would occur for the following page replacement algorithm assuming three and four frames? Remember all frames are initially empty:  
i) FIFO ii) Optimal iii) LRU
23. Simulate and Compare page replacement algorithms using OS simulator. Consider the following reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with four free frames which are empty initially. Which algorithm gives the minimum number of page faults?
24. Design and build the following client server applications using inter process communication, multithreading, synchronization and generate report.
- Tollgate monitoring system
  - Hotel Management System
  - Bank ATM system
  - Inventory management System
  - Coffee Vending machine
  - Ticket Reservation System
  - Digital Library System

**19CS48C DATABASE MANAGEMENT SYSTEMS LABORATORY**

**L T P C  
0 0 3 1.5**

### **COURSE OUTCOMES**

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

- CO 1: generate the query using SQL commands. (K3)
- CO 2: develop PL/SQL programs to enhance the database activities using stored procedures, stored functions and triggers. (K3)
- CO 3: design and build No-SQL applications using Mongo-DB and Cassandra. (K3)

### **LIST OF EXPERIMENTS**

1. Database creation and use of DDL commands.
2. Perform DML commands.

3. Implement DCL/TCL commands.
4. Perform database operations using advanced queries like ORDER BY and GROUP BY.
5. Demonstrate all types of join operations for the given database schema.
6. Design all the appropriate normal forms for the given database schema.
7. Write a PL/SQL block to satisfy some constraints.
8. Create procedures in PL/SQL block.
9. Implement triggers in PL/SQL block.
10. Design a NoSQL database.

## SOFTWARE REQUIREMENTS

- Software tools: Oracle, MySQL, ERD plus
- GUI development: Python IDLE / JAVA/Visual C++

**P: 45; TOTAL: 45 PERIODS**

### Sample Question Bank (Exercises not limited to this)

1. Build the following database schemas and perform the manipulation operations on these schema using SQL DDL,DML,TCL and DCL commands.

#### I. Database Schema for a customer-sale scenario

Customer(**Cust id : integer**, cust\_name: string)

Item(**item id: integer**, item\_name: string, price: integer)

Sale(**bill no: integer**, bill\_date: date, cust\_id: integer, item\_id: integer, qty\_sold: integer)

For the above schema, perform the following:-

- a) Neatly sketch schema diagram and identify join relationship among tables.
- b) Create the tables with the appropriate integrity constraint Insert around 10 records in each of the tables
- c) List all the bills for the current date with the customer names and item numbers
- d) List the total Bill details with the quantity sold, price of the item and the final amount
- e) List the details of the customer who have bought a product which has a price>200
- f) Give a count of how many products have been bought by each customer
- g) Give a list of products bought by a customer having cust\_id as 5
- h) List the item details which are sold as of today
- i) Create a view which lists out the bill\_no, bill\_date, cust\_id, item\_id,price, qty\_sold, amount
- j) Create a view which lists the daily sales date wise for the last one week
- k) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema.

#### II. Database Schema for a Student Library scenario

Student(**Stud no : integer**, Stud\_name: string)

Membership(**Mem no: integer**, Stud\_no: integer)

Book(**book no: integer**, book\_name:string, author: string)

Iss\_rec(**iss no:integer**, iss\_date: date, Mem\_no: integer, book\_no: integer)

For the above schema, perform the following:-

- a) Neatly sketch schema diagram and identify join relationship among tables.
- b) Create the tables with the appropriate integrity constraints
- c) Insert around 10 records in each of the tables
- d) List all the student names with their membership numbers
- e) List all the issues for the current date with student and Book names

- f) List the details of students who borrowed book whose author is CJDATE
- g) Give a count of how many books have been bought by each student
- h) Give a list of books taken by student with stud\_no as 5
- i) List the book details which are issued as of today
- j) Create a view which lists out the iss\_no, iss\_date, stud\_name, book name
- k) Create a view which lists the daily issues-date wise for the last one week
- l) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema

### **III. Database Schema for a Employee-pay scenario**

employee(**emp\_id : integer**, emp\_name: string)  
department(**dept\_id: integer**, dept\_name:string)  
paydetails(emp\_id : integer, dept\_id: integer, basic: integer, deductions:integer, additions: integer, DOJ: date)  
payroll(emp\_id : integer, pay\_date: date)

For the above schema, perform the following:-

- a) Neatly sketch schema diagram and identify join relationship among tables.
- b) Create the tables with the appropriate integrity constraints
- c) Insert around 10 records in each of the tables
- d) List the employee details department wise
- e) List all the employee names who joined after particular date
- f) List the details of employees whose basic salary is between 10,000 and 20,000
- g) Give a count of how many employees are working in each department
- h) Give a names of the employees whose netsalary>10,000
- i) List the details for an employee\_id=5
- j) Create a view which lists out the emp\_name, department, basic, deductions, netsalary
- k) Create a view which lists the emp\_name and his netsalary
- l) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema.

### **IV. Database Schema for a Video Library scenario**

Customer(**cust\_no: integer**,cust\_name: string)  
Membership(**Mem\_no: integer**, cust\_no: integer)  
Cassette(**cass\_no:integer**, cass\_name:string, Language: String)  
Iss\_rec(**iss\_no: integer**, iss\_date: date, mem\_no: integer, cass\_no: integer)

For the above schema, perform the following:-

- a) Neatly sketch schema diagram and identify join relationship among tables.
- b) Create the tables with the appropriate integrity constraints
- c) Insert around 10 records in each of the tables
- d) List all the customer names with their membership numbers
- e) List all the issues for the current date with the customer names and cassette names
- f) List the details of the customer who has borrowed the cassette whose title is "The Legend"
- g) Give a count of how many cassettes have been borrowed by each customer
- h) Give a list of book which has been taken by the student with mem\_no as 5
- i) List the cassettes issues for today
- j) Create a view which lists outs the iss\_no, iss\_date, cust\_name,cass\_name
- k) Create a view which lists issues-date wise for the last one week
- l) Identify the normalization of this schema. Justify your answer. If the schema is not normalized then normalize the schema.

2. Draw the Entity-Relationship (ER) model for the following Schema using ERDplus software. Identify the entities, attributes and relationship exists between the entities in the schema. Clearly indicate the cardinality mappings as well as any role indicators in your ER diagram.

**I) Database Schema for a customer-sale scenario**

Customer(**Cust id : integer**, cust\_name: string)

Item(**item id: integer**, item\_name: string, price: integer)

Sale(**bill no: integer**, bill\_date: date, cust\_id: integer, item\_id: integer, qty\_sold: integer)

**II) Database Schema for a Student Library scenario**

Student(**Stud no : integer**, Stud\_name: string)

Membership(**Mem no: integer**, Stud\_no: integer)

Book(**book no: integer**, book\_name:string, author: string)

Iss\_rec(**iss no:integer**, iss\_date: date, Mem\_no: integer, book\_no: integer)

**III) Database Schema for a Employee-pay scenario**

employee(**emp id : integer**, emp\_name: string)

department(**dept id: integer**, dept\_name:string)

paydetails(emp\_id : integer, dept\_id: integer, basic: integer, deductions: integer, additions: integer, DOJ: date)

payroll(emp\_id : integer, pay\_date: date)

**IV) Database Schema for a Video Library scenario**

Customer(**cust no: integer**,cust\_name: string)

Membership(**Mem no: integer**, cust\_no: integer)

Cassette(**cass no:integer**, cass\_name:string, Language: String)

Iss\_rec(**iss no: integer**, iss\_date: date, mem\_no: integer, cass\_no: integer)

3. Demonstrate all types of join operations for the database schema for the exercise1 (I-IV)
- Inner Join
  - Left outer join
  - Right outer join
  - Full outer join
4. Demonstrate the concept of database connectivity with front end for the following application
- Make a SQL data base of student details and collaborate it with student semester performance and display each student performance individually.
  - Develop a Library management system, where indexing of book according to the author or alphabetical order can be done. Issuing of books to the student can be managed and searching of books.
5. Develop the PL/SQL programs based on the given constraints.
- Create a cursor, which displays list of products bought by a customer having cust\_id as 5.
  - Create a cursor, which displays names of employees whose basic salary is between 10,000 and 20,000.
6. Develop the PL/SQL programs to demonstrate the concept of procedure.
- Create a procedure to update the salaries of all employees 20% in their basic pay.
  - Create a procedure to demonstrate IN, OUT and INOUT parameters.
7. Develop the PL/SQL programs to demonstrate the concept of functions.

- (a) Create a function to find sum of salaries of all employees working in department id 10.
8. Construct a PL/SQL program to retrieve customer name whose customer\_id as 101 using %type and %rowtype attributes.
  9. Create a Trigger which comes into action when updating is performed onto the Employee table. The new action triggered is: Insertion of a row into the Employee History table which has all information in Employee table in addition to the date and time when the salary was updated in the original Employee table.
  10. Create a Trigger which comes into action when deletion is performed onto the Employee table. The new action triggered is: Insertion of a row into the Employee Resigned table which has all information in Employee table in addition to the date and time when the Employee was relieved from duty officially effecting the removal of his/her information from the Employee table.
  11. Create a Trigger which comes into action when insertion is performed onto the Employee table. The new action triggered is: Computation and Display of age of the new employee after the addition of new employee information into the Employee table.
  12. Create a database and collection using MongoDB environment. For example a document collection meant for analyzing Restaurant records can have fields like restaurant\_id, restaurant\_name, customer\_name, locality, date, cuisine, grade, comments. etc. Create database using INSERT, UPDATE, UPSERTS, DELETE and INDEX. Practice writing simple MongoDB queries such as displaying all the records, display selected records with conditions
  13. Create database in Casandra using – Create, Alter and Drop. Add records using Inset, Update, Delete and Truncate, Select records with specific conditions

**Miniproject:**

Design and build the following applications using SQL and front end tool and generate report

1. Student information system for your college.
2. Hospital Management System.
3. A video library management system.
4. Inventory management system for a hardware / sanitary item shop.
5. Banking System.
6. Railway Reservation System
7. Car Insurance Company

**19CS49C**

**NETWORKS LABORATORY**

**L T P C  
0 0 3 1.5**

**COURSE OUTCOMES**

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

- CO 1: describe the basic concept of computer networks and analyze the functionalities of the OSI model. (K2)
- CO 2: implement the various services of the data link layer. (K2)
- CO 3: instruct to design, troubleshooting, modeling and evaluation of computer networks commands and Protocols. (K2)

CO 4: design cryptographic algorithms for avoiding basic level threats.(K2)

CO 5: implement the working protocols of the higher level layer. (K3)

### LIST OF EXPERIMENTS:

1. Simulate the open system interconnection (OSI Layer model) model.
2. Configure a Network topology using network simulator.
3. Study of network devices and different types of network cables. Practically implement LAN using the cross-wired cable and straight through cable and clamping tool.
4. Implementation of Error Detection / Error Correction Techniques.
5. Design and develop a program for ARP and RARP protocols.
6. Simulation of TCP & UDP Performance using Simulation Tool.
7. Implement the Unicast routing protocol for finding the shortest path in a network.
8. Design and implement the conventional cryptographic algorithm (encryption and decryption) for secure communication.
9. Implement Chat application.

### HARDWARE & SOFTWARE REQUIREMENTS

1. Hardware Requirements: RJ-45 connector, Clamping Tool, Twisted Pair Cable.
2. Software Requirements:
  - Command Prompt and Simulation Tools
  - Turbo C++/ C /JAVA
  - OS – LINUX/ UNIX/Windows 2008/ Windows XP/ NT

**P: 45; TOTAL: 45 PERIODS**

### Sample Question Bank (Exercises not limited to this)

1. Simulate the open system interconnection (OSI Layer model) model that transmits a message from sender to receiver through different layers. At sender side, adds the appropriate header and trailer and receiver side removes the same.
2. Configure a Network topology using network simulator : Star ,Ring, Bus etc.
3. Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whois etc,.
4. Study of network devices and different types of network cables. Practically implement LAN using the cross-wired cable and straight through cable and clamping tool.
5. Implementation of the data link farming methods: Bit stuffing in a frame & Parity checking.
6. Implementation of Stop and Wait Protocol and Sliding Window Protocol. Implementation and study of Goback-N and selective repeat protocols
7. Implement the Distance Vector Routing protocol for finding the shortest path. Implement the Link state Routing protocol for finding the shortest path.
8. Alice and Bob want to communicate each other securely. Design the various encryption and decryption algorithm for their secure communication using following techniques ,
  - a.  $c = E(k, p) = (p + k) \bmod (26)$  &  $p = D(k, c) = (c - k) \bmod (26)$ .
  - b. Transposition the message using some keyword.
9.
  - a. Applications using TCP sockets like:  
Echo client and echo server , DNS ,SNMP & File Transfer



- b. Simulation of DNS using UDP sockets.
- 10 Implementation of concurrent chat server that allows current logged in users to communicate one with other.
- 11 Write a program to connect the server with the client and passes information from one system to another and vice versa that by creating / establishing a connection.

**19CS51C**

**JAVA PROGRAMMING**

**L T P C QP**

**3 1 0 4 A**

### **COURSE OUTCOMES**

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

- CO 1: apply object oriented concepts to solve real world problems (K3)
- CO 2: explore java I/O streams and compute various strings handling methods (K3)
- CO 3: develop effective applications using collection framework (K3)
- CO 4: create user interfaces using Swing concepts (K3)
- CO 5: build real time applications with JDBC and Struts (K3)

### **UNIT I JAVA BASICS**

**12**

OOPS Concepts-Java Programming Constructs - Objects and Classes - Methods - Constructors -Access Specifiers - Data Types – Variables – Operators - Control Statements – Arrays - Inheritance – Method Overloading and Overriding - Abstract Class – Interfaces– Packages – Access Modifiers

### **UNIT II STRINGS, I/O AND FILE OPERATIONS**

**12**

Strings – String methods – String Comparison – StringBuilder vs StringBuffer – Exception Handling – I/O Stream – Buffered Reader/Writer –FileInputStream – FileOutputStream – Threads : Life Cycle – Creating Thread Using Thread Class and Runnable Interface – Thread Priorities – Shutdown Hook –Suspending, Resuming and Stopping of Threads-Multi Threading

### **UNIT III COLLECTION FRAMEWORK**

**12**

Collection framework – Collection Class: ArrayList, HashMap, Set, LinkedList –Iterating Collection –Collection Interface: List, Map- Collections class – iterating a collection – Filter – Optional Class – Map operations – Flatmap operations –Regular Expression - sorting a collection using Comparable and Comparator Interface – Aggregation operations – min, max operations

### **UNIT IV SWING FRAMEWORK**

**12**

UI Controls (JLabel, JButton, JTextField, JPasswordField, JCheckBox, JRadioButton, JComboBox, JSpinner,JTable, JList, JOptionPane, JScrollBar, JMenuItem&JMenu, JProgressBar, JTabbedPane, JPanel, JScrollPane, JFrame) – Event Handling – ToolTip.

### **UNIT V JDBC**

**12**

JDBC Architecture – CRUD Operations using console application – CRUD Operations using Java Desktop Application– Struts: Introduction to Struts-Architecture Configuration-Actions-Interceptors-Result Type.

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

**TEXT BOOKS**

1. Anita Seth, B.L.Juneja, "JAVA one step ahead", Oxford University Press Publication, 2<sup>nd</sup> Edition, 2018.
2. Deitel H M and Deitel P I, "Java - How to Program", Pearson Education, New Delhi, 11<sup>th</sup> Edition, 2017.

**REFERENCES**

1. Herbert Schildt, "Java: The Complete Reference", 11<sup>th</sup> Edition, 2018.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume - I Fundamentals", Prentice Hall, 10<sup>th</sup> Edition, 2016.
3. Hortsman & Cornell, "CORE JAVA 2 Advanced Features – VOL-II", Pearson Education, 10<sup>th</sup> Edition, 2017.
4. Sachin Malhotra and Saurabh Choudhary," Programming in Java", Oxford University press, 2<sup>nd</sup> Edition, 2018.
5. Chunk Cavaness, "Programming Jakarta Struts", O'reilly media Publication, 2<sup>nd</sup> Edition, 2004.

**19CS52C****THEORY OF COMPUTATION****L T P C QP  
3 1 0 4 A****COURSE OUTCOMES**

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

CO1: prove the equivalence of regular expressions and finite automata. (K3)

CO2: acquire insights into the relationship among context free languages and context free grammars (K3)

CO3: construct and prove the equivalence of languages described by pushdown automata and context free grammars. (K3)

CO4: realize the concepts of turing machines and its construction methods. (K3)

CO5: recognize the concepts of undecidability and complexity theory. (K2)

**UNIT I FINITE AUTOMATA****12**

Introduction to Finite Automata (FA) – Basic notation and convention - Deterministic Finite Automata (DFA) – Nondeterministic Finite Automata (NFA) - Equivalence of NFA and DFA - NFA with  $\epsilon$  moves – Equivalence of NFA's with and without  $\epsilon$ -moves – Regular Expression (RE) – Equivalence of FA and REs – DFA minimization - Regular Language (RL) - Closure properties of RLs - Pumping Lemma for Regular sets – Proving languages not to be regular.

**UNIT II CONTEXT FREE GRAMMAR****12**

Context Free Grammar (CFG) - Derivations and Languages – Parse tree - Relationship between derivation and derivation trees - Ambiguity in CFG - Simplification of CFG - Normal forms - Chomsky Normal Form (CNF) - Greibach Normal Form (GNF) – Problems related to CNF and GNF - Pumping lemma for Context Free Language (CFL) - Examples of non-CFLs

### UNIT III            PUSHDOWN AUTOMATA

12

Pushdown Automata (PDA) - Moves – Instantaneous descriptions – Acceptance by empty stack – Conversion from PDA to CFG – Conversion from CFG to PDA – Problems - Closure properties of CFL – Deterministic CFL.

### UNIT IV            TURING MACHINES

12

Turing Machines (TM) - Configuration – Models – Computable languages and functions – Programming techniques for turing machine construction – Non deterministic turing machine- Configuration graphs.

### UNIT V            UNDECIDABILITY

12

Undecidability - Recursive and recursively enumerable languages - Encoding of turing machine -Halting problem – Reduction - Application of Reduction - Rice's Theorem - Introduction to Computational Complexity theory – class P & NP - NP complete problems.

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

### TEXT BOOKS

1. Peter Linz, "Introduction to Formal Languages and Automata", Jones & Bartlett Publisher, 6<sup>th</sup> Edition, 2016.
2. Michael Sipser, "Introduction to the Theory of Computation", Cengage Publisher, 3<sup>rd</sup> Edition, 2014.
3. S.Arora, B.Barak, "Computational Complexity: A Modern Approach", Cambridge University Press, 1<sup>st</sup> Edition, 2009.

### REFERENCES

1. J. Martin, "Introduction to Languages and the Theory of computation", Tata McGraw Hill, 3<sup>rd</sup> Edition, 2009.
2. Kamala Krithivasan and R.Rama, "Introduction to Formal Languages, Automata Theory and Computation" Pearson, 1<sup>st</sup> Edition, 2009.
3. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3<sup>rd</sup> Edition, 2008.
4. Thomas A. Sudkamp, "An Introduction to the Theory of Computer Science, Languages and Machines", Pearson Education, 3<sup>rd</sup> Edition, 2007.

### 19CS53C            PROFESSIONAL ETHICS AND HUMAN VALUES

**L T P C QP  
3 0 0 3 A**

### COURSE OUTCOMES

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

- CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
- CO2: Expose awareness on professional ethics. (K2)
- CO3: Analyze the engineering ethical breach from past study. (K2)
- CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)
- CO5: Discuss about the global issues with regard to ethics. (K2)

<b>UNIT I</b>	<b>HUMAN VALUES</b>	<b>9</b>
Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character – Spirituality.		
<b>UNIT II</b>	<b>ENGINEERING ETHICS</b>	<b>9</b>
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.		
<b>UNIT III</b>	<b>ENGINEERING AS SOCIAL EXPERIMENTATION</b>	<b>9</b>
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster.		
<b>UNIT IV</b>	<b>SAFETY, RESPONSIBILITIES AND RIGHTS</b>	<b>9</b>
Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster		
<b>UNIT V</b>	<b>GLOBAL ISSUES</b>	<b>9</b>
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility		

**L: 45 TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", 4<sup>th</sup> Edition, McGraw-Hill, New York 2017.
2. Govindarajan M, Natarajan S and Senthil Kumar VS, "Engineering Ethics", Prentice Hall of India, New Delhi, 2013.

#### **REFERENCES**

1. John R Boatright, "Ethics and the Conduct of Business", 4<sup>th</sup> Edition, Pearson Education, New Delhi, 2017.
2. Charles D and Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2012.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Fourth Edition, Wadsworth Thompson Learning, United States, 2005.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001.

<b>19CS54C</b>	<b>EMBEDDED SYSTEMS</b>	<b>L T P C QP</b>
		<b>3 0 0 3 A</b>

#### **COURSE OUTCOMES**

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

CO1: Understand the elements of Embedded System (K2)

CO2: Discuss the LPC2148 peripherals (K2)

CO3: Write simple interfacing program for LPC2148 peripherals (K2)

CO4: Understand the programming fundamentals of ARM programming (K2)

CO5: Write simple interfacing programs using python and Raspberry Pi (K2)

**UNIT I INTRODUCTION TO EMBEDDED SYSTEM 9**

Definition: Embedded system, Intelligent System, Expert system – software architecture, hardware Architecture; Embedded System design process–ARM Processor- CPU: Programming input and output-Supervisor mode, exception and traps Binary image creation from source file. Role of bootloader-significant of Device driver and Device tree

**UNIT II ARM ARCHITECTURE VARIANTS – FUNCTIONAL BLOCK DIAGRAM OF LPC 2148 9**

Functional Block diagram of internal peripherals: GPIO, UART, PWM, ADC, SPI-Bus Protocols: UART, I2C,SPI

**UNIT III ARM PROGRAMMING USING C 9**

Introduction to ARM programming environment - Interfacing program for LEDs and Switches - Serial IO interfacing (UART) – LCD interface - Motor Interfacing - Sensor Interfacing (Temperature, Pressure).

**UNIT IV ARDUINO FUNDAMENTALS AND PROGRAMMING 9**

Arduino IDE Overview-Operators in Arduino – Function Libraries – Control Statement – Loops – Arrays – String - Math library - Random Number – Interrupts – Integration of Sensors and Actuators with Arduino -sensor Interface with Arduino -Working model of Digital Humidity and Temperature Sensor – Basic Working Principle of Servo-Actuator – Case Study : Traffic Control System

**UNIT V EMBEDDED SYSTEM PROGRAMMING USING PYTHON 9**

Raspberry Pi Introduction - Raspberry Pi programming environment – Python Concepts: Arithmetic – flow control – loops. Lists- Strings – File handling – Functions – modules. Graphical programming – (GUI) – Simple Interfacing program

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Mark Siegesmund, “Embedded C Programming: Techniques and Applications of C and PIC MCUS”, An imprint from Elsevier, 1<sup>st</sup> Edition, 2014.
2. Charalampos Doukas, “Building Internet of Things with the Arduino (Volume 1)”, Create Space Independent Publishing Platform, 2015.
3. Alex Bradbury, Ben Everard, “Learning Python with Raspberry Pi”, John Wiley & Sons Ltd, 1<sup>st</sup> Edition, 2014.
4. Richard Blum Christine Bresnahan, “Python Programming for Raspberry Pi”, Sams Publishing, 2<sup>nd</sup> Edition, 2016.
5. www.arm.com- (LPC 2148 User manual)

**19CS55C      CRYPTOGRAPHY AND NETWORK SECURITY      L T P C QP**  
**3 0 0 3 A**

### **COURSE OUTCOMES**

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

- CO1: identify common network security vulnerabilities and attacks (K2).
- CO2: apply standard cryptographic algorithms to avoid basic level threats. (K3).
- CO3: comprehend the issues involved in hash functions, authentication applications and key management (K2).
- CO4: realize the importance of security practice and system security (K2).
- CO5: acquire the knowledge of internet security protocols.(K2).

### **UNIT I      INTRODUCTION AND CLASSICAL CRYPTOGRAPHY TECHNIQUES      9**

**Introduction:** Security Trends - OSI security architecture – Principles of Security- Security Attacks- Security services Security mechanisms - **Classical Encryption Techniques:** Substitution Ciphers - Transposition Ciphers- Steganography.

### **UNIT II      SYMMETRIC AND ASYMMETRIC KEY ALGORITHMS      9**

**Symmetric Key Algorithms:** Stream and Block Ciphers - Data Encryption Standards (DES) Advanced Encryption Standard (AES)-RC4.  
**Asymmetric Key Algorithms:** Rivest Shamir Adleman (RSA) algorithm - Elgamal Encryption Algorithm.

### **UNIT III      HASH FUNCTION, KEY MANAGEMENT AND AUTHENTICATION APPLICATIONS      9**

**Hash functions:** Message Digest 5(MD5) – Secure Hash Algorithm (SHA) - Digital signatures.**Key Management:** Distribution of Public Keys, Distribution of Secret Keys using Public-Key Cryptography -Diffie Hellman key Exchange.  
**Authentication Applications:** Kerberos-X.509 certificates - Public key infrastructure.

### **UNIT IV      NETWORK SECURITY      9**

**E-mail Security:** Pretty Good Privacy-S/MIME. **IP Security:** IP Security Architecture - Authentication Header- Encapsulation Security Payload (ESP). IP Security Key Management: Oakley Key Determination Protocol-Internet Security Association and Key Management Protocol (ISAKMP).**System Security:** Firewalls: Firewall Characteristics - Types of Firewalls - Firewall Configurations.

### **UNIT V      INTERNET SECURITY      9**

Secure Socket Layer (SSL) - Transport Layer Security (TLS) - Secure Hypertext Transfer Protocol (SHTTP) - Time Stamping Protocol (TSP) – Wireless Application Protocol (WAP) Security.

**L: 45; TOTAL: 45 PERIODS**

### **TEXT BOOKS**

1. William Stallings, "Cryptography and Network Security", Pearson Education, 7<sup>th</sup> Edition, 2017.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill Publishers, 3<sup>rd</sup> Edition, 2017.

## REFERENCES

1. B.A. Forouzan, “Cryptography & Network Security”, Tata Mc Graw Hill, 3<sup>rd</sup> Edition, 2016.
2. William Stallings,” Network Security Essentials: Applications and Standards”, Pearson Education, 6<sup>th</sup> Edition, 2018.
3. Eric Maiwald,” Fundamentals of Network Security”, Tata McGraw Hill, 1<sup>st</sup> Edition, 2017.

**19MC02C**

**CONSTITUTION OF INDIA**

**L T P C**

**3 0 0 0**

## COURSE OUTCOMES

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

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

### UNIT I INDIAN CONSTITUTION

**9**

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

### UNIT II PARLIAMENTARY SYSTEM

**9**

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

### UNIT III FEDERAL SYSTEM

**9**

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

### UNIT IV THE JUDICIARY

**9**

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

### UNIT V INTERNATIONAL POLITICS

**9**

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

**L: 45; TOTAL: 45 PERIODS**

## TEXT BOOKS

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

**REFERENCES**

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

**19CS56C****JAVA PROGRAMMING LABORATORY****L T P C****0 0 3 1.5****COURSE OUTCOMES**

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

- CO1: implement object oriented programming features such as Inheritance, interfaces, Polymorphism and exception handling for different scenarios (K2)
- CO2: design and develop GUI applications using AWT, Applet, Swing, collection framework and facilitate appropriate event handling facilities. (K3)
- CO3: design and develop web applications which communicate with database. (K3)

**LIST OF EXPERIMENTS**

1. Implementation of methods, classes, and inheritance concepts.
2. Exercises on interfaces and package concepts.
3. Exercises on string manipulation and exception handling.
4. Implementation of Multithreading concept
5. Exercises on file handling and stream concepts.
6. Implementation of event handling.
7. Exercises on swing components
8. Implementation of collection classes.
9. Development of database connectivity that displays a simple message on the screen.

**Mini Project to be developed for any one of the following applications**

Employee payroll calculation, Hospital Management, Bank Management, Library Management, Attendance Calculation, Grade sheet Calculation, Railway Reservation System, Electricity Bill generation, Inventory Control System, ATM System etc.,

**SOFTWARE REQUIREMENTS**

1. Front end: JAVA, IDE: Net beans / Eclipse
2. Back end: Oracle

**P: 45; TOTAL: 45 PERIODS****Sample Question Bank (Exercises not limited to this)**

1. Write a program to define a class for a student result processing system.
2. Write a Java program to sort an array of positive integers of a given array, in the sorted array the value of the first element should be maximum, second value should



be minimum value, third should be second maximum, fourth second be second minimum and so on.

3. Write a Java Program to create a class named StudentInfo with the following data members (i)name (ii)address (iii) branch (iv)department

Method: (i)display() to show the student details

Derive a subclass from the super class and name it StudeentRegular.Further,extend this class and create another class StudentETC that will inherit the methods and variables of class StudentInfo and having the following data Members (i)marks (ii)attendance

Method:display() to show marks and attendance along with other details.

4. Demonstrate a program for method overloading. Consider the different types of transaction modes used for transferring money. (Credit card, Debit card, Net banking etc).
5. Develop an abstract class Reservation which has an abstract method called Reserve(). Derive the sub-classes ReserveTrain and ReserveBus classes from Reservation and implement the abstract method Reserve(). The class Reservation has a default constructor to initialize the member variables source, destination. The subclasses have to get the no of passengers and amount during the implementation of abstract method.
6. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
7. Develop a program for banking application with exception handling. Handle the exceptions in following cases:
  - Account balance <1000
  - Withdrawal amount is greater than balance amount
  - Transaction count exceeds 3
  - One day transaction exceeds 1 lakh.
8. Write a Java Program in which two threads with names A and B play a random number generation game. The one who generates the maximum is the winner. The program should declare the winner.
9. Write a Java Program in which a particular text is stored in a string buffer and find the number of times the specified characters appear in the string and print the total number of these letters. Then replace all letters 'a' appearing in the string with letters 'e' in the string contained in the string buffer.
10. Write an applet Program to show a person walking.(Hint: Make 4 to 5 images showing different aspects of walking and show the images one after another with a delay of 1/30 of a second)

11. Write a java program that handles all mouse events and shows the event name at the center of the window when mouse event is fired (Use Adapter Classes).
12. Write a Program using Swing to construct a table of class timetable for a week with 5 subjects, 3 hours per subject per week, and 5 labs with 2 hours per week. The class works for 5 days 5 hours per day.
13. Develop a JDBC application in which the records of table 'WeatherDetail' are updated in a batch. The table is having the fields State, Maximum Temperature, Minimum Temperature, These records describe the weather conditions of states in a particular country.
14. Develop a Java Program using Maps in which You are given a phone book that consists of people's names and their phone number. After that you will be given some person's name as query. For each query, print the phone number of that person.
 

**Input Format** The first line will have an integer denoting the number of entries in the phone book. Each entry consists of two lines: a name and the corresponding phone number. After these, there will be some queries. Each query will contain a person's name. Read the queries until end-of-file.

**Constraints:** A person's name consists of only lower-case English letters and it may be in the format 'first-name last-name' or in the format 'first-name'. Each phone number has exactly 10 digits without any leading zeros. For each case, print "Not found" if the person has no entry in the phone book. Otherwise, print the person's name and phone number.
15. Write a program to develop a login validation form using struts.
16. Develop a mini project for any one application using Java concepts.

**19CS57C          EMBEDDED SYSTEMS LABORATORY**

**L T P C**  
**0 0 3 1.5**

### **COURSE OUTCOMES**

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

- CO1: Work with Arduino chipset for interfacing external sensors. (K3)
- CO2: Work with ARM chipset for interfacing external sensors. (K3)
- CO3: Work with Raspberry pi chipset for interfacing external sensors. (K3)

### **LIST OF EXPERIMENTS**

#### **I. Arduino Experiments**

1. LCD Display Interfacing
2. IR Sensor Interfacing
3. PIR Sensor Interfacing
4. I<sup>2</sup>C Communication

#### **II. ARM LPC2148 Interfacing Experiments**

1. PWM – LED Interfacing
2. Switches – Buzzer Interfacing
3. Motor Interface

#### 4. LCD Display Interfacing

### III. Raspberry Pi Interfacing Experiments

1. Distance Measurement using HCSR 04 Sensor.
2. Temperature measurement using DHT11 sensor
3. Pressure measurement using BMP280 sensor
4. Analog sensor interfacing using LM35D and ADC080
5. Onboard webserver for External Communication

**P: 45; TOTAL: 45 PERIODS**

**19CS58C CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY L T P C  
0 0 2 1**

### COURSE OUTCOMES

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

- CO1: explore the classic cryptographic techniques and algorithms to encipher the plain text. (K3)
- CO2: experiment security algorithms with efficiently implement key exchange algorithm and hashing techniques (K2).
- CO3: configure the secure shell (SSH) for providing secure environment. (K3).
- CO4: perform basic protocol data unit (PDU) capture, analysis and display filtering using wireshark features. (K3)

### LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
  - a) Ceaser Cipher
  - b) Substitution Cipher
  - c) Hill Cipher
  - d) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
  - a) Rail fence
  - b) Row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement the Diffie-Hellman Key Exchange algorithm to use insecure email to agree on a secret "shared key" and further encryption for a long message.
6. Calculate the message digest of a text using the SHA-1 algorithm and implement the hash code using MD5.
7. Authentication using Digital Signature Algorithm - Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the Configured parameters.
8. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
9. Perform basic PDU capture, analysis and display filtering for a simple scenario using Wireshark.

10. Examine how networking packets are transferred and exchanged in a TCP/IP network. Student will develop an understanding of the protocols in packets transfer and corresponding protocols like Address Resolution Protocol (ARP), and Internet Control Message Protocol (ICMP) using Wireshark software.
11. Demonstrate Intrusion Detection System (IDS) using any tool eg. Snort or any other s/w.

**Mini Project to be developed for any one of the following applications**

1. Sniffing for Passwords.
2. Sniffing HTTP Traffic
3. Analysis of RTP Packet Delay and Loss
4. Employee website monitoring using packet analysis.
5. Network Intrusion Detection using Pattern Matching.

**SOFTWARE REQUIREMENTS**

1. Operating System - Linux (Ubuntu)
2. Wireshark
3. Snort

**P: 30; TOTAL: 30 PERIODS**

**Sample Question Bank (Exercises not limited to this)**

1. a. Alice meets Bob and Says “jrg lv juhdw”. If she is using Caesar Cipher with key 29, what does she want to convey? Implement this using C Program.
- b. Alice meets Bob and Says “efgfoe uif fbtu xbm pg uif dbtumf”. If she is using Caesar Cipher with key 131, what does she want to convey? Implement this using C Program.
- c. Consider a scheme involving the replacement of alphabets as follows.

Original	a	b	c	.....	x	Y	Z
Changed to	z	y	x	.....	c	B	A

If Alice sends a message “hznzig xrgb uli z hznzig kozmvg”, what should Bob infer from this? Implement this using C Program.

- d. Consider a scheme involving the replacement of alphabets as follows.

Plaintext Alphabet	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
Ciphertext Alphabet	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A

If Alice sends a message “B TJNQMF NFTTBHF”, what should Bob infer from this? Implement this using C Program.

- e. Using the vignere cipher encrypts the word “explanation” using the key “leg”. Also decrypt the same. Implement this using C Program.
- f. Using the vignere cipher encrypts the word “life is full of surprises” using the key “health”. Also decrypt the same. Implement this using C Program.
- g. Solve using playfair cipher. Encrypt the word “Semester Result” with the keyword “Examination”. Implement this using C Program.
- h. Use the playfair cipher to encipher the message, “Attack Cancelled on MONDAY. Wait for next message” with the keyword “MORNING”. Implement this using C Program.

- i. Encrypt the following using play fair cipher using the keyword MONARCHY. "SWARAJ IS MY BIRTH RIGHT". Implement this using C Program.
2. Implement the key generation of Simple DES algorithm using C. Consider the 10 bit key input is '1000010000'. Generate two keys each of size 8 bits. The P10 box will do the permutation in the order 2,4,6,8,10,1,3,5,7,9. Also The P8 box will do the permutation in the order 1,5,7,9,2,3,8,10.
3. Perform encryption and decryption using the RSA algorithm for the following. Implement this using C Program.
  - a)  $p=17$ ;  $q=31$ ,  $e=7$ ;  $M=2$
  - b)  $p=11$ ;  $q=13$ ,  $e=11$ ;  $M=7$
4. Given the message 09810461, how to decode it using RSA algorithm with  $p=43$ ,  $q=59$  and  $e=13$ . Implement this using C Program.
5. Consider the key generation of AES algorithm. Suppose the round key for round 8 is "EA D2 73 21 B5 8D BA D2 31 2B F5 60 7F 8D 29 2F". Find the round key for round 9? Implement this using C.

	00	01	02	03	04	05	06	07	08	09	0a	0b	0c	0d	0e	0f
00	63	7c	77	7b	f2	6b	6f	c5	30	01	67	2b	fe	d7	ab	76
10	ca	82	c9	7d	fa	59	47	f0	ad	d4	a2	af	9c	a4	72	c0
20	b7	fd	93	26	36	3f	f7	cc	34	a5	e5	f1	71	d8	31	15
30	04	c7	23	c3	18	96	05	9a	07	12	80	e2	eb	27	b2	75
40	09	83	2c	1a	1b	6e	5a	a0	52	3b	d6	b3	29	e3	2f	84
50	53	d1	00	ed	20	fc	b1	5b	6a	cb	be	39	4a	4c	58	cf
60	d0	ef	aa	fb	43	4d	33	85	45	f9	02	7f	50	3c	9f	a8
70	51	a3	40	8f	92	9d	38	f5	bc	b6	da	21	10	ff	f3	d2
80	cd	0c	13	ec	5f	97	44	17	c4	a7	7e	3d	64	5d	19	73
90	60	81	4f	dc	22	2a	90	88	46	ee	b8	14	de	5e	0b	db
a0	e0	32	3a	0a	49	06	24	5c	c2	d3	ac	62	91	95	e4	79
b0	e7	c8	37	6d	8d	d5	4e	a9	6c	56	f4	ea	65	7a	ae	08
c0	ba	78	25	2e	1c	a6	b4	c6	e8	dd	74	1f	4b	bd	8b	8a
d0	70	3e	b5	66	48	03	f6	0e	61	35	57	b9	86	c1	1d	9e
e0	e1	f8	98	11	69	d9	8e	94	9b	1e	87	e9	ce	55	28	df
f0	8c	a1	89	0d	bf	e6	42	68	41	99	2d	0f	b0	54	bb	16

Round	Constant(Rcon)	Round	Constant(Rcon)
1	01 00 00 00	6	20 00 00 00
2	02 00 00 00	7	40 00 00 00
3	04 00 00 00	8	80 00 00 00
4	08 00 00 00	9	1B 00 00 00
5	10 00 00 00	10	36 00 00 00

6. User A and B uses the Diffie-Hellman key exchange technique with a common prime  $q=71$  and a primitive root  $\alpha = 7$ . If user A has private key  $X_A=5$ , what is A's public key  $Y_A$ ? If user B has private key  $X_B=12$  what is B's public key  $Y_B$ ? What is the shared secret key? Implement this using C
7. Consider the prime number 37 and its primitive root is 13. Alice chooses her private key is 10 and bob chooses his private key is 7. Apply Diffie Hellman algorithm to find out the secret key exchanged between Alice and Bob. Implement this using C.
8. User A and B uses the Diffie-Hellman key exchange technique with a common prime  $q=11$  and a primitive root  $\alpha = 7$ . If user A has private key  $X_A=3$ , what is A's public key  $Y_A$ ? If user B has private key  $X_B=6$  what is B's public key  $Y_B$ ? What is the shared secret key? Implement this using C..
9. Consider the input message of size 500 characters. Generate hash value of this message using 128 bit hash generation algorithm. It is decided to change the last 20 characters in the original message. How many bits in the digest/hash will change? Implement this using C.
10. Consider the input message of size 200 characters. Generate hash value of this message using 160 bit hash generation algorithm. It is decided to change the last 10



- Craig Larman, "Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and Iterative Development", Pearson Education, 3<sup>rd</sup> Edition, 2008.

**19CS62C**

**PRINCIPLES OF COMPILER DESIGN**

**L T P C QP**

**3 0 2 4 A**

### **COURSE OUTCOMES**

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

- CO 1: design a lexical analyzer for a simple language (K3)
- CO 2: apply different parsing algorithms to develop the parsers for a given grammar (K3)
- CO 3: generate three address codes for a simple program (K3)
- CO 4: optimize the source code using suitable code optimization techniques (K3)
- CO 5: implement the back-end of the compiler (K3)

### **UNIT I LEXICAL ANALYSIS**

**15**

Introduction to Compiler - Analysis of the source program - The phases – Cousins - The grouping of phases - Compiler construction tools. The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens – Develop a lexical analyzer to recognize a few patterns in C - Create a symbol table, while recognizing identifiers - Implementation of Lexical Analyzer using Lex Tool.

### **UNIT II SYNTAX ANALYSIS**

**15**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General - Strategies - Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - CLR Parser - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC- Implementation of Arithmetic Calculator using LEX and YACC.

### **UNIT III INTERMEDIATE CODE GENERATION**

**15**

Intermediate languages – Declarative Statement - Assignment statements - Boolean expressions - Case statements - Backpatching - Procedure calls - Generate three address code for a simple program using LEX and YACC.

### **UNIT IV CODE OPTIMIZATION**

**15**

Introduction - The principle sources of optimization - Peephole optimization - Optimization of basic blocks - Loops in flow graphs - Introduction to global data-flow analysis - Code improving transformations – Implementation of simple code optimization techniques.

### **UNIT V CODE GENERATION**

**15**

Issues in the design of a code generator - The target machine - Run-time storage management - Basic blocks and flow graphs - Next-use information - A simple code generator - Register allocation and assignment - The Directed Acyclic Graph (DAG) representation of basic blocks - Generating code from DAGs – Implementation of back-

end of the compiler (three address code is given as input and the 8086 assembly language code is produced as output).

**L: 45; P: 30; TOTAL: 75 PERIODS**

### TEXT BOOK

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D.Ullman, Compilers: Principles, Techniques and Tool, Pearson Education, 2<sup>nd</sup> Edition (Reprint), 2013.

### REFERENCES

1. K.Muneeswaran, "Compiler Design", Oxford University Press, 1<sup>st</sup> Edition, 2013.
2. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 1<sup>st</sup> Edition, 2017.
3. C.N.Fisher, R.J.LeBlanc "Crafting a Compiler with C", Pearson Education, 3<sup>rd</sup> Edition, 2010.
4. Steven S. Muchnick, "Advanced Compiler Design & Implementation", Morgan Kaufmann Publishers, Elsevier India, 1<sup>st</sup> Edition, 2008.
5. Seth D. Bergmann, "Compiler Design: Theory, Tools, and Examples", William C Brown Pub, 2016.
6. <https://rdw.rowan.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1001&context=oer>.
7. <http://dinosaur.compilertools.net>
8. <http://epaperpress.com/lexandyacc>

**19CS63C**

**INTERNET AND WEB TECHNOLOGY**

**L T P C QP  
3 0 0 3 A**

### COURSE OUTCOMES

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

- CO1: construct a website using HTML and Cascading Style Sheets. (K3)
- CO2: build dynamic web page with validation using Java Script and AngularJS. (K3)
- CO3: develop and deploy an Enterprise Application. (K3)
- CO4: design a web page in PHP and present the data in XML format. (K3)
- CO5: acquire knowledge in AJAX and web services. (K2)

### UNIT I INTRODUCTION, HTML 5.0 AND CSS 3.0

**9**

**Web Essentials:** Clients, Servers and Communication – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5: Tables – Lists – Image- Frames - Forms - control elements – CSS3- Inline, embedded and external style sheets – Rule cascading – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations – CSS Flex Property.

### UNIT II CLIENT SIDE SCRIPTING

**9**

**Java script:** Introduction- Control statements- Functions- Objects- Event handling- Form Validation - Document Object Model (DOM) - Async/Await-Promises. **AngularJS:** Introduction – Directives - Expressions-Controllers- Filters - Tables- Form validation.



**UNIT III SERVER SIDE SCRIPTING 9**

**Servlets:** Java Servlet Architecture- Servlet Life Cycle- GET and POST Methods- Session Handling – Cookies. **Java Server Pages (JSP):** Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

**UNIT IV PHP AND XML 9**

**PHP:** Introduction - Variables- Program control- Built-in functions-Connecting to Database –Cookies-Regular Expressions; **XML:** Basics - Document Type Definition- XML Schema - DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation.

**UNIT V AJAX AND WEB SERVICE 9**

**AJAX:** Client Server Architecture-XML Http Request Object- Call Back Methods; **Web Services:** Introduction- Java web services -Basics – Creating, Publishing, Testing and Describing a Web services – Web Services Description Language -Consuming a web service, Database Driven web service from an application –SOAP - REST.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Paul Deitel, Harvey Dietel and Abbey deitel, “Internet and World Wide Web-How to Program”, Prentice Hall, 5<sup>th</sup> Edition, 2018.
2. Brad Dayley, “Learning AngularJS”, Addison-wesley professional, 1<sup>st</sup> Edition,2014.

**REFERENCES**

1. Chris Bates, “Web Programming – Building Intranet Applications”, Wiley Publications, 3<sup>rd</sup> Edition, 2018.
2. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2<sup>nd</sup> Edition, 2014.
3. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, “Mastering HTML, CSS & Javascript Web Publishing”, BPB Publications, 1<sup>st</sup> Edition, 2016.

**19CS64C**

**BUSINESS PROCESS MANAGEMENT**

**L T P C QP**

**2 0 0 2 B**

**COURSE OUTCOMES**

Upon completion of this course the students will be able to

- CO 1: define the required processes and able to identify process improvement opportunities / strategies. (K2)
- CO 2: plan a BPM strategy for an organization. (K3)
- CO 3: propose business solutions in written and verbal forms for process innovation and redesign Projects. (K2)
- CO 4: explain the role of Information Technology and other resources in BPM. (K2)
- CO 5: synthesis the principles of organizational strategy and process design. (K2)

<b>UNIT I</b>	<b>INTRODUCTION TO BUSINESS PROCESS MANAGEMENT</b>	<b>6</b>
Ingredients of Business Process, BPM Life Cycle, Process Identification – The context of process identification, Definition of the process architecture, process selection.		
<b>UNIT II</b>	<b>PROCESS MODELING</b>	<b>6</b>
Essential Process Modeling – First Steps with BPMN, Branching and merging, Business Objects, Resources, Process decomposition, Process model reuse.		
<b>UNIT III</b>	<b>ADVANCED PROCESS MODELING</b>	<b>6</b>
Rework and repetition, Handling events, Handling exceptions, Process and Business rules. Process Discovery - The setting of process discovery, process discovery methods, process modeling methods.		
<b>UNIT IV</b>	<b>QUALITATIVE AND QUANTITATIVE PROCESS ANALYSIS</b>	<b>6</b>
Value added analysis, waste analysis, stakeholder analysis and issue documentation, root cause analysis. Flow analysis, Queues, Simulation.		
<b>UNIT V</b>	<b>PROCESS AWARE INFORMATION SYSTEM</b>	<b>6</b>
Types of Process Aware Information System, Advantages of Introducing a BPMS, Challenges of Introducing a BPMS. Process implementation with executable models.		

**L: 30; TOTAL: 30 PERIODS**

#### **TEXT BOOKS**

1. Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, “Fundamentals of Business Process Management”, 2<sup>nd</sup> Edition, Springer, 2018.
2. Akhil Kumar, “Business Process Management”, 1<sup>st</sup> Edition, Routledge, 2018.

#### **REFERENCES**

1. Carl F. Lehmann, “Strategy and Business Process Management: Techniques for Improving Execution, Adaptability, and Consistency”, CRC Press, 2016.
2. John Jeston, Johan Nelis, “Business Process Management”, 3<sup>rd</sup> Edition, Routledge, 2014.
3. Van der Aalst, Wil, “Process Mining: Data Science in Action”, 2<sup>nd</sup> Edition, Springer 2016.

<b>19CS65C</b>	<b>INTERNET AND WEB TECHNOLOGY LABORATORY</b>	<b>L T P C</b>
		<b>0 0 3 1.5</b>

#### **COURSE OUTCOMES**

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

- CO1: create website using HTML and style sheets. (K3)
- CO 2: design interactive web pages using javascript and angularJS. (K3)
- CO 3: develop and deploy a web application using PHP, JSP and servlet.(K3)

#### **LIST OF EXPERIMENTS**

1. Web Page Creation using HTML5 and CSS3

2. Implement BMI calculator using javascript.
3. Client Side Scripts for Validating Web Form Controls using javascript.
4. Perform temperature conversion using angularJs.
5. Working with directives concept using angularJs.
6. Validate the form using PHP regular expression.
7. Store a form data into database using PHP
8. Programs using XML and XSLT.
9. Create three-tier applications using JSP and Databases.
10. Invoking servlets from HTML forms.

**Mini Project to be developed for any one of the following applications**

1. Examination Result Analysis System.
2. Create a technical blog for hosting the symposium related information.
3. Design and simulate a digital wallet platform (Google pay) and online payment system enabling people to make payments.
4. Leave Application Management System.
5. Create a discussion forum for online health consultation website.
6. Online old Books dealer Portal.
7. E Commerce for Online Medicine Shopping.

**SOFTWARE REQUIREMENTS**

1. HTML5
2. Java, IDE: Net beans / Eclipse
3. JSP
4. WAMPP
5. XML editor
6. Oracle, mysql

**P: 45; TOTAL: 45 PERIODS**

**Sample Question Bank (Exercises not limited to this)**

- 1a. **Create a web page with the following using HTML**
  - a. To embed a map in a web page
  - b. To fix the hot spots in that map
  - c. Show all the related information when the hot spots are clicked.
- 1b. **Create a web page with the following.**
  - a. Cascading style sheets.
  - b. Embedded style sheets.
  - c. Inline style sheets.Use our college information for the web pages.
2. **BMI Calculator:** The following HTML snippet shows the skeleton of a BMI calculator. Write the calculate() function that takes the weight and height in the text boxes and displays the BMI in the span with the id of "score." You may find the compute BMI function in the Compute BMI exercise helpful for this task. You should also describe the person's body type based on their BMI score using the

following criteria:

- Underweight: < 18
- Normal: 18 – 25
- Overweight: 25 – 30
- Obese: > 30.

The person's body type should be displayed in the span with the id of "type" and you may assume valid input into the text boxes.

3. **Design a HTML document to collect feedback from participants after attending a Technical workshop using HTML forms and validate the same using javascript.**

The form should contain text boxes, radio button, option button, text area and Submit button. Display the information accepted in a formatted form. After submitting the form, it should be validated and display the message "Thanks for your feedback".

4. **Create a temperature converter using HTML and angularJS.**  
 5. **Consider a use case where we need an HTML structure to display movie titles.**

The HTML snippet looks like this:

```
<div class="movie">
  <div class="title">
    Movie Title
  </div>
  <div class="movie">
    Movie name
  </div>
</div>
```

The code given above seems rich in terms of CSS classes and HTML tags, but the code is not repeatable. In a case where multiple movies will need to be displayed, this code structure would become messy. Use directives in angularJs to resolve the problem.

6. **Design a web page for Online aadhaar registration with various HTML components.**

The form should collect the Pre-Enrolment ID, NPR receipt, FullName, District in textboxes, Address using text area and Gender using radio Button. Develop a PHP script to receive the aadhar registration details and store it into a table.

7. **Implement the following web application using PHP.**

A user validation web application, where user submits the login name and password to server. These are checked against the data already available in database and if the data matches a successful login page is returned. Otherwise a failure message is shown to the user.

8. **Create and save an XML document at the server, which contains ten users information.**

Write a program which takes User Id as input and returns the user details by taking the user information from the XML document.

9. **Develop a JSP code to perform the following job.**

Insert the details of the three or four users who register with the web site by using

registration form. Authenticate the user when he submits the login form using the user name and password from the database.

10. **Design a web page for an Email Registration Form with various HTML components.** Develop a Servlet application to receive the email registration information and store the details into a table. If passwords are mismatch then display the message “Enter a Correct password” and provide a link to the Registration form for reentering the details again.

<b>19CS66C</b>	<b>COMPREHENSION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **COURSE OUTCOMES**

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

- CO1: Enhance the comprehensive knowledge for attending interviews and competitive exams. (K4)
- CO2: Pursue their higher education and research. (K3)
- CO3: Undergo entrance exams such as GATE, GMAT. (K3)
- CO4: Demonstrate the comprehensive knowledge being acquired through core engineering courses. (K3)
- CO5: Develop logical and analytical skills to ensure on campus placement. (K4)

### **COURSE CONTENT AND LAYOUT**

The students will be engaged to review the fundamental core courses also based on their area of interest, they can select any 2 courses under below Special Interest Group (SIG)

### **FUNDAMENTAL CORE COURSES**

The highlights of the following core courses will be reviewed through Aptitude Test and Mock interviews to improve their competency

- Data Structures and Algorithms
- Compiler Design
- Digital Logic Design
- C , C++ and JAVA Programming
- Computer Networks
- Operating System
- Computer Organization and Architecture
- Database Management Systems
- Software Engineering

### **SPECIAL INTEREST GROUPING**

To bring deeper understanding and exchange information among special interest groups ( not limited) by concentrating on any two area of specializations as listed below

- Angular JS
- Web Technology

- Social Networks
  - Distributed Computing
  - Advanced Database Technology
  - Data Warehouse and Data Mining
  - Artificial Intelligence
  - Deep Learning
- The staff-coordinator is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
  - The technical seminars and group discussions will be assisted by subject experts in the department.
  - Each student must participate in all the activities and their performance assessment must be recorded.

**P: 30; TOTAL: 30 PERIODS**

## REFERENCES

1. Dr.R.S.Aggarwal, "Quantitative Aptitude for Competitive Examinations", S Chand Publications, New Delhi, 2017.
2. Herbert Schildt, "Java: A Beginner's Guide", 8<sup>th</sup> Edition, McGraw-Hill Education, 2018.
3. Thomas Anderson and Michael Dahlin, "Operating Systems: Principles and Practice (Volume 1 of 4)", Recursive Books, 2<sup>nd</sup> Edition, 2015.
4. Gerardus Blokdyk, "DBMS Management A Complete Guide", 5STARCOOKS, 2020 Edition, 2021.
5. Roger Pressman & Bruce Maxim, "ISE SOFTWARE ENGINEERING: A PRACTITIONERS APPROACH", McGraw-Hill Education, 9<sup>th</sup> Edition, 2019.
6. Shakuntala Devi, "Puzzles To Puzzle To You" Orient Paperbacks, 1<sup>st</sup> Edition, 2005.

## ASSESSMENT PROCEDURE

- The staff-coordinator per group is responsible for scheduling the session plans, monitoring the activities and recording the continual assessments.
- The technical seminars, group discussions and comprehensive viva will be conducted and assisted by subject experts in the department.
  1. Technical Seminars: Each student will be required to make one technical presentation for minimum 15 minutes duration in this course. Individual topics will be assigned to the students by the department.
  2. Group Discussion: Assessment must focus on evaluating Teamspirit and Body Language of student's participation
  3. Comprehensive Viva: Viva should be handled on their area of interest in both written / oral mode
- Each student must participate in the suggested activities and their performance assessment must be recorded

## Suggested Activities for improving placements:

### 1. Written Test:

- a. Verbal

- Synonyms
  - Antonyms
  - Sentence completion
  - Passage writing
- b. Aptitude
- Quantitative and Logical
- c. Analytical
- Critical Reasoning

## **2. Mock Interviews:**

### *a. Pure HR Panel*

- Communication Skills
- Attitude
- Interpersonal Skills
- Openness to learn
- Eligibility Check
- Stresstest
- Co-curricular achievements
- Extra-curricular achievements

### *b. Management Interview*

- Industry Orientation
- Industry Trends
- Career Goals
- Adaptability
- Culture Fitment

### *c. TechPanel:*

- Programming languages you know about.
- Data Structures
- Project related
- Subject Knowledge
- Practical applicability of basic concepts
- Certifications
- Problem Solving

## **Suggested Activities for Encouraging Higher Studies**

### **1. Mock GATE Examination**

- Solving previous year question papers
- Objective type test for Aptitude and Verbal practices.

### **2. Technical Review (Suggested to practice any Two Interview process)**

#### **Set one Interview Process**

#### **Written Test procedure:**

1. Verbal – Synonyms, Antonyms, Sentence completion & passage

2. Aptitude – Quantitative and Logical reasoning, Old TCS questions
3. Analytical – Critical Reasoning - Refer Barron's GRE

**Technical interview procedure:**

- **Technical interview:** C, C++ & java. And interviewer will ask the questions based on your Area of Interest
- **HR interview:** It will be like stress interview. There is a possibility for asking the technical questions. But technical questions will ask to test the patience and coolness of a candidate. Some interviewer asks questions rapidly. Sometimes candidate will be asked to talk about current affairs.

<b>Round 1:</b>	<b>AMCAT ONLINE TEST</b>	computer programming, quantitative, logical and verbal
<b>Round 2:</b>	<b>TECHNICAL HR</b>	In this round, there will be one HR, face to face process. Only way to clear this round SPEAK SPEAKSPEAK. Be confident and maintain eye contact
<b>Round 3:</b>	<b>FINAL HR</b>	<i>It took around 10 min...There were 2HRs – Personal Questions</i>

**Set Two Interview Process**

**Set Three Interview Process**

**1. Written Test procedure:**

- Verbal – Synonyms, Antonyms, Sentence completion & passage
- Aptitude – Quantitative and Logical reasoning, Old TCS questions
- Analytical - Critical Reasoning - Refer Barron'sGRE

**2. Group Discussion :** A GD is a methodology used by an organization to gauge whether the candidate has certain personality traits and/or skills (Communication skills, Interpersonal Skills, Leadership Skills, Motivational Skills, Team Building Skills)

**3. HR Interview:** Both Technical and personal Interview



19CS67C

PRODUCT DEVELOPMENT LABORATORY

L T P C

1 0 2 2

### COURSE OUTCOMES

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

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

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

### UNIT I                    NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION                    20

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

### UNIT II                    PROTOTYPING AND DEMONSTRATION                    25

Prototype development and demonstration - cost estimation - product documentation

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

### REFERENCES

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

### Mentor Activities

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

### End semester Assessments can be made through

- Product demonstration and presentation

### Other points

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

**19CS71C                      RESEARCH PAPER AND PATENT REVIEW – SEMINAR                      L T P C**  
**0 0 2 1**

**COURSE OUTCOMES**

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

- CO1: understand the emerging technology / research development in the engineering Field (K2)
- CO2: acquaint with the concepts published in reputed journals on their area of interest (K2)
- CO3: examine patents and procedures available in the data base. (K3)
- CO4: effectively communicate the contents to the target audience and handle the questions with confidence (K3)
- CO5: Check for patent plagiarism (K2)

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

**P: 30 TOTAL: 30 PERIODS**

**19CS72C    PROJECT WORK – I    L T P C**  
**0 0 6 3**

**COURSE OUTCOMES**

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

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

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

**P: 45; TOTAL: 45 PERIODS**

**19CS81C**

**PROJECT WORK – II**

**L T P C**  
**0 0 12 6**

**COURSE OUTCOMES**

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

CO1: design and develop the working model (K3)

CO2: work independently to complete the project along with team members (K2)

CO3: demonstrate the results and documents the report (K4)

**Project work shall be based on any of the following:**

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

**P: 180; TOTAL: 180 PERIODS**

**19CS82C**

**INTERNSHIP / IN-PLANT TRAINING**

**L T P C**  
**0 0 4 2**

**COURSE OUTCOMES**

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

CO1: acquire the knowledge of different industrial / organizational activities (K2)

CO2: document the work and communicate effectively through technical presentation (K2)

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

**P : 60; TOTAL : 60 PERIODS**

<b>19CS01E</b>	<b>DATA VIRTUALIZATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Recognize the needs of data virtualization, virtual data services and data Virtualization solutions.(K2)
- CO2: Realize the concepts of exploratory data analysis. (K2)
- CO3: Apply the data virtualization concepts in information management and data governance.(K3)
- CO4: Acquire insights into the relationship among data virtualization and Business agility.(K2)
- CO5: Explore the storage virtualization concepts. (K3)

**UNIT I INTRODUCTION 9**

Data Virtualization: Introduction, challenges - Building virtual data services, General architectural framework – Data Abstraction Layer –Platforms – Key Capabilities - Data integration – Solutions.

**UNIT II EXPLORATORY DATA ANALYSIS 9**

Incorrect Data and Data Quality, Complex and Irregular Data Structures, Implementing Transformations in Wrappers or Mappings, Analyzing Incorrect Data, Data Stores and Data Transmission, Exploratory Data Analysis for data integration.

**UNIT III DATA MANAGEMENT AND GOVERNANCE 9**

Data Virtualization Information Modelling and Database Design– Data Virtualization on Data Profiling – Data Virtualization on Data Cleansing – Data Virtualization on Data Governance and Security.

**UNIT IV DATA VIRTUALIZATION TO BUSINESS AGILITY 9**

Business Agility Challenges, Business Agility Data Integration Flexibility, Time-To-Solution Agility, Optimized Data Integration, Benefits to Business Agility. Case Study on business agility.

**UNIT V STORAGE VIRTUALIZATION 9**

Storage Virtualization Definition, Forms of Virtualization, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization, Storage Networking Technologies and Virtualization

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Tom Clark, "Storage Virtualization: Technologies for Simplifying Data Storage and Management", Pearson Education, 1<sup>st</sup> Edition, 2018.
2. Judith R. Davis and Robert Eve, "Data Virtualization: Going beyond Traditional Data Integration to Achieve Business Agility", Nine Five Zero, 1<sup>st</sup> Edition 2011.

## REFERENCES

1. Rick F. vander Lans, "Designing a Data Virtualization Environment A Step-By-Step Approach", redhat, 2016.
2. Gustavo A. A. Santana, "Data Center Virtualization Fundamentals", Cisco Press, 1<sup>st</sup> edition, 2013.
3. Lawrence C. Killer, "Data Virtualization for Dummies, Denodo Edition, 2018.
4. <https://www.elsevier.com/books/data-virtualization-for-business-intelligence-systems/van-der-lans/978-0-12-394425-2>.

<b>19CS02E</b>	<b>BIG DATA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO1: Understand the characteristics of big data and concepts.(K2)
- CO2: Understand the importance of visualization and analytics .(K3)
- CO3: Apply the requirements for a Big Data Analytics System for departmental organizational requirements using Hadoop. (K3)
- CO4: Analyze Spark and its uses for big data processing. (K2)
- CO5: Utilize and apply the Analytical methods, Technology and tools in the industry.(K3)

### UNIT I INTRODUCTION TO BIG DATA 9

Basics of big data – Issues – Case for Big data – Big data options Team challenge – Big data sources - Acquisition – Nuts and Bolts of Big data. Features of Big Data - Evolution of Big data– Best Practices for Big data Analytics - Big data characteristics.

### UNIT II DATA ANALYTICS AND VISUALIZATION 9

Predictive Analytics- Simple linear regression- Multiple linear regression- classification – clustering - association. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications. Case Studies: social media data analysis

### UNIT III HADOOP ENVIRONMENT 9

Introduction – Components of Hadoop - Analyzing the Data with Hadoop – Scaling out - Hadoop Streaming - Design of HDFS - Java interfaces to HDFS Basics - Developing a Map Reduce Application - Map Reduce concepts -Anatomy of a Map Reduce Job run – Failures - Job Scheduling - Shuffle and Sort – Task execution - Map Reduce Types and Formats - Map Reduce Features

### UNIT IV SPARK 9

Installing spark - Spark applications - Jobs - Stages and Tasks - Resilient Distributed databases - Anatomy of a Spark Job Run - Spark on YARN - SCALA: Introduction - Classes and objects - Basic types and operators – Built-in control structures - functions and closures - inheritance.

**UNIT V ANALYTICS FOR UNSTRUCTURED DATA 9**

The Hadoop Ecosystem – NoSQL - In-Database Analytics - SQL Essentials - In-Database Text Analysis - Advanced SQL.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1<sup>st</sup> Edition, Wiley, 2018.
2. Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia "Learning Spark", O'Reilly, 1<sup>st</sup> Edition, 2015.
3. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 1<sup>st</sup> Edition, 2015.

**REFERENCES**

1. Kim H. Pries, Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers", CRC Press, 2015.
2. <https://www.sciencedirect.com/topics/computer-science/hadoop-ecosystem>

**19CS03E**

**DATA SCIENCE**

L	T	P	C	QP
3	0	0	3	A

**COURSE OUTCOMES**

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

- CO1: Understand fundamentals of data analysis.(K2)
- CO2: Explore the data analysis techniques (K2)
- CO3: Analyze the key concepts in predictive data analysis.(K3)
- CO4: Apply data science in data visualization techniques(K3)
- CO5: Apply the concepts in real-world applications using python (K3)

**UNIT I DATA SCIENCE FUNDAMENTALS 9**

Linear Algebra, Graph theory, Probability, Measures of central tendency: mean, median and mode, Measuring asymmetry: skewness – Measures of location of dispersions

**UNIT II STATISTICAL TECHNIQUES 9**

Basic analysis techniques - Statistical hypothesis generation and testing - Chi-Square test - t-Test - Analysis of variance - Correlation analysis - Maximum likelihood test.

**UNIT III PREDICTIVE DATA ANALYSIS 9**

Predictive models : Regression, classification, time series forecasting, clustering, association rule mining, text mining : Sentimental Analysis

**UNIT IV DATA VISUALISATION 9**

Introduction – Data visualization methods: Mapping - Time series - Connections and correlations – Scatter plot maps - Trees, Hierarchies and Recursion – Data visualization using Tableau

## UNIT V DATA SCIENCE TOOLS

9

Python Programming: Working with data set, data manipulation, Data analysis models using python: Pre-processing, predictive models - Application development with Jupyter, Data Science Experience (IBM - DSX).

L:45; TOTAL:45 PERIODS

### TEXT BOOKS

1. Vijay Kotu, Bala Deshpande, "Data Science: Concepts and Practice", Morgan Kaufmann Publishers, 2<sup>nd</sup> Edition ,2019.
2. Cathy O'Neil and Rachel Schutt. "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 1<sup>st</sup> Edition, 2014.

### REFERENCES

1. Lillian Pierson, "Data Science For Dummies", John Wiley & Sons, 2<sup>nd</sup> Edition, 2017.
2. Hadley Wickham, Garrett Golemund," R for Data Science: Import, Tidy, Transform, Visualize, and Model Data", O'Reilly Media Inc, 1<sup>st</sup> Edition, 2017.

19CS04E

DATA MINING

L	T	P	C	QP
3	0	0	3	A

### COURSE OUTCOMES

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

- CO1: Apply pre-processing methods based on characteristics of data. (K3)
- CO2: Comprehend features of classification techniques.(K2)
- CO3: Identify appropriate clustering technique to analyze the data.(K3)
- CO4: Use association rule mining to generate rules. (K3)
- CO5: Use recent trends of Data mining in Business applications (K3)

## UNIT I DATA MINING AND DATA PREPROCESSING

12

Introduction to KDD process – Knowledge discovery from databases – Need for data pre Processing – Data cleaning – Data integration and transformation – Data reduction – Data discretization and concept hierarchy generation.

## UNIT II CLASSIFICATION

9

Basic concepts – decision tree induction – bayes classification methods – rule based classification – model evaluation and selection – techniques to improve classification accuracy –classification: advanced concepts – bayesian belief networks - support vector machine –classification using frequent patterns.

## UNIT III CLUSTER ANALYSIS

9

Cluster Analysis: Basic concepts and Methods – Cluster Analysis – Partitioning methods - Hierarchical methods – Density Based Methods– Grid Based Methods - Evaluation of Clustering – Advanced Cluster Analysis: Probabilistic model Based clustering – Clustering High Dimensional Data.

**UNIT IV ASSOCIATION RULE MINING 9**

Association Rule Mining: Market Basket Analysis - Frequent pattern mining – Apriori algorithm - Generating Association rules from frequent items - Improving the efficiency of Apriori algorithm – Mining Multilevel association rules - Multidimensional association rules – Constraint based association Mining. Applications of Data Mining-Temporal and Sequence Mining, Web and Text Mining.

**UNIT V APPLICATIONS AND RECENT TRENDS 6**

Dataset Collection- Disease Prediction-Weather Prediction-Student's future learning behavior prediction- Anomaly detection-Stock market Analysis-Commercial applications.

**L:45; TOTAL:45 PERIODS****TEXT BOOKS**

1. Jiawei Han, Micheline Kamber and Jian Pei "Data Mining: Concepts and Techniques", Elsevier, 3<sup>rd</sup> Edition, 2012.
2. Charu C. Aggarwal, "Data Mining: The Textbook", Springer International Publisher, 2015.
3. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, 10<sup>th</sup> Reprint, 2007.

**REFERENCES**

1. Pawel Cichosz, "Data Mining Algorithms: Explained Using R", John Wiley & Sons, 2015.
2. Pang-Ning Tan, Vipin Kumar, Michael Steinbach, "Introduction to Data Mining", Pearson Education India, 2012.
3. Daniel T. Larose, "Data Mining and Predictive Analytics", John Wiley & Sons, 2015.
4. <http://www.learningdom.com>.
5. <http://www.dataminingblog.com>

**19CS05E****BUSINESS ANALYTICS**

L	T	P	C	QP
3	0	0	3	A

**COURSE OUTCOMES**

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

- CO1: understand the concepts and methods of business analytics and solve decision problems (K2)
- CO2: design effective data visualizations techniques and evaluate different data mining concepts (K3)
- CO3: develop a greater familiarity with a range of techniques and methods through a diverse set of theoretical and applied readings (K2)
- CO4: apply appropriate analytical methods to find solutions to business problems (K3)
- CO5: analyze and appreciate variety of performance measures for various optimizations problems (K3)



**UNIT I INTRODUCTION 9**

Business Analytics Definition, Decision Making, A Categorization of Analytical Methods and Models, Big Data, applications, Descriptive Statistics: Types of Data, Modifying Data in Excel, Creating Distributions from Data, Measures of Location & Variability, Analyzing Distributions, Measures of Association between Two Variables, Data Cleansing.

**UNIT II DATA VISUALIZATION AND DESCRIPTIVE DATA MINING 9**

Data Visualization: Overview of Data Visualization, Tables, Charts, Advanced Data Visualization, Data Dashboards. Descriptive Data Mining: Cluster Analysis, Association Rules, Text Mining. Probability: Conditional Probability, Random Variables, Discrete Probability Distributions, Continuous Probability Distributions.

**UNIT III STATISTICAL INFERENCE AND REGRESSION 9**

Statistical Inference: Point Estimation, Sampling Distributions, Interval Estimation, Hypothesis Tests, Big Data, Statistical Inference, and Practical Significance. Linear Regression: Simple Linear Regression Model, Least Squares Method, Assessing the Fit of the Simple Linear Regression Model, the Multiple Regression Model. Inference and Regression: Categorical Independent Variables, Modeling Nonlinear Relationships, Model Fitting, Big Data and Regression

**UNIT IV TIME SERIES ANALYSIS AND PREDICTIVE DATA MINING 9**

Time Series Analysis and Forecasting: Time Series Patterns, Forecast Accuracy, Moving Averages and Exponential Smoothing, Regression Analysis for Forecasting. Predictive Data Mining: Data Sampling, Preparation, and Partitioning, Performance Measures, Logistic Regression, k-Nearest Neighbors, Classification and Regression Trees.

**UNIT V OPTIMIZATION MODELS 9**

Linear Optimization Models: A Simple Maximization and Minimization Problem, General Linear Programming Notation and More Examples. Integer Linear Optimization Models: Types, Solving Integer Optimization Problems with Excel Solver, Applications Involving Binary Variables, Modelling Flexibility Provided by Binary Variables. Nonlinear Optimization Models: Local and Global Optima, A Location Problem, Markowitz Portfolio Model.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, "Business Analytics", Cengage Learning, 3<sup>rd</sup> Edition ,2019.
2. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics, and Data Science: A Managerial Perspective,Person, , 4<sup>th</sup> Edition, 2018.

**REFERENCE**

1. S. Christian Albright, Wayne L. Winston, "Business Analytics: Data Analysis & Decision Making" Cengage Learning, 5<sup>th</sup> Edition, 2015.

<b>19CS06E</b>	<b>SOCIAL MEDIA ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

CO1: Understand the concept of semantic web and related applications.(K2)

CO2: Learn knowledge representation using ontology.(K2)

CO3: Understand human behaviour in social web and related communities and visualization of social networks.(K2)

CO4: Understand the prediction of Human Behaviour and privacy Issues.(K2)

CO5: Apply social network in real time applications.(K3)

**UNIT I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

**UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9**

Understanding and predicting human behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and counter measures.

**UNIT V APPLICATIONS 9**

A Learning Based Approach for Real Time Emotion Classification of Tweets- A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting- Social Network Analysis for Biometric Template Protection- Analysis of Social media data with Google Analytics.

**L:45; TOTAL:45 PERIODS**

### TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web", Springer, 1<sup>st</sup> Edition, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1<sup>st</sup> Edition, 2010.

### REFERENCES

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1<sup>st</sup> Edition, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

**19CS07E**

**ANALYTIC COMPUTING**

L	T	P	C	QP
3	0	0	3	A

### COURSE OUTCOMES

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

- CO1: Understand basic concepts and terminologies of data analytics. (K3)
- CO2: Know the importance of qualitative data, get insights and techniques. (K3)
- CO3: Understand the Big Data flow and Big Data Analytics. (K3)
- CO4: Explore various parameters tools and techniques used for web analytics. (K3)
- CO5: Predict the possible next outcome of the social network and to Mine the opinion of the user. (K3)

### UNIT I DATA ANALYTICS

**9**

Data Analytics Overview- Terminologies in Data Analytics - Types of Data-Qualitative and Quantitative Data-Data Levels of Measurement-Normal Distribution of Data-Statistical Parameters-Types of Data Analytics-Descriptive Analytics- Diagnostic Analytics-Predictive Analytics-Prescriptive Analytics-Data Analytics for different sector-Analytics for Products or Services.

**UNIT II QUALITATIVE ANALYSIS & PREDICTIVE DATA ANALYTICS 9**

Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys.

Predictive data analytics: Predictive Analysis-Different kinds of predictive analysis-Predictive Models-Descriptive Modeling-Decision Modeling-Predictive Analysis Methods.

**UNIT III BIG DATA ANALYTICS 6**

Introduction to Big Data Analytics-Framework for Big Data Analysis-Approaches for big data analysis- ETL in Big Data-Understanding Text Analytics and Big Data-Predictive Analysis on Big Data, Role of Data Analyst.

**UNIT IV WEB ANALYTICS 9**

Web Analytic fundamentals: Capturing data-Web logs-Separate data serving and data capture-Integration-Selecting optimal web analytic tool-Understanding click stream data quality-Identifying unique page definition-Using cookies-Link coding issues. GOOGLE ANALYTICS: Brief introduction - Adwords- Categories of traffic-SEO- Limitations.

**UNIT V SOCIAL NETWORK DATA ANALYTICS 12**

An introduction - Online Social Networks: Research Issues,-Data Mining Methods for Social Media- visualizing social networks, Taxonomy of Visualizations- The Convergence of Visualization- Interaction and Analytics - Tools for Social Network Analysis- UCINET – PAJEK – ETDRAW – Splus – R – NodeXL – SIENA and RSIENA – Real world Social Networks (Facebook- Twitter- etc.)

**L:45; TOTAL:45 PERIODS****TEXT BOOKS**

1. EMC Education Services, 'Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data', John Wiley & Sons, New Delhi, 2015.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Charu C. Aggarwal, "Social Network Data Analytics", Springer, 2011.
4. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2<sup>nd</sup> Edition, 2010.
5. Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users", Morgan Kaufmann, 2013.

**REFERENCES**

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics", John Wiley & sons, 2012.
2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
3. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Elsevier,Reprinted, 2<sup>nd</sup> Edition, 2008.
4. Arthur Zhang,"Data Analytics: Practical Guide to Leveraging the Power of Algorithms,

- Data Science, Data mining”, Kindle Edition, 2017.
5. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science OfCustomer Centricity “, Sybex, 1<sup>st</sup> Edition, 2009.
  6. Sule Gündüz-Ogüdücü, A. Şima Etaner-Uyar, “Social Networks: Analysis and Case Studies”, Springer, 2014.

<b>19CS08E</b>	<b>ALGORITHMIC GAME THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### **COURSE OUTCOMES**

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

- CO1: Comprehend a conceptual overview to the tools of game theory and its applications.(K2)
- CO2: Analyze situations in which two or more individuals (or firms, political parties, countries) interact in a strategic manner (K4)
- CO3: Analyze the situations involving conflict and/or cooperation (K4)
- CO4: Introduce the concepts of social choice theory (K2)

### **UNIT I STATIC GAMES OF COMPLETE INFORMATION 9**

Introduction – Decision Theory –Strategic Game - Nash Equilibrium – Multiple Nash Equilibrium Applications - Mixed Strategy Equilibrium.

### **UNIT II DYNAMIC GAMES WITH COMPLETE INFORMATION 9**

Extensive Form Games – strategies and equilibrium in extensive form games - Backward Induction and sub game perfection.

### **UNIT III STATIC GAMES OF INCOMPLETE INFORMATION 9**

Bayesian Games – Bayesian Nash Equilibrium – Applications

### **UNIT IV DYNAMIC GAMES WITH INCOMPLETE INFORMATION 9**

Perfect Bayesian Equilibrium – Signaling Games – Applications.

### **UNIT V SOCIAL CHOICE THEORY 9**

Social choice and social welfare functions - Condorcet’s paradox - Desirable properties of social choice procedures (Pareto condition, independence of irrelevant alternatives) – Popular voting procedures (Borda) - Arrow’s theorem.

**L:45; TOTAL:45 PERIODS**

### **TEXT BOOKS**

1. Martin Osborne, “An Introduction to Game Theory”, Oxford University Press, 2<sup>nd</sup> Edition, 2012.
2. G.Chalkiadakis, E.Elkind, and M.Wooldridge, “Computational Aspects of Cooperative Game Theory”, Morgan & Claypool, 2011.

**REFERENCES**

1. Michael Maschler, Eilon Solan, Shmuel Zamir, "Game Theory", Cambridge University Press, 1<sup>st</sup> Edition, 2013.
2. Y. Shoham and K. Leyton-Brown, "Multiagent Systems", Cambridge University Press, 2009.
3. Drew Fudenberg and Jean Tirole, "Game Theory", MIT Press, 1<sup>st</sup> Edition, 2005.
4. Y. Narahari, "Game Theory and Mechanism Design", IISc Press and the World Scientific, 2014.

<b>19CS09E</b>	<b>BLOCKCHAIN ARCHITECTURE AND DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

CO1: Understand blockchain, blocks, transactions and models (K2)

CO2: Recognize the basic security and its significance in Bitcoin (K2)

CO3: Implement consensus protocol mechanisms and mining concepts (K3).

CO4: Understand the different consensus mechanisms used in permissioned blockchains (K2)

CO5: Implement the consensus mechanisms in hyperledger tool (K3)

**UNIT I INTRODUCTION 9**

Basics- History – Bitcoin: Technology behind Bitcoin – Bitcoin Transaction Life Cycle. - Architecture: Smart Contracts – Crowdfunding. – Block in a Blockchain: Structure of a Block – Block Header – Transactions in a Block. - Conceptualization: Permission-less Model – Blockchain as a Tree – Accepting the longest chain – Orphaned Blocks – Permissioned Model – Applications

**UNIT II CRYPTO PRIMITIVES AND BITCOIN 9**

Cryptographic Hash Function - Properties of Hash Function – Hash Pointer – Merkle Tree - Blockchain as a Hash chain – Digital Signature - Symmetric and Asymmetric Key Cryptography – Bitcoin - Creation of Coins – Sending Payments – Double Spending - - Transaction in Bitcoin Network – Mining in a Bitcoin network - Bitcoin Scripts.

**UNIT III CONSENSUS AND MINERS 9**

Consensus in Bitcoin - Proof of Work (PoW) – Hashcash PoW – Bitcoin Proof of Work System – Tampering PoW Blockchain – Sybil Attacks – Denial of Service Attacks - Proof of Stack – Proof of Burn – Proof of Elapsed Time – Miners – Life of a Miner – Mining Difficulty – Mining Pool Methods.

**UNIT IV PERMISSIONED BLOCKCHAINS 9**

Basics- Smart Contracts – Consensus – State Machine Replication – Distributed Consensus – Different Algorithms – PAXOS – RAFT- Byzantine General Problem (BGP) – Practical Byzantine Fault Tolerance (PBFT).

## UNIT V HYPERLEDGER AND ETHEREUM 9

Hyperledger Fabric V1 – Architecture - Decomposing the consensus process - Hyperledger fabric components - Chaincode Design and Implementation - Ethereum Blockchain: Smart Contracts – Structure – Operations - Incentive Model.

**L:45; TOTAL:45 PERIODS**

### TEXT BOOK

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” , Princeton University Press , Kindle Edition ,2016.

### REFERENCES

1. Andreas M. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, 2<sup>nd</sup> Release, 2015.
2. Blockchain Technology, Kindle Edition, BBVA innovation center.
3. <http://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf>
4. Joseph Bonneau et al, “SoK: Research perspectives and challenges for Bitcoin and cryptocurrency”, IEEE Symposium on security and Privacy, 2015.
5. <https://www.coursera.org/learn/blockchain-basics#about>

<b>19CS10E</b>	<b>COMPUTATIONAL GRAPH THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### COURSE OUTCOMES

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

- CO1: Understand and apply the basics of graphs as a modeling tool in computer science and engineering (K3)
- CO2: Comprehend the connectivity & planarity of graphs and illustrate the structures of trees (K3)
- CO3: Apply the concepts of matching & coloring and understand the concepts of directed graphs (K3).
- CO4: Understand the flows and substructures of dense and sparse graphs (K2)
- CO5: Provide a conceptual overview to minors and well quasi ordering of trees (K2)

## UNIT I INTRODUCTION 9

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree.

## UNIT II TREES, CONNECTIVITY AND PLANARITY 9

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets -Connectivity and separability – Combinational and geometric graphs – Planer graphs –Representation of a planer graph – Hyper graphs.

**UNIT III MATCHING, COLOURING AND DIRECTED GRAPH 9**

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness.

**UNIT IV FLOWS AND SUBSTRUCTURES 9**

Flows – Circulations - Flows in networks - Flow-coloring duality - Tutte's flow conjectures - Substructures in Dense Graphs – Subgraphs – Substructures in Sparse Graphs - Topological minors – Minors.

**UNIT V MINORS AND WELL QUASI ORDERING 9**

Well-quasi-ordering - The graph minor theorem for trees - Tree-decompositions - Tree-width path width, upper and lower bounds for tree width, relation of tree width and minors.

**L:45; TOTAL:45 PERIODS****TEXT BOOKS**

1. Narsingh Deo, "Graph Theory: With Application to Engineering and Computer Science", Prentice Hall of India, 2004.
2. Reinhard Diestel, "Graph Theory", Springer-Verlag Berlin Heidelberg, 5<sup>th</sup> Edition 2017.

**REFERENCES**

1. Jay Yellen, Jonathan L. Gross, Mark," Graph Theory and Its Applications", CRC Press, 2019.
2. Lowell W. Beineke, Robin J. Wilson, Ortrud R. Oellermann," Topics in Structural Graph Theory " Cambridge University Press, 2013.

<b>19CS11E</b>	<b>QUANTUM COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Understand the differences between classical and quantum computing.(K2)  
 CO2: Apply the concepts of quantum mechanics to understand basic quantum algorithms.(K3)  
 CO3: Understand the algorithms for quantum computational models (K2)  
 CO4: Utilize quantum algorithms to make the transmission from classical AI to Quantum AI.(K3)  
 CO5: Analyzing the Applications of quantum algorithms and error correction Standards (K3).

**UNIT I QUANTUM COMPUTING FOUNDATIONS 9**

Overview of traditional computing – Superposition, Entanglement and Reversibility - A Brief History of Quantum Computing - Qubits, Operators and Measurement- Complexity Theory - Quantum Computing and the Church-Turing Thesis.



**UNIT II QUBITS AND QUANTUM MODEL OF COMPUTATION 9**

State of a quantum system – Time evolution of a closed system – Composite systems – Measurement – Mixed states and general quantum operations – Quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – quantum circuits –Building a Quantum computer - Development Libraries for Quantum Computer Programming : Case study: quirk

**UNIT III BASIC QUANTUM ALGORITHMS 9**

Super dense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch-Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform – Eigen value estimation

**UNIT IV ADVANCED QUANTUM ALGORITHMS 9**

Order-finding problem – Eigen value estimation approach to order finding – Shor's algorithm for order finding – Finding Discrete Logarithms – Hidden subgroups – Grover's quantum search algorithm – Quantum Computing Methods- Machine Learning on Quantum Processors - Solving Linear Systems- Quantum Random Number Generator.

**UNIT V QUANTUM COMPLEXITY, ERROR CORRECTION AND APPLICATIONS 9**

Computational complexity – black-box model – lower bounds for searching – general black-box lower bounds – polynomial method – block sensitivity – adversary methods – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-tolerant quantum computation – Applications : Optimization - Tensor Networks - Case Study : Intel Quantum Simulator.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Jack D.Hidary , “Quantum Computing: An Applied Approach” Springer Nature Switzerland AG ,2019.
2. P. Kaye, R. Laflamme, and M. Mosca, “An introduction to Quantum Computing”, Oxford University Press, 2007.

**REFERENCES**

1. V. Sahni, “Quantum Computing”, Tata McGraw-Hill Publishing Company, 2007.
2. Neil Gershenfeld, Physics of Information Technology, Cambridge University Press, 2000
3. Michael A. Nielsen and Isaac L. Chuang, “Quantum Computation and Quantum Information” , Cambridge University Press, 2000
4. Mika Hirvensalo, “Quantum Computing”, Springer-Verlag New York, 2000.
5. <https://github.com/iqusoft/intel-qs>
6. <https://arxiv.org/abs/2001.10554>
7. <https://algassert.com/quirk>
8. [https://www.cse.iitk.ac.in/users/rmittal/course\\_s21.php](https://www.cse.iitk.ac.in/users/rmittal/course_s21.php)
9. [https://onlinecourses.nptel.ac.in/noc19\\_cy31/preview](https://onlinecourses.nptel.ac.in/noc19_cy31/preview)

<b>19CS12E</b>	<b>MULTI-CORE PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

CO1: Understand the importance of multi-core processors, and their architecture (K2)

CO2: Realize the necessitate and challenges in parallel and multi-threaded programming (K2)

CO3: Develop parallel programs using OpenMP (K2)

CO4: Design and Develop distributed applications using MPI library functions (K3)

CO5: Apply the openMP and MPI libraries to build parallel applications (K3)

**UNIT I MULTI-CORE PROCESSORS 9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

**UNIT II PARALLEL PROGRAM CHALLENGES 9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives: mutexes, locks, semaphores, barriers – deadlocks and livelocks – communication between threads: condition variables, signals, message queues and pipes.

**UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP 9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.

**UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation.

**UNIT V PARALLEL PROGRAM DEVELOPMENT 9**

Two n-Body Solvers- Parallelizing and Evaluation in OpenMP- Tree search – Recursive and Non-Recursive DFS –Data structures and Performance of the serial implementations- static and dynamic parallelization of tree search using Pthreads and evaluation - Parallelizing the tree-search programs using OpenMP and its performance- Implementation of tree search using MPI with static and dynamic partitioning.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Victor Alessandrini, “Shared Memory Application Programming Concepts and Strategies in Multicore Application Programming”, Morgan Kaufmann, 2<sup>nd</sup> Edition 2016.
2. Yan Solihin, “Fundamentals of Parallel Multicore Architecture”, CRC Press, 2016.

## REFERENCES

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kaufman, Elsevier, 2011.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011.

<b>19CS13E</b>	<b>MIRCOSERVICE ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO1: Understand the fundamentals of a microservices architecture.(K2)
- CO2: Identify the characteristics of popular microservices, and understand the design differences.(K2)
- CO3: Expose an Application Program Interface for the Microservice application.(K3)
- CO4: Evaluate various approaches to infrastructure used in deploying microservices.(K3)
- CO5: Exploit the security and migration of Microservice Architecture.(K2)

### **UNIT I INTRODUCTION OF MICROSERVICES ARCHITECTURE 9**

Introduction to Service Oriented Architecture(SOA) – web services- Demystifying MicroService Architecture (MSA)- Need for MSA- Issues with traditional Enterprise Applications- Capabilities, Features and Benefits of MSA- Differences between SOA and MSA- Typical use cases of MSA – Trade-offs in MSA.

### **UNIT II MICROSERVICE ARCHITECTURE DESIGN PRINCIPLES 9**

Key Architectural elements of MSA-Service Interaction-Communication Models for Microservices-Synchronous Communication-Representational State Transfer Architecture- REST and HTTP methods- Asynchronous Communication-Rabbit MQ-Apache Kafka.

### **UNIT III MICROSERVICE DISCOVERY AND DESIGNING API 9**

Need for Microservice Discovery- Service Registration- Service Discovery and Tools- API Gateways-Creation of client specific API- Service Composition- Service Routing- Data Aggregation- API Design Mechanisms- REST API- Apache Thrift API- API Gateway Monitoring and Design Consideration- Service Orchestration and Choreography.

### **UNIT IV PATTERNS AND PLATFORM FOR MICROSERVICE ARCHITECTURE 9**

Decomposition Patterns- Composition Patterns- Database Patterns- Observability Patterns- Cross cutting Patterns- Additional Database Architecture Patterns – Deployment Patterns- Challenges in MSA Approach- Foundational capabilities of Microservices Platforms- Classification of Microservices Platforms- Deployment platforms – Service Resiliency Platform- API platforms- Microservice Development Platforms.

**UNIT V SECURITY AND MIGRATION OF MICROSERVICE ARCHITECTURE 9**

Basic security requirements- Pragmatic Architecture for secure MSA- Security Mechanisms for MSA Applications- MSA Migration-Advantage of MSA –Motivating Drivers for MSA Migration- Issues in MSA Migration – Migration process –Candidate applications for MSA migration.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOK**

1. Chellammal Surianarayanan, Gopinath Ganapathy, Pethuru Raj “Essentials of Microservices Architecture- Paradigms, Applications and Techniques” CRC Press, Taylor & Francis Group, 1<sup>st</sup> edition, 2019.

**REFERENCES**

1. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, Mike Amundsen, “Microservice Architecture: Aligning Principles, Practices, and Culture”, O’Reilly, 1<sup>st</sup> edition, 2016.
2. Eberhard Wolff, “Microservices: Flexible Software Architecture” Addison-Wesley Professional, 1<sup>st</sup> edition, 2016.
3. Sam Newman, “Building Microservices: Designing Fine-Grained Systems” O’Reilly, 1<sup>st</sup> edition, 2015.
4. [www.udemy.com/course/microservices-architecture/](http://www.udemy.com/course/microservices-architecture/).

**19CS14E COMPUTATIONAL METHODS OF OPTIMIZATION L T P C QP**  
**3 0 0 3 A**

**COURSE OUTCOMES**

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

- CO1. Formulate optimization problems and apply the concept of optimality criteria for various types of optimization problems. (K2)
- CO2. Apply the optimality criteria through evolutionary approach (K3)
- CO3. Examining the concept of optimization through swarm intelligence (K3).
- CO4. Apply science based concepts in optimization (K3).
- CO5. Acquire knowledge about optimization through human behaviour (K2).

**UNIT I INTRODUCTION 9**

Optimization Problems, Definition of Minimum Points, Unconstrained Optimization: Direct Search Methods, Derivative Search Methods, Constrained Optimization: Linear Constraints, Linear Inequality Constraints. General Structure of Optimization Algorithms – Constraints – Feasible Region – Branches of Mathematical Modelling.

**UNIT II EVOLUTIONARY BASED APPROACH 9**

Evolutionary Algorithms - Evolutionary Strategies - Genetic Algorithms - Genetic Programming - Differential Evolution - Estimation of Distribution Algorithms

**UNIT III SWARM INTELLIGENCE-BASED APPROACH 9**

Swarm Intelligence - Ant Colony Optimization - Bee Metaheuristics - Particle Swarm Optimization - Artificial Immune Systems - Bacterial Foraging Algorithm

**UNIT IV SCIENCES-BASED APPROACH 9**

Simulated Annealing - Biomolecular Computing: DNA Computing, Membrane computing - Quantum Computing: Fundamentals, Hybrid methods - Metaheuristics Based on Sciences

**UNIT V HUMAN BASED APPROACH 9**

Memetic Algorithms - Tabu Search, Scatter Search and Path Relinking - Search Based on Human Behaviours: Seeker Optimization Algorithm, Teaching Learning based Optimization, Imperialist Competitive Algorithm, Metaheuristics inspired by Human Behaviours

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Ke-Lin Du, M.N.S. Swamy, "Search and Optimization by Metaheuristics: Techniques and Algorithms", Inspired by Nature, 2016.
2. Xin-She Yang, "Nature-Inspired Algorithms and Applied Optimization", Springer, 2018.

**REFERENCES**

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 1<sup>st</sup> Edition, 2000.
2. Leandro N. De Castro, Fernando J. Von Zuben, "Recent Developments in Biologically Inspired Computing, Idea Group Inc., 2005

<b>19CS15E</b>	<b>ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Use appropriate search algorithms for any AI problem (K3)
- CO2: Provide the apt agent strategy to solve a given problem (K3)
- CO3: Represent a problem using first order and predicate logic (K2)
- CO4: Design software agents to solve a problem (K3)
- CO5: Design some of the applications that use Artificial Intelligence (K3)

**UNIT I INTRODUCTION 9**

Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

**UNIT II PROBLEM SOLVING METHODS 9**

Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.

**UNIT III KNOWLEDGE REPRESENTATION 9**

**First Order Predicate Logic:** Prolog Programming - Unification – Forward Chaining- Backward Chaining – Resolution.

**Knowledge Representation:** Ontological Engineering, Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information.

**UNIT IV SOFTWARE AGENTS 9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

**UNIT V APPLICATIONS 9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. S.Russel, P.Norvig, Artificial Intelligence - A Modern Approach, Pearson Education, New Delhi, 4<sup>th</sup> Edition, 2020.
2. I. Bratko, Prolog: Programming for Artificial Intelligence, Addison-Wesley Educational Publishers Inc., 4<sup>th</sup> Edition, 2011.

**REFERENCES**

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; 1<sup>st</sup> Edition, 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. Gerhard Weiss, "Multi Agent Systems", MIT Press, 2<sup>nd</sup> Edition, 2013.
4. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.
5. <https://silp.iitaa.ac.in/wp-content/uploads/PROLOG.pdf>.

<b>19CS16E</b>	<b>MACHINE LEARNING IN HEALTHCARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Recognize the fundamentals of electronic health record (EHR) (K2)
- CO2: Comprehend the EHR frameworks and National EHR efforts. (K2)
- CO3: Understand the basics of healthcare and basic operations on clinical data. (K2)
- CO4: Analyze the machine learning projects. (K3)

**UNIT I INTRODUCTION TO EHR 9**

EHR: Definition – Functions – Significance – Factors affecting implementation of EHR – EHR architecture requirements. Standard for healthcare - EN 13940. Standard for EHR Functional Specifications - HL7 EHR-S FM. Standard for EHR communication – Message standard for healthcare data. Standard for healthcare data - Clinical document standards – Standard for medical Image and communication - Standard for patient health summary

**UNIT II EHR FRAMEWORKS AND NATIONAL EHR EFFORTS 9**

Standard frameworks: openHR – Integrating the healthcare enterprise. Case studies: National EHR efforts: Australia’s HealthConnect, Austria’s ELGA, Canada’s EHRS Blueprint, Denmark’s MedCom, India’s Health IT Initiatives

**UNIT III INTRODUCTION TO HEALTHCARE AND CLINICAL DATA 9**

Overview of Health Care Systems and Key Challenges: Physicians, Physician Practices, and Physician Payment - Hospitals, Other Provider Organizations, and Related Payment Systems - Intermediaries, Health Insurance Plans, and Health Care Financing. Introduction to Clinical Data: Data available from Healthcare systems - Representing time, timing of events for clinical data mining - Data Analytics – Tuning – Reasoning – Challenges of Big data. Evaluation and Metrics for machine learning in healthcare.

**UNIT IV MACHINE LEARNING FOR HEALTHCARE ANALYTICS PROJECTS-I 9**

Breast cancer detection: SVM and KNN models – data visualization with machine learning – relationship between variables – understanding machine learning algorithms – training models – predictions in machine learning. Diabetes onset detection: deep learning grid – building Keras model – grid search using scikit-learn – reducing over fitting using dropout regularization – finding optimal hyper parameters – optimizing the number of neurons – predictions using optimal hyper parameters.

**UNIT V MACHINE LEARNING FOR HEALTHCARE ANALYTICS PROJECTS-II 9**

DNA classification: classifying DNA sequences using NLP. Diagnosing coronary artery disease: dataset – fixing missing data – splitting the data set – training the neural network – comparison of categorical and binary problems. Autism screening with supervised learning: Autism Spectrum Disorder screening with machine learning – splitting the data set – building the network – testing the network.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Machine Learning for Healthcare Analytics Projects, Eduonix Learning Solutions, 2018
2. Pradeep Sinha, Gaur Sunder, Prashant Bendale, Manisha Mantri, Atreya Dande, “Electronic Health Record Standards, Coding Systems, Frameworks, and Infrastructures”, IEEE press, Wiley publication, 2013.
3. Arjun Panesar, “Machine Learning and AI for Healthcare”, Apress, 2019.
4. Dr.Parag Suresh Mahajan, “Artificial Intelligence in Healthcare”, Second Edition, (Kindle Edition, 2019)

**REFERENCES**

1. Fai Jiang, Yi Dong, “Artificial intelligence in healthcare: past, present and future”, Stroke and Vascular Neurology 2(4), 2017
2. Prashant Natarajan, John C. Frenzel, Detlev H. Smaltz, “Demystifying Big Data and Machine Learning for Healthcare”, CRC Press, 2017.
3. <https://www.coursera.org/specializations/ai-healthcare>

<b>19CS17E</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Know the basic concepts and techniques of Machine Learning (K2).
- CO2: Design neural network to solve classification and function approximation problems (K3).
- CO3: Implement typical clustering algorithms for different types of applications(K3).
- CO4: Identify applications suitable for different types of machine learning with suitable Justification (K3).
- CO5: Understand graphical models of machine learning algorithms(K3).

**UNIT I INTRODUCTION 9**

Introduction to Machine Learning - Types of Machine learning - Basic Concepts in Machine Learning -Examples of Machine Learning Applications, Perspectives and Issues in Machine Learning, Concept of Learning Task, Concept Learning as Search, Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants, Perceptron, Linear Separability, Linear Regression, Case Study : Inventory Prediction

**UNIT II SUPERVISED LEARNING 9**

Supervised learning, Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting, Evaluating and debugging learning algorithms. Classification Case Study: Object Recognition

**UNIT III UNSUPERVISED LEARNING 9**

Clustering K-means, Association analysis with the Apriori algorithm, Expectation Maximization algorithm. Mixture of Gaussians, Factor analysis, Principal components analysis, Independent components analysis. Case Study: Planning a vacation.

**UNIT IV REINFORCEMENT LEARNING 9**

Markov decision process (MDP). Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR), Linear Quadratic Gaussian, Q-learning. Value function approximation, Policy search, Reinforce, POMDPs.

**UNIT V GRAPHICAL MODELS 9**

Markov Chain Monte Carlo Methods, Sampling, Proposal Distribution, Markov Chain Monte Carlo, Graphical Models, Bayesian Networks, Markov Random Fields, Hidden Markov Models, Tracking Methods..

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 1<sup>st</sup> Edition, 2012.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 1<sup>st</sup> Edition, 2006.
3. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python",Wiley, 1<sup>st</sup> Edition, 2019.



## REFERENCES

1. Dr. Rajiv Chopra, "Machine Learning", Khanna Book Publishing Co. (P) LTD, 1<sup>st</sup> Edition, 2018.
2. Anuradha Srinivasaraghavan, Vincy Joseph, "Machine Learning", Wiley publication, 1<sup>st</sup> Edition, 2019.

<b>19CS18E</b>	<b>NATURE AND BIO INSPIRED COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO 1: Understand the natural phenomena that motivate the algorithms (K2)
- CO 2: Understand genetic algorithm and differential evolution (K2)
- CO 3: Understand swarm optimization and ant colony for feature selection. (K2)
- CO 4: Select the appropriate strategy or optimal solution based on bio-inspired algorithms (K3)
- CO5: Apply the optimization algorithms for the problems.(K5)

### **UNIT I      NATURAL COMPUTING      9**

From nature to natural computing, sample idea, Philosophy of natural computing, Natural computing approaches, Conceptualization – general concept, Problem solving as a search track, Hill climbing, Simulated annealing.

### **UNIT II      EVOLUTIONARY COMPUTING      9**

Evolutionary computing: Evolutionary biology, Evolutionary computing – standard evolutionary algorithm; Genetic algorithm, evolutionary strategies, Evolutionary programming.

### **UNIT III      SWARM INTELLIGENCE      9**

Swarm intelligence-biological motivation, from natural to artificial, standard algorithm of Ant colony optimization, Ant clustering algorithm, Particle swarm optimization.

### **UNIT IV      BIOLOGICAL MOTIVATION      9**

Biological motivation, from natural to artificial, standard algorithm of cuckoo search, bat algorithm, flower pollination, firefly algorithm, framework for self tuning algorithms - case study of firefly algorithm.

### **UNIT V      APPLICATIONS      9**

Travelling Salesman problem- NP Hard Problem- Routing Problem- Machine Learning Problem- The Ant Net Algorithm -Heating System Planning Problem- Job Shop Scheduling Problem for Minimization of Makespan

**L:45; TOTAL:45 PERIODS**

## TEXT BOOKS

1. Tao Song , Pan Zheng , Mou Ling Dennis Wong,Xun Wang ,“ Bio-Inspired Computing Models and Algorithms” , World Scientific Publishing Pvt. Ltd., Kindle 1<sup>st</sup> Edition, 2019.
2. D. Floreano and C. Mattiussi, “ Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, MIT Press, 2<sup>nd</sup> Edition 2010.
3. L. N. de Castro, “Fundamentals of Natural Computing: Basic Concepts, Algorithms, and Applications”, CRC Press, 1<sup>st</sup> Edition, 2006.
4. Marco Dorigo, Thomas Stutzle, “Ant Colony Optimization”, MIT Press, 1<sup>st</sup> Edition 2006.
5. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, “Swarm Intelligence: From Natural to Artificial Systems,” Oxford University press, 1<sup>st</sup> Edition, 2000.

## REFERENCES

1. Sam Jones (Editor), “Bio Inspired Computing-Recent Innovations and Applications”, Clanrye International; 2<sup>nd</sup> Edition, 2015.
2. Yang Xiao, “Bio-Inspired Computing and Networking”, CRC Press.2016.
3. Adries Engelbrecht, “Computational Intelligence”, Wiley, 2<sup>nd</sup> Edition, 2007.
4. D.Floreano and C. Mattiussi, “Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, MIT Press, 1<sup>st</sup> Edition, 2008.
5. Russell C. Eberhart, Yuhui Shi , James Kennedy, “ Swarm Intelligence: The Morgan Kaufmann Series in Evolutionary Computation”, 1<sup>st</sup> Edition, 2001.
6. M. Goodrich, Tamassia, “Algorithm Design & Applications”, Wiley, 1<sup>st</sup> Edition, 2017.

<b>19CS19E</b>	<b>NATURAL LANGUAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO1: Identify the different linguistic components of natural language (K2)
- CO2: Design a morphological analyser for a given natural language (K3)
- CO3: Decide on the appropriate parsing techniques necessary for a given language (K2)
- CO4: Understand the role of semantics of sentences and pragmatics (K2)
- CO5: Design applications involving natural language (K3)

## UNIT I INTRODUCTION 9

Introduction to Natural Language Processing, Origins and challenges of NLP -Language and Grammar, Information Retrieval. Language Modeling: Various Grammar-based Language Models -Statistical Language Model, Representation and understanding, Linguistic background.

## UNIT II MORPHOLOGY AND PART-OF-SPEECH PROCESSING 9

Morphology and Part-Of-Speech Processing Introduction –Regular Expressions and Automata-Non-Deterministic FSAs. Transducers –English Morphology -Finite-State Morphological Parsing -Porter Stemmer -Tokenization-Detection and Correction of Spelling Errors. N-grams –Perplexity - Smoothing -Interpolation -Backoff. Part-of-Speech

Tagging –English Word Classes -Tagsets -Rule-Based -HMM -Transformation-Based  
Tagging-Evaluation and Error Analysis. Hidden Markov and Maximum Entropy Models

### **UNIT III SYNTAX ANALYSIS 9**

Syntax Analysis Finite-State and Context-Free Grammars -Dependency Grammars. Syntactic Parsing – Ambiguity -Dynamic Programming Parsing Methods –CKY-Earley and Chart Parsing-Partial Parsing-Evaluation. Statistical Parsing –Probabilistic Context-Free Grammars –Probabilistic CKY Parsing of PCFGs –Probabilistic Lexicalized CFGs – Collins Parser – Shallow parsers – Dependency parsing.

### **UNIT IV SEMANTIC ANALYSIS & PRAGMATICS 9**

Semantic and Pragmatic Interpretation Representation of Meaning –Desirable Properties -Computational Semantics -Word Senses -Relations Between Senses –WordNet -Event Participants-Proposition Bank -Frame Net –Metaphor. Computational Lexical Semantics –Word Sense Disambiguation-Supervised Word Sense Disambiguation -Dictionary and Thesaurus Methods – Word Similarity - Minimally Supervised WSD - Hyponymy and Other Word Relations - Semantic Role Labeling -Unsupervised Sense Disambiguation. Computational Discourse - Discourse Segmentation - Unsupervised Discourse - Segmentation - Text Coherence -Reference Resolution – Phenomena – Features and algorithms - Pronominal Anaphora Resolution.

### **UNIT V APPLICATIONS 9**

Applications Information Extraction –Named Entity Recognition -Relation Detection and Classification –Temporal and Event Processing -Template-Filling -Biomedical Information Extraction. Question Answering and Summarization - Information Retrieval -Factoid Question Answering -Summarization -Single and Multi-Document Summarization - Focused Summarization -Evaluation. Dialog and Conversational Agents –Properties of Human Conversations -Basic Dialogue Systems.

**L:45; TOTAL:45 PERIODS**

### **TEXT BOOKS**

1. Sowmya Vajjala, Bodhisattwa Majumder and Anuj Gupta,” Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems”, O’ Reilly, 1<sup>st</sup> Edition, 2020.
2. Emily M. Bender and Alex Lascarides “Linguistic Fundamentals for Natural Language Processing II: 100 Essentials from Semantics and Pragmatics”, Morgan and Claypool , 1<sup>st</sup> Edition, 2019.
3. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Pearson Publication, 1<sup>st</sup> Edition, 2014.
4. James Allen “Natural Language Understanding”, Pearson Publication 8<sup>th</sup> Edition, 2012.

### **REFERENCES**

1. NitinIndurkha, Fred J. Damerau, “Handbook of Natural Language Processing”, (Chapman & Hall/CRC Machine Learning & Pattern Recognition), 2<sup>nd</sup> Edition, 2010.

2. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2<sup>nd</sup> Edition, 2010.
3. <https://nptel.ac.in/courses/106/105/106105158/>
4. <https://www.coursera.org/learn/language-processing>

**19CS20E COMPUTER VISION AND IMAGE PROCESSING**    **L T P C QP**  
**3 0 0 3 A**

### **COURSE OUTCOMES**

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

- CO1: Explore the goals of computer vision and methods of image formation. (K2)
- CO2: Realize the fundamental image processing techniques of computer vision. (K2)
- CO3: Explore the computational methods on digital images.(K3)
- CO4: Extract features form Images and do analysis of Images.(K3)
- CO5: Elaborate understanding on object detection techniques.(K2)

### **UNIT I IMAGE FORMATION AND IMAGE PROCESSING 9**

Introduction to Computer Vision - Goals of Computer Vision - Image Formation and Radiometry -Image formation- Radiometric quantities - Shape from shading - Photometric stereo-2D transformations- 3D transformations- Single camera setup of image formation - Image formation in a stereo vision setup - Basics of stereo correspondence-Inverse Radon transform- back-projection method - Inverse Radon transform - Fourier transform method

### **UNIT II IMAGE PROCESSING CONCEPTS 9**

Fundamentals-Point operations-Geometric operations-Spatial operations-Operations between images-Discrete Fourier transform - Discrete cosine transform - K-L transform-Wavelet transform-Curvelet transform - Ridgelet transform- Shearlet transform-Contourlet transform- Spatial domain filtering-Frequency domain filtering-Homomorphic filtering-Wiener filter for image restoration-Colour models-Colour constancy-Colour image enhancement and filtering

### **UNIT III MORPHOLOGY AND IMAGE SEGMENTATION 9**

Mathematical Morphology - Binary morphological operations- Applications of binary morphological operations - Grayscale morphological operations - Distance transformation - Image Segmentation – Threshold - Region-based segmentation methods-Edge detection-based segmentation - Deformable models for image segmentation – Image Segmentation Applications

### **UNIT IV IMAGE FEATURES 9**

Image Descriptors and Features - Texture Descriptors - Texture representation methods - Gabor filter - MPEG-7 homogeneous texture descriptor- Local binary patterns -Colour Features - Edge Detection- Gradient-based methods-Laplacian of

Gaussian operator-Difference of Gaussian operator- Canny edge detector- Hough transform for detection of a line and other shapes- Chain code and shape number - Fourier descriptors - Boundary representation by B-spline curves- SUSAN edge and corner point detector - Moravec corner detector- Feature extraction applications

**UNIT V PATTERN RECOGNITION 9**

Introduction - Linear Regression - Linear discriminant functions for pattern classification - Minimum distance classifier - Elementary Statistical Decision Theory - Gaussian Classifier - Parametric approaches - Non-parametric approaches - Clustering for Knowledge Representation-Dimension Reduction - Unsupervised-Supervised - Semi-supervised linear dimension reduction - Finding patterns in an image - Shape similarity measurement by Hausdorff distance-Object recognition applications.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. M.K.Bhuyan, "Computer Vision and Image Processing: Fundamentals an Applications", CRC Press, 2<sup>nd</sup> Edition, 2020.
2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Pearson Education, 4<sup>th</sup> Edition, 2018.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2016.

**REFERENCES**

1. Sonka, Hlavac, and Boyle. Thomson, "Image Processing, Analysis, and Machine Vision", Cengage Learning, 4<sup>th</sup> Edition, 2017.
2. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", Pearson Education, Inc., 2<sup>nd</sup> Edition, 2015.
3. B. K. P. Horn, "Prentice Hall Robot Vision", McGraw-Hill, 1<sup>st</sup> Edition, 2015.

<b>19CS21E</b>	<b>STORAGE AREA NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Identify the challenges in managing information and analyze the potency of different storage networking technologies (K2).
- CO2: Understand about components and implementation of Network Attached Storage (NAS) (K2).
- CO3: Understand the different types of backup, archives and forms of virtualization (K2).
- CO4: Identify the cloud computing infrastructure and services to store the massive data (K3).
- CO5: Apply the secure storage infrastructure and management activities (K3).

**UNIT I STORAGE SYSTEMS 9**

Introduction to Information Storage: Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Host, Connectivity, Storage. RAID: Implementation Methods, Techniques, RAID Impact on Disk Performance. Intelligent Storage Systems: Components, Storage Provisioning.

**UNIT II PRINCIPLES OF DESIGN THINKING 9**

Fibre Channel Storage Area Networks: Components, connectivity, Architecture, Zoning, Topologies, Virtualization, IP SAN, FCoE, iSCSI, FCIP, Network Attached Storage: Components, I/O Operation, File Sharing Protocols, File-Level Virtualization, Object based Storage, Unified Storage: Object based Storage Devices, Content Addressed Storage.

**UNIT III BACKUP, ARCHIVE AND REPLICATION 9**

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, BC Technology Solutions. Backup and Archive: Backup Methods, Backup Topologies, Backup Targets, Data Deduplication, Data Archive, Local Replication: Terminology, Applications, Technologies, Virtualized Environment. Remote Replication: Technologies, Three-Site Replication, Virtualized Environment Remote Replication and Migration.

**UNIT IV CLOUD COMPUTING AND VIRTUALIZATION 9**

Cloud computing: Technologies, Characteristics, Benefits, Infrastructure, challenges, Cloud Service Models, Cloud Deployment Models, Cloud Adoption Considerations. Virtualization Appliances: Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances, Storage Automation and Virtualization: Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications. Case study: own Cloud configuration.

**UNIT V SECURING AND MANAGING STORAGE INFRASTRUCTURE 9**

Securing and Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, SAN Security Implementations, Securing Storage Infrastructure: Virtualized Environment, Cloud Environments. Storage Infrastructure: Monitoring, Management activities and Challenges, Information Lifecycle management, Storage Tiering.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Robert Spalding, "Storage Networks: The Complete Reference", McGraw Hill Education, Indian Edition, 1<sup>st</sup> Edition, 2017.
2. Waman S Jawadekar, Sanjiva Shankar Dubey, "Management Information System: Text and Cases", McGraw Hill, 6<sup>th</sup> Edition, 2020.
3. Ramesh Behl, James A. O'Brien, George M. Marakas, "Management Information Systems", McGraw Hill India, 11<sup>th</sup> Edition, 2019.

**REFERENCES**

1. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas, "Introduction to Storage Area Networks", IBM, International Technical Support Organization, Red Books, 9<sup>th</sup> Edition, 2017.
2. Rahul De, "MIS: Managing Information Systems in Business, Government and Society", Wiley; 2<sup>nd</sup> Edition, 2018.
3. [https://doc.owncloud.com/server/admin\\_manual/configuration/](https://doc.owncloud.com/server/admin_manual/configuration/)

<b>19CS22E</b>	<b>WIRELESS ADHOC NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### **COURSE OUTCOMES**

Upon completion of this course students will be able to

- CO1: Understand the basis of wireless Ad-hoc networks. (K2)
- CO2: Acquire design, operation and the performance of MAC layer protocols of wireless Ad-hoc networks. (K2)
- CO3: Recognize operation and the performance of routing protocol of wireless Ad-hoc network.(K3)
- CO4: Aware about design, operation and the performance of transport layer protocol of Wireless Ad-hoc networks.(K2)
- CO5: Investigate the importance of security in wireless Ad-hoc networks.(K3)

### **UNIT I WIRELESS LANS AND PANS 9**

Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF. Wireless ad hoc networks: Introduction, Issues in Wireless Ad Hoc Networks.

### **UNIT II MAC PROTOCOLS 9**

Introduction, Issues in Designing a MAC protocol for Wireless Ad Hoc Networks, Design goals of a MAC Protocol for Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

### **UNIT III ROUTING PROTOCOLS 9**

Introduction, Issues in Designing a Routing Protocol for Wireless Ad Hoc Networks, Classification of Routing Protocols, Table Driven Routing Protocols: OLSR & STAR, On Demand Routing Protocols: AODV & TORA, Hybrid Routing Protocols: ZRP & ZHLS, Location aware Protocols: GPSR & GLR, Cluster based Routing Protocols: LEACH & TEEN, Power Aware Routing Protocols : DEAR & MEHDSR.

### **UNIT IV TRANSPORT LAYER PROTOCOLS 9**

Introduction, Issues in Designing a Transport Layer Protocol for Wireless Ad Hoc Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Wireless Ad Hoc Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

**UNIT V SECURITY IN WIRELESS ADHOC NETWORKS****9**

Security in Wireless Adhoc Networks Introduction – Security issues in adhoc networks- Keying Management- Security Requirements - Attacks on adhoc Networks - Secure Routing: Secure AODV, ARAN, SEAD and MASK-Intrusion detection systems-Policy Management.

**L:45; TOTAL:45 PERIODS****TEXT BOOKS**

1. Mohammed Ilyas, "The hand book of wireless adhoc networks", CRC Press, 1<sup>st</sup> Edition, 2017.
2. Jing selenia He, Shouling Ji, Yipan, and Yingshu Li, "Wireless adhoc and sensor Networks Management, Performance and Applications", 2<sup>nd</sup> Edition, CRC Press, 2019.
3. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference, 2<sup>nd</sup> Edition, 2008.
4. Farooq Anjum and Petros Mouchtaris, "Security for wireless ad hoc networks", Wiley Interscience publication, 1<sup>st</sup> Edition, 2010.

**REFERENCES**

1. Hai Lu, Yiu wing and Xiaawen "Adhoc and sensor Wireless Networks: Architectures, Algorithms and Protocols", Bentham press, 1<sup>st</sup> Edition, 2018.
2. Luigi, Gennaro, Giuseppe, Yaser and Claudis, "Ad-Hoc Networks and Wireless", ADHOC-NOW 2020 Proceedings, Springer, 4<sup>th</sup> Edition, 2020.
3. Jesus Hamilton Ortiz and Alvaro, "Adhoc Networks", ITeXLi, 1<sup>st</sup> Edition, 2017.
4. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 1<sup>st</sup> Edition, 2011.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks - Technology, Protocols, and Applications", John Wiley, 1<sup>st</sup> Edition, 2010.

**19CS23E****TCP / IP**

L	T	P	C	QP
3	0	0	3	A

**COURSE OUTCOMES**

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

- CO1: Describe the architecture, design and behaviors of the internet and of the TCP/IP suite of protocols (K2)
- CO2: Build an understanding of the fundamental concepts of internetworking. (K3)
- CO3: Express their knowledge in various congestion control techniques and mechanisms in Quality of Service in networking.(K2)
- CO4: Design active router queue management to avoid congestion control.(K3)
- CO5: Acquire the knowledge of STCP and identify the issues in transport and application layers. (K2)



**UNIT I NETWORK MODELS 9**

Layered Tasks - OSI Model - TCP/IP Protocol suite -Addressing. Connecting devices: Passive Hubs - Repeaters - Active Hubs - Bridges - Two Layer Switches - Routers - Three Layer Switches - Gateway - Backbone Networks

9

**UNIT II INTERNETWORKING CONCEPTS**

Principles of Internetworking, Connectionless Interconnection - Application Level Interconnection - Network Level Interconnection - Internet Architecture - Interconnection through IP Routers TCP - UDP & IP: TCP Services - TCP Features – Segment - TCP Connection - Flow Control - Error Control - Congestion Control - Process to Process Communication - User Datagram - Checksum - UDP Operation - IP Datagram - Fragmentation, Options - IP Addressing: Classful Addressing - IPV6.

**UNIT III CONGESTION AND QUALITY OF SERVICE 9**

Data Traffic - Congestion: Congestion Control - Congestion Control in TCP - Congestion Control in Frame Relay - Source Based Congestion Avoidance - DEC Bit Scheme - Quality of Service - Techniques to Improve QOS: Scheduling - Traffic Shaping - Admission Control - Resource Reservation - Integrated Services and Differentiated Services.

**UNIT IV QUEUE MANAGEMENT 9**

Buffer Management - Drop Tail - Drop Front- Random Drop - Passive Buffer Management Schemes - Active Queue Management: Early Random Drop - RED Algorithm.

**UNIT V STREAM CONTROL TRANSMISSION PROTOCOL 9**

Introduction - Packet Format – Flow Control - Error Control - Congestion Control. Mobile Network Layer: Entities and Terminology - IP Packet Delivery - Agents - Addressing - Agent Discovery, Registration - Tunnelling and Encapsulating - Inefficiency in Mobile IP. Mobile Transport Layer : Classical TCP Improvements - Indirect TCP - Snooping TCP - Mobile TCP - Fast Retransmit/Fast/Recovery – Transmission - Timeout Freezing- Selective Retransmission - Transaction Oriented TCP.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill Education, 5<sup>th</sup> Edition, 2017.
2. Behrouz A Forouzan, “TCP/IP Protocol Suite”, McGraw-Hill Education, 4<sup>th</sup> Edition, 2017.

**REFERENCES**

1. W. Richard Stevens, Kevin R. Fall, “TCP/IP Illustrated”, Addison-Wesley Professional, 2<sup>nd</sup> Edition, 2012.
2. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” Elsevier, 5<sup>th</sup> Edition, 2014.
3. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6<sup>th</sup> Edition, 2015.

**19CS24E CYBER FORENSICS AND ETHICAL HACKING L T P C QP**  
**3 0 0 3 A**

### **COURSE OUTCOMES**

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

- CO1: Understand the basics of computer forensics (K2)
- CO2: Apply a number of different computer forensic tools to a given scenario (K3)
- CO3: Analyze and validate forensics data (K3)
- CO4: Identify the vulnerabilities in a given network infrastructure (K2)
- CO5: Implement real-world hacking techniques to test system security (K3)

### **UNIT I INTRODUCTION TO COMPUTER FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology – Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. – Forensics Technology and Systems – Understanding Computer Investigation – Data Acquisition.

### **UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Computer Forensics Tools: Deleted Digital Data Restoration Tools - Data Recovery Pro, Recuva, Deleted Partitions Restoration Tools – Ease US Partition Recovery Wizard, Active Partition Recovery.

### **UNIT III ANALYSIS AND VALIDATION 9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

### **UNIT IV ETHICAL HACKING 9**

Introduction to Ethical Hacking – Foot printing and Reconnaissance – Scanning Networks – Enumeration – System Hacking – Malware Threats – Sniffing

### **UNIT V ETHICAL HACKING IN WEB 9**

Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications – SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms.

**L : 45; TOTAL : 45 PERIODS**

### **TEXT BOOKS**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 1<sup>st</sup> Edition, 2016.
2. Kimberly Graves, “CEH official Certified Ethical Hacking Review Guide”, Wiley India Edition, 1<sup>st</sup> Edition, 2016.

### **REFERENCES**

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2<sup>nd</sup> Edition, 2015.
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, 3<sup>rd</sup> Edition, Prentice Hall, 2020.

3. AnkitFadia, "Ethical Hacking", Macmillan India Ltd, 2<sup>nd</sup> Edition, 2006.
4. Kenneth C.Brancik, "Insider Computer Fraud", Auerbach Publications Taylor Francis Group, 1<sup>st</sup> Edition, 2019.

<b>19CS25E</b>	<b>SOFTWARE DEFINED NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### **COURSE OUTCOMES**

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

- CO1: Comprehend the evolution of software defined networks.(K2)
- CO2: Express the specifications of SDN Controllers. (K2)
- CO3: Describe the SDN solutions for the Data Centre Network.(K3)
- CO4: Explicate network function virtualization and ecosystem.(K2)
- CO5: Comprehend various SDN Applications.(K3)

#### **UNIT I INTRODUCTION 9**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Need for SDN – Evolution of SDN – SDN Working Principle – SDN Operation - SDN Devices - SDN Controller - SDN Applications - Alternate SDN Methods

#### **UNIT II OPEN FLOW SDN CONTROLLERS 9**

Open Flow Specification – Drawbacks of Open SDN- SDN via APIs- SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Protocol Models - SDN Controller Models - Application Models

#### **UNIT III DATA CENTERS AND OTHER NETWORK ENVIRONMENT 9**

Definition – Demands - Tunnelling Technologies - Path Technologies - Ethernet Fabrics - SDN Use Cases - Comparison of Open SDN, Overlays, and APIs - Real-World Implementations -Wide Area Networks - Service Provider and Carrier Networks - Campus Networks - Hospitality Networks - Mobile Networks

#### **UNIT IV NETWORK FUNCTION VIRTUALIZATIONAND SDN ECOSYSTEM 9**

Definition – Uses - Standards - Open Platform NFV - Leading NFV Vendors - SDN vs NFV - In-Line Network Functions – Software Vendors - White-Box Switches - Cloud Services and Service Providers

#### **UNIT V SDN APPLICATIONS 9**

Terminology - Application Types - History of SDN Controllers - Reactive Java Application - Controller Considerations - Network Device Considerations - Creating Network Virtualization Tunnels - Offloading Flows in the Data Center - Access Control for the Campus - Traffic Engineering for Service Providers

**L:45; TOTAL:45 PERIODS**

### **TEXT BOOKS**

1. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 1<sup>st</sup> Edition, 2019.

- Paul Goransson Chuck Black Timothy Culver,” Software Defined Networks: A Comprehensive Approach”, Morgan Kaufmann, 2<sup>nd</sup> Edition, 2016.

## REFERENCES

- SiamakAzodolmolky, “Software Defined Networking with Open Flow”, Packet Publishing, 2<sup>nd</sup> Edition, 2017.
- Vivek Tiwari, “SDN and Open Flow for Beginners”, Amazon Digital Services, Inc., 1<sup>st</sup> Edition, 2017.
- Fei Hu, Editor, “Network Innovation through Open Flow and SDN: Principles and Design”, CRC Press, 1<sup>st</sup> Edition, 2014.

**19CS26E**

**CLOUD COMPUTING**

L	T	P	C	QP
3	0	0	3	A

## COURSE OUTCOMES

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

CO1: Recognize the fundamental concepts of Cloud Computing (K2)

CO2: Familiar with the various types of virtualization and its importance (K2)

CO3: Explore the various cloud infrastructures and application (K2)

CO4: Analyze the methods used for secure cloud access and application development (K3)

CO5: Analyze the various cloud platforms to provide cloud based services for complex applications. (K3)

## UNIT I CLOUD COMPUTING BASICS

**9**

Introduction to Cloud Computing: Roots of Cloud Computing-Layers and Types of Clouds-Desired Features of a Cloud-Cloud Infrastructure Management – Infrastructure As A Service Providers-Platform As Service Providers-Challenges and Risks-Migrating into a Cloud: Broad Approaches to Migrating into the Cloud-The Seven-Step Model of Migration into a Cloud.

## UNIT II VIRTUALIZATION

**9**

Basics of Virtualization: Characteristics – Taxonomy of Virtualization Techniques – Hardware Level Virtualization – Operating System Level Virtualization – Virtualization and Cloud Computing – Pros and Cons of Virtualization – Case Study: XEN, VMware.

## UNIT III CLOUD ARCHITECTURE AND SERVICES

**9**

Cloud Architecture – Cloud Services: Infrastructure as a Service – Platform as a Service – Software as a Service – Types of Cloud: Private Cloud – Public Cloud – Hybrid Cloud – Community Cloud – Challenges – Cloud Applications- Scientific Applications – Business Applications

## UNIT IV IAAS & PAAS

**9**

Virtual Machines Provisioning and Migration Services - Virtual Machines Provisioning and Manageability- Virtual Machine Migration Services - VM Provisioning and Migration in

Action - Provisioning in the Cloud Context - Aneka-Integration of Private and Public Clouds - Technologies and Tools for Cloud Computing - Aneka Cloud Platform - Aneka Resource Provisioning Service - Hybrid Cloud Implementation - CometCloud Architecture - Autonomic Behaviour of CometCloud - CometCloud-based Applications.

**UNIT V INDUSTRIAL PLATFORMS AND APPLICATION DEVELOPMENT 9**

Service creation environments - Compute Services – Storage Services – Communication Services – Additional Services - Google App Engine – Architecture core concepts – Application life cycle – Cost model – Azure core concepts – SQL Azure – platform appliance- Develop cloud based applications.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, “Mastering in Cloud Computing”, Tata McGraw Hill Education Private Limited (New Delhi), 1<sup>st</sup> Edition, 2017.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski “Cloud Computing Principles and Paradigms” John Wiley & Sons, Inc., Hoboken, New Jersey, 1<sup>st</sup> Edition, 2013.

**REFERENCES**

1. Barrie Sosinsky, Cloud Computing Bible, Wiley Publishing, Inc, 1<sup>st</sup> Edition, 2014.
2. Michael Miller, Cloud Computing: “Web-Based Applications That Change the Way You Work and Collaborate Online”, 2<sup>nd</sup> Edition, 2009.

**19CS27E ROBOTIC PROCESS AUTOMATION IN CLOUD L T P C QP**  
**3 0 0 3 A**

**COURSEOUTCOMES**

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

- CO1: recognize the basic concepts of the robotic process automation and its tools (K3)
- CO2: explore the various concepts of the cloud to provide cloud based services (K2)
- CO3: analyze the various azure services and tools used in various applications (K3)
- CO4: apply and understand the various security and privacy policies in azure (K3)
- CO5: create cloud azure subscriptions and to analyze its services and support (K4)

**UNIT I INTRODUCTION TO RPA AND ITS TOOLS 9**

Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots. Blue Prism Introduction – Architecture - Operating Model- Features - Applications. Introduction to Automation Anywhere – Architecture - Features – Deployment - Security – Applications. Introduction to UiPath - Architecture and Operating Model – Orchestrator – Multi Tenant Architecture – Applications.

**UNIT II CLOUD CONCEPTS 9**

Introduction to Cloud Computing: definition, private, public and hybrid cloud. Roots of Cloud Computing-Layers and Types of Clouds Desired Features of a Cloud-Cloud Infrastructure Management-Infrastructure As A Service Providers-Platform As Service Providers-Challenges and Risks-Migrating into a Cloud: Broad Approaches to Migrating into the Cloud-The Seven-Step Model of Migration into Cloud. Benefits and challenges of cloud computing, public vs private clouds. Benefits and challenges to the Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

### **UNIT III CLOUD AZURE SERVICES 9**

Introduction – Azure architectural components – Azure regions – Azure resource manager (ARM) - Azure core products in market place and its usage scenarios – Azure solutions: IOT, Big data and Artificial Intelligence – Azure Management tools – Azure and Power shell – Azure CLI- Azure Advisor.

### **UNIT IV CLOUD AZURE SECURITY AND PRIVACY 9**

Introduction – Azure security and Network connectivity – Azure Firewall –DDoS protection – Azure identity services- Azure security tools - Azure security center – key vault – Information Protection – Azure governance methodologies – Azure privacy, compliance and data protection standards – Microsoft Privacy statements – Trust Center – Service trust portal – Compliance manager.

### **UNIT V CLOUD AZURE SUBSCRIPTIONS AND SUPPORT 9**

Azure subscriptions – uses and options – Case study: Creation of Azure user subscription - planning and management costs – products and services – factors affecting costs – cost management- support plans – service level agreement (SLA) – Azure service lifecycle.

**L:45; TOTAL:45 PERIODS**

#### **TEXT BOOKS**

1. Alok Mani Tripathi, “Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool- UiPath”:- Create Software robots with the leading RPA tool- UiPath, 2018.
2. Gerardus Blokdyk, “Robotic Process Automation A Complete Guide”, 2020.
3. Jim Cheshire, “Microsoft Azure Fundamentals – Exam Ref Second Edition AZ-900”:- Microsoft Press, 2020.
4. John W. Ritting house, James F. Ransome, “Cloud Computing” by CRC Press, 2017.

#### **REFERENCES**

1. Tim Woodruff, “Learning Service Now: Administration and Development on the Now Platform, for Powerful IT Automation”, 2<sup>nd</sup> Edition Book, 2018.
2. Aashish Rudra Srivastava, “Service New Automation” Packt Publishing Limited, 2018.
3. Rajkumar Buyya, Christian Vecchiola and Thamari Selvi S, Mastering in Cloud Computing-II, Tata McGraw Hill Education Private Limited (New Delhi), 2015.

4. Sanjay Chaudhary, Gaurav Somani, "Research Advances in Cloud Computing", Springer Publications, 2018.
5. <https://azure.microsoft.com/en-in/overview/what-is-azure/> for Microsoft azure platform.
6. Mustafa Toromon and Tom Janetscheck, "Mastering Azure security", 2020
7. Dr.Kumarsaurabh, "Cloud computing – Architecting next gen-transformation paradigms", 4<sup>th</sup> Edition, Wiley publications, 2017.

<b>19CS28E</b>	<b>CLOUD SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### **COURSE OUTCOMES**

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

- CO1: Understand the fundamentals of cloud security (K2)
- CO2: Explore the cloud security architecture (K2)
- CO3: Apply the key concepts of cloud platforms and provide storage services for load balancing in cloud architecture. (K3)
- CO4: Assess the security of virtual systems and Analyse attacks on the VM (K3)
- CO5: Examine the risks involved in cloud security (K2)

#### **UNIT I INTRODUCTION TO CLOUD SECURITY 9**

Cloud Security objectives-Cloud security services-Cloud security design principles-Secure cloud software requirements -Approaches to Cloud Software Requirements Engineering-Cloud Security Policy Implementation and Decomposition-Secure Cloud Software Testing.

#### **UNIT II CLOUD SECURITY ARCHITECTURE 9**

Cloud Computing Security Architecture-Architectural considerations, Identity Management and Access Control, Autonomic Security.

#### **UNIT III CLOUD PLATFORMS 9**

Structure & security – Storage services - Networking and databases service- App services and web apps- Virtual machine-Case studies using open stack.

#### **UNIT IV VIRTUALIZATION BASED SECURITY ENHANCEMENT 9**

Guest hopping - attacks on the VM - VM migration attack - hyper jacking- IBM security - virtual server protection - virtualization-based sandboxing - Storage Security- HIDPS - log management - Data Loss Prevention.

#### **UNIT V CLOUD RISK MANAGEMENT 9**

Cloud Computing Risk Issues: The CIA Triad-Threats to Infrastructure, Data and Access Control-Cloud Service Provider Risks-Cloud Computing Security Challenges: Security Policy Implementation.

**L:45; TOTAL:45 PERIODS**

### **TEXT BOOKS**

1. Michael Collier, Robin Shahan, "Fundamentals of Azure", Microsoft press, 1<sup>st</sup> Edition, 2016.
2. Dr.Immad M Abbadi, "Cloud Management and Security" Wiley-Blackwell publication, 2<sup>nd</sup> Edition, 2015.
3. Ronald L.Krutz and Russell Dean Vines," Cloud Security: A Comprehensive Guide to Secure", Wiley-India, 2<sup>nd</sup> Edition, 2013.

## REFERENCES

1. Bernard Golden, "Amazon webservices", John Wiley & Sons, Inc, 1<sup>st</sup> Edition, 2015.
2. Maddiestigler, "Beginning Serverless Computing-Developing with Amazon Web Services, Microsoft Azure, and Google Cloud", APress, 2<sup>nd</sup> Edition, 2018.
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 1<sup>st</sup> Edition, 2014.

<b>19CS29E</b>	<b>INTERNET OF THINGS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO1: Understand the basics of IoT and its application sectors (K2)
- CO2: Recognize and apply IoT protocols appropriately (K2)
- CO3: Realize the IoT Reference Architecture and Real-World Design Constraints (K2)
- CO4: Design a portable IoT using Raspberry Pi (K3)
- CO5: Deploy an IoT application and connect to the cloud (K3)

### UNIT I INTRODUCTION 9

Definitions and functional requirements –IoT conceptual framework – IoT architectural view – Technology behind IoT - Components of Internet of Things: Control units – Sensors – Communication modules – Power sources. Communication technologies: RFID – Bluetooth – ZigBee – WiFi – RF Links – Mobile Internet – Wired Communication – M2M communication – Examples of IoT.

### UNIT II BASICS OF NETWORKING AND COMMUNICATION PROTOCOLS 9

Sensor technology – Actuator - Participatory sensing, industrial IoT and automotive IoT – Data acquiring and storage – organizing the data – analytics – knowledge acquiring, managing and storing processes - Sensor data communication protocols - Functions of CoAP, MQTT, OAuth2, XMPP, CoAPvs HTTP, CoAP Structure Model, Security Protocol and Application for CoAP.

### UNIT III IOT PLATFORMS 9

Arduino Platform - Programming Arduino for the Internet of Things - Reading from Sensors - Communication: Connecting Arduino with a mobile device - Communicating using Bluetooth - Communicating using USB - connection with the Internet using Wifi / Ethernet.



**UNIT IV RASPBERRY PI AND CLOUD SERVICES 9**

Basic building blocks of an IoT Device - Raspberry Pi - Linux on Raspberry Pi - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Cloud Storage Models & Communication APIs - WAMP - AutoBahn for IoT - Xively Cloud for IoT.

**UNIT V CASE STUDIES 9**

The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case Studies Illustrating IoT Design: IoT in Cities / IoT in the Home/ IoT in Healthcare / IoT in Agriculture. autonomous vehicles, Google Assistant based IO Control. IoT Platforms Design Methodology case studies: Intel IoT Framework, Qualcomm IoT Framework, Microsoft IoT Framework.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands -on Approach", University Press, 1<sup>st</sup> Edition, 2015.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw-Hill Education Pvt. Ltd., 1<sup>st</sup> Edition, 2018.
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Academic Press, 1<sup>st</sup> Edition, 2014.
4. Charalampos Doukas, "Building Internet of Things with the Arduino", Create Space, 2<sup>nd</sup> Edition, 2013.
5. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From parallel processing to the Internet of Things", Morgan Kaufmann Publishers, 1<sup>st</sup> Edition, 2012.
6. Marco Schwatz, "Internet of Things with Arduino Cookbook", Packt Publications, 1<sup>st</sup> Edition, 2016.

**REFERENCES**

1. Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things", published by Wiley, 1<sup>st</sup> Edition, 2015.
2. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", VPT, 1<sup>st</sup> Edition, 2014.
3. Marco Schwatz, "Internet of Things with Arduino Cookbook", Packt Publications, 1<sup>st</sup> Edition, 2016.
4. Nick Antonopoulos and Lee Gillam, "Cloud Computing: Principles, Systems and Applications", 2<sup>nd</sup> Edition, Springer, 2017.
5. <http://www.buildinginternetofthings.com/>
6. <http://www.theinternetofthings.eu>
7. <http://postscapes.com/projects>
8. <http://www.internetofthings.fi/>
9. <http://aws.amazon.com/>

<b>19CS30E</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Understand J2EE appraise and Collections Framework. (K2).
- CO2: Apply the various network programming constructs in Java (K3)
- CO3: Create web application using Java Server pages. (K4)
- CO4: Develop web services-based application using SOAP and RESTful WS (K4)
- CO5: design and develop enterprise applications using Spring and Ember JS (K3)

**UNIT I J2EE AND COLLECTIONS FRAMEWORK 9**

Introduction to J2EE – Java Platform-J2EE Architecture Types-Explore Java EE Containers, Types of Servers in J2EE Application-Enterprise java beans-Session Beans – Entity Beans – Persistent Entity Beans-Collections Framework: Enumerations - Stack - Queue – Sets – Maps - Utility Classes-Generics in Java- Primitive Wrapper classes- Comparable Interface-Comparator Interface.

**UNIT II NETWORK PROGRAMMING IN JAVA 9**

Looking up internet address: Inet Address class – Inet4Address- Network Interface Class – URL class: URL Encoder and Decoder classes- URI Class- Socket Class – Sockets for client sockets for server- Multicast Sockets-Java Messaging Services. JNI: primitive types – overloading & overriding native methods - Accessing Instance Fields of a Java Class in C/C++ - Resolving Native File Stream Conflicts.

**UNIT III JAVASERVER PAGES 9**

Introduction to JSP - Comparison with Servlet - JSP Architecture - JSP Life Cycle – JSP Scripting Elements - JSP Directives - JSP Implicit Objects - JSP Standard Tag Libraries - JSP Session Management - JSP CRUD Application.

**UNIT IV JAVA WEB SERVICES 9**

WS Components- WS Features-SOAP web services-RESTful web services- Web Services Security- JAX-WS in Java Application Servers-Develop and Execute SOAP and RESTful Web Service based Application.

**UNIT V JAVA FRAMEWORKS 9**

Spring Core Framework - Spring RESTful web services Framework - Spring Transaction Management Framework - Spring Validation Framework. Spring Boot: Introduction - Rest Annotation with In Memory Database & CRUD Operations - JPA Repository Concepts - Micro Services. Ember JS: Architecture – Templates – Routing – Models – Views.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Paul. Deitel, Harvey Deitel, “Java How to Program” Prentice Hall Publications, 11<sup>th</sup> Edition, 2017.
2. Elliotte Rusty Harold, “Java Network Programming”, O’Reilly Media Inc., 4<sup>th</sup> Edition,

2013.

3. Martin Kalin Java Web Services: Up and Running, O'Reilly Media, Inc., 2<sup>nd</sup> Edition, 2013.
4. Phillip Hanna, "JSP 2.0: The Complete Reference", 2<sup>nd</sup> Edition, McGraw Hill Education, 2017.
5. Dinesh Rajput, "Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot" Packt Publisher, 2018.

## REFERENCES

1. Patrick Naughton, "Complete Reference: Java 2", Tata McGraw-Hill, 5<sup>th</sup> Edition, 2017.
2. Cay S.Hortsmann, Gray Cornell, "Core Java: Volume II – Advanced Features", Pearson Education, 10<sup>th</sup> Edition, 2017.
3. Ed Roman, Rima Patel Sriganesh, Gerold Brose, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 2012.
4. Jesse Cravens, Thomas Q Brady, "Building Web Apps with Ember.js: Write Ambitious JavaScript", 1<sup>st</sup> Edition, O'Reilly Media, 2014.

<b>19CS31E</b>	<b>MOBILE APPLICATION DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO1: Understand the Concepts of Mobile Application.(K1)
- CO2: Analyze and Design UI in the context of mobile application. (K2)
- CO3: Analyze how the Android platform uses Intents.(K2)
- CO4: Understand the concept of Data storage and Content providers (K1).
- CO5: Develop mobile applications for Android. (K3)

### UNIT I INTRODUCTION 9

Mobile Applications – Characteristics and Benefits –Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Web vs Mobile App.

### UNIT II USER INTERFACE 9

User Interface Design part 1: Views & View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. User Interface Design Part 2: Menus, Action Bars, and Notifications: Status, Toasts and Dialogs.

### UNIT III INTENTS AND BROADCAST RECEIVERS 9

Introducing intents- Using intent to launch activities- Introducing Linkify- Using intents to Broadcast Events- Creating Intent filters and broadcast receivers –Using intent filters to services toimplicit intent- Using Intent Filters for Plug-Ins and Extensibility- Monitoring Device State Changes using Broadcast Intents.

**UNIT IV CONTENT PROVIDERS AND DATA STORAGE 9**

Content Providers: Contents provider, Uri, CRUD access, Browser, CallLog, Contacts, Media Store, and Setting. Data Access and Storage: Shared Preferences, Storage External, Network Connection. SQLite - SQLite Databases.

**UNIT V ANDROID APPLICATION DEVELOPMENT 9**

Designing Real world android application –Mapping out the application flow- Application source code- Managing jobs- Sever code- Building android application without SDK.

**L:45; TOTAL:45 PERIODS****TEXT BOOKS**

1. Joseph Annuzzi, Jr.,Lauren Darcey, Shane Conder “Introduction to Android Application Development”, Addison-Wesley, 4<sup>th</sup> Edition, 2015.
2. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
3. W. Frank Ableson, RobiSen, Chris King, C. Enrique Ortiz, “Android in Action”, 3<sup>rd</sup> Edition, 2012.

**REFERENCES**

1. ZigurdMednieks, Laird Dornin, G.BlakeMeike and Masumi Nakamura, “Programming Android”, O“Reilly, 2012.
2. <http://developer.android.com/guide/index.html>.

**19CS32E****UI / UX DESIGN**

L	T	P	C	QP
3	0	0	3	A

**COURSE OUTCOMES**

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

- CO1: Understand the principles of UI/UX Design in order to design with intention. (K2)
- CO2: Learn the effective user experience and the psychology behind user decision-making.(K2)
- CO3: Understand the importance of design principles of good user interface. (K3)
- CO4: Elucidate the implications for designing web application with multimedia and effects. (K3)
- CO5: Develop meaningful user interface for mobile applications. (K3)

**UNIT I INTRODUCTION 9**

Introduction about UX - Five Main Ingredients of UX - Three “Whats” of User Perspective - Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

**UNIT II USER OBSERVATION AND EXPERIENCE 9**

User Research - Subjective Research - Objective Research - Sample Size - Three Basic Types of Questions. Observe a User: Watch How They Choose - Interviews - Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.

### **UNIT III USER INTERFACE DESIGN PRINCIPLES 9**

Designing Behaviour: Designing with Intention - Rewards and Punishments - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust - Hidden versus Visible. Basic Visual Design Principles : Visual Weight - Contrast - Depth and Size - Color. Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - One Long Page or a Few Short Pages - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

### **UNIT IV WEB INTERFACE DESIGN 9**

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-Pattern - F-Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

### **UNIT V MOBILE INTERFACE DESIGN 9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

**L:45; TOTAL:45 PERIODS**

#### **TEXT BOOKS**

1. Joel Marsh, “UX for Beginners”, O’Reilly Media, Inc., 1<sup>st</sup> Edition 2015.
2. Xia Jiajia, “UI UX Design”, O’Reilly, Artpower International, 2016.
3. Brian Fling, “Mobile Design and Development”, O’Reilly Media Inc., 1<sup>st</sup> Edition, 2009.

#### **REFERENCES**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Pearson Education, 3<sup>rd</sup> Edition, 2004.
2. Alan Cooper, “The Essential Of User Interface Design”, Wiley Dream Tech Ltd., 2002.

<b>19CS33E</b>	<b>SOFTWARE DESIGN ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

#### **COURSE OUTCOMES**

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

- CO1: Analyze and design the object oriented model for a problem (K2)
- CO2: Implement a combination of design patterns (K3)
- CO3: Analyze, evaluate the application’s architecture (K3)
- CO4: Develop Service Oriented Architecture (K5)
- CO5: Design an architecture for real world problems (K5)

### **UNIT I OBJECT ORIENTED DESIGN 9**

Object Oriented Modeling principles – Inheritance – Association, Aggregation, Composition - Class Responsibility Collaborator technique – UML class diagrams - Modularity, separation of concerns, information hiding, and conceptual integrity – Tradeoff between cohesion and coupling.

**UNIT II DESIGN PATTERNS 9**

Design patterns -User interface design issues. - Design principles: open-closed, dependency inversion, least knowledge- Identifying and refactoring anti-patterns - Micro kernel - Model-view-controller architectural pattern – Proxy design pattern - Master Slave Design Pattern.

**UNIT III SOFTWARE ARCHITECTURE 9**

Software Architecture - Patterns - Reference Model - Components - Stakeholders - Architectural styles: main program and subroutine, object-oriented, interpreters, pipes and filters, database centric, event-based - Layered and n-tier architectures - UML package - Behaviour of a system using UML activity diagrams. – Aspect Oriented architecture.

**UNIT IV SERVICE-ORIENTED ARCHITECTURE 9**

Web-based systems. – Web System services: SOAP over HTTP, WSDL, UDDI, BPEL - REST architecture: JSON over HTTP, URI. - REST design principles. – Microservice architecture.

**UNIT V ARCHITECTURAL CASE STUDIES 9**

Case Studies: Designing a URL shortening service like TinyURL - Designing youtube or Netflix - Designing a web crawler – KWIC (Key Word in Context), Instrumentation Software, Mobile Robotics - Email: SMTP, POP – Virtual Machine - SandBox.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Pearson Education India, 3<sup>rd</sup> Edition, 2015.
2. Humberto Cervantes, Rick Kazman, “Designing Software Architectures - A Practical Approach”, Pearson Education India, 1<sup>st</sup> Edition, 2017.
3. Craig Larman, “Applying UML Patterns: An Introduction to Object–Oriented Analysis, Design and Iterative Development”, Pearson Education India, 3<sup>rd</sup> Edition, 2015.

**REFERENCES**

1. Nick Rozanski, Edin Woods, “Software Systems Architecture - Working with Stakeholders Using Viewpoints and Perspectives”, Pearson Education India, 2<sup>nd</sup> Edition, 2016.
2. Taylor, “Software Architecture: Foundations, Theory, and Practice”, John Wiley, 2010.
3. Clements, P., et al., “Documenting Software Architectures: Views and Beyond, Addison- Wesley”, 2<sup>nd</sup> Edition, 2010.
4. <https://www.coursera.org/specializations/software-design-architecture>
5. <http://nptel.vtu.ac.in/econtent/courses/CSE/06IS72/index.php>
6. <http://csce.uark.edu/~cwt/COURSES/2011-01--CSCE-5013--SW-ARCH/syllabus.html>
7. <https://www.educative.io/courses/grokking-the-system-design-interview/m2ygV4E81AR>

**19CS34E AUGMENTED REALITY AND VIRTUAL REALITY L T P C QP**  
**3 0 0 3 A**

### **COURSE OUTCOMES**

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

CO1: explore the interactive techniques in Virtual Reality(K3)

CO2: develop the simple framework of virtual reality(K3)

CO3: explore the research issues in Augmented Reality (K3)

### **UNIT I VIRTUAL REALITY 9**

Introduction - Fundamental Concept and Components - Primary Features and Present Development on Virtual Reality. Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output -- Visual /Auditory / Haptic Devices.

### **UNIT II VISUAL COMPUTATION IN VIRTUAL REALITY 9**

Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

### **UNIT III FRAMEWORKS AND APPLICATIONS 9**

Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc. Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.

### **UNIT IV AUGMENTED REALITY 9**

Introduction - Concepts-Hardware-Software- Taxonomy - Technology and features - Augmented reality methods - visualization techniques for augmented reality.

### **UNIT V AUGMENTED AND MIXED REALITY 9**

Augmented Reality: Challenges – systems – functionality - wireless displays in educational augmented reality applications-mobile projection interfaces - marker-less tracking for augmented reality - enhancing interactivity in AR environments - evaluating AR systems.

**L:45; TOTAL:45 PERIODS**

### **TEXT BOOKS**

1. Jesse Glover, Jonathan Linowes, "Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications", Kindle Edition, 1<sup>st</sup> Edition, 2019.
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.
3. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality

Applications, Foundations of Effective Design”, Morgan Kaufmann, 2009.

## REFERENCES

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Wiley-IEEE Press, 2<sup>nd</sup> Edition, 2006.
2. <https://nptel.ac.in/courses/106/106/106106138/>
3. [https://booksite.elsevier.com/samplechapters/9780123749437/01~Front\\_Matter.pdf](https://booksite.elsevier.com/samplechapters/9780123749437/01~Front_Matter.pdf)
4. <http://staff.fhhagenberg.at/burger/publications/pdf/ifip-portugal94.pdf>

**19CS35E**

**WEB ANALYTICS**

L	T	P	C	QP
3	0	0	3	A

## COURSE OUTCOMES

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

- CO1: Recognize the concepts and terminologies required for web analytics (K2)
- CO2: Comprehend the principles, methods and concepts used in web analytics.(K2)
- CO3: Apply the appropriate metrics to analyze the web data. (K4)
- CO4: Appreciate the concept of web goals and apply suitable filter in web analytics for tracking e-commerce sites. (K3)
- CO5: Explore the use of tools and techniques involved in web analytics.(K2)

### UNIT I INTRODUCTION

9

Web Analytics – Basics – Traditional Ways – Expectations – Data Collection – Click stream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing –Outcomes data – Competitive data – Search Engine Data.

### UNIT II WEB ANALYTIC CONCEPTS

9

URLS – Cookies – Time on site – Page views – Understand standard reports – Website content quality – Navigation reports – Search Analytics – Internal search, SEO and PPC – Measuring Email and Multichannel Marketing - Competitive intelligence and Web 2.0Analytics – Segmentation – Connectable reports.

### UNIT III WEB METRICS AND KPIS

9

Measuring Reach – Measuring Acquisition – Measuring Conversion – Measuring Retention – Focus on ‘Critical Few’- Key Performance Indicators – Case Studies.

### UNIT IV WEB GOALS AND FUNNELS

9

Filters - Ecommerce Tracking - Real Time Reports - Customer Data Alert - Adwords Linking - Adsense Linking -Attribution Modeling - Segmentation -Campaign Tracking - Multi-Channel Attribution

### UNIT V WEB ANALYTIC TOOLS

9

Content organization tool – Process measurement tools- Visitor Segmentation Tools-



Campaign Analysis – Commerce Measurement Tools -Google Analytics- Piwik Web Analytics – Emerging Analytics.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Michael Loban, Alex Yastrebenetsky, "Crawl, Walk, Run : Advancing Analytica Maturity with Google Marketing Platform", 2020.
2. Eric Fettman, Shiraz Asif, Feras Ahlou, "Google Analytics Breakthrough", John Wiley & Sons, 2016.

**REFERENCES**

1. Brian Clifton," Successful Analytics: Gain Business Insights by Managing Google Analytics", Advanced Web Metrics Ltd, 2015.
2. Brian Clifton, "Advanced Web Metrics with Google Analytics", Sybex, 3<sup>rd</sup> Edition, 2012.
3. Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users", Morgan Kaufmann, 2013.
4. Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., "Game Analytics: Maximizing the Value of Player Data", Springer, 2013.
5. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2<sup>nd</sup> Edition, Springer, 2011.

<b>19CS36E</b>	<b>SOCIAL COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Understand the basic concepts of computational social sciences (K2)
- CO2: Identify online social networks and understand how various social media networks are working and using SNA in their infrastructure (K3)
- CO3: Apply social media analytics concepts, techniques and tools in social media applications(K3)
- CO4: Analyze the mining methods on social web (K3)
- CO5: Explore the use of tools and techniques involved in web analytics. (K2)

**UNIT I INTRODUCTION TO COMPUTATIONAL SOCIAL SCIENCE 9**

Introduction to Social computing – Human centered computing : Methods – benefits- Introduction to CSS- Examples of CSS investigations - Society as a complex Adaptive system - Main Areas of CSS: An Overview - Computation and Social Science: Computers and programs - Data structures - Modules and modularization - Computability and Complexity – Algorithms - Introduction to Crowd sourcing: Components – activities - Crowd sourcing as a model for problem solving

**UNIT II ONLINE SOCIAL NETWORKS 9**

Introduction - Nodes, Edges and Network Measures, Basics of network structure and properties, Representing networks, Entity Resolution and Link Prediction - Social Network

methods - Social network data – Graphs to represent social relations – Matrices to represent social relations – working with network data – Connection: Networks and actors – basic demographics – density – reachability – connectivity – distance - Types of social networks - Human Cognition and Belief systems - Decision Making Models - International Relations-Software for SNA.

### **UNIT III SOCIAL NETWORK DATA ANALYTICS 9**

Introduction - Random walks in social networks and their applications a survey - Random walks on Graphs – Applications - Evaluation and datasets - Community Maintained Resources, Supporting technologies for community maintained resources – Social Media in the public sector, Analyzing public sector social media. Social Media Marketing, Mobile Marketing, Web Analytics, Social Media Analytics - Criteria of Effectiveness, Metrics, Techniques, Tools, Social Media Management, Centrality Measures-opinion mining, feature based sentiment analysis

### **UNIT IV VISUALIZING SOCIAL NETWORKS 9**

Visualizing social networks – Introduction - A Taxonomy of visualizations – The convergence of Visualization, Interaction and Analytics - Data mining in social media – Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts– Integrating sensors and social networks – Multimedia information networks.

### **UNIT V MINING THE SOCIAL WEB 9**

Mining twitter in all the rage – Exploring Twitter’s API - Mining Facebook - Exploring Facebook’s social Graph API – Analyzing social graph connections - Mining Google+ - Exploring the Google+ API - Mining web pages -Scraping, Parsing and crawling the Web - Using Natural Language processing to understand Human Language - Summarize Blog posts and more - Twitter Cookbook - Discovering the trending topics - Tabulating frequency analyzing - Getting all friends and Followers for a User.

**L:45; TOTAL:45 PERIODS**

#### **TEXT BOOKS**

1. Cioffi-Revilla, Claudio, “Introduction to Computational Social Science Principles and Applications”, Springer, 2<sup>nd</sup> Edition, 2017.
2. Mikhail Klassen, Matthew A. Russell “Mining the Social Web” O’Reilly Media, Inc. 3<sup>rd</sup> Edition, 2019.
3. Matthew Ganis, AvinashKohirkar, “Social Media Analytics”, Pearson Education India, 1<sup>st</sup> Edition, 2016.
4. Social Network Data Analytics by Charu C. Aggarwal, Springer India, 2015.

#### **REFERENCES**

1. Philip Kosky,George Wise, Robert Balmer and William Keat, “Exploring Engineering an Introduction to Engineering and Design”, Academic Press, Elsevier, USA, 4<sup>th</sup> Edition,2015
2. Sharp, Rogers, Preece, Interaction Design-Beyond Human Computer Interaction, Wiley, 4<sup>th</sup> Edition, 2015.
3. [www.ieagrements.org/IEA-Grad-Attr-Prof-Competencies.pdf](http://www.ieagrements.org/IEA-Grad-Attr-Prof-Competencies.pdf)

<b>19CS37E</b>	<b>SOFTWARE TESTING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### **COURSE OUTCOMES**

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

- CO1: Apply software testing fundamentals and testing design strategies to enhance Software quality. (K4)
- CO2: Design test cases for unit test, integration test, system test, regression and acceptance test.(K3)
- CO3: Discover how work test plan components, test measurements and reviews (K3)
- CO4: Perform Testing in software with various testing tools (K4)
- CO5: Develop and validate a test plan (K4)

### **UNIT I INTRODUCTION 8**

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process -The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of defects- Defect classes the defect repository. Analysis of defect for a project.

### **UNIT II TEST CASE DESIGN STRATEGIES 9**

Introduction to Testing Design Strategies - Black Box testing - Random Testing – Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing -White-Box testing - Test Adequacy Criteria - Coverage and Control Flow Graphs - Covering Code Logic Paths - White-box Based Test design.

### **UNIT III LEVELS OF TESTING 10**

The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests - Integration tests- Designing Integration Tests - system testing - Regression Testing. Alpha –Beta and Acceptance Test- Usability and Accessibility Testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

### **UNIT IV TEST MANAGEMENT 9**

People and organizational issues in testing – Organization structures for testing teams – testing services -Testing and Debugging Goals and Policies - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - Reporting Test Results - The role of three groups in Test Planning and Policy Development - Process and the Engineering Disciplines.

### **UNIT V AUTOMATED TESTING AND TEST TOOLS & BUG REPORTING 9**

Automated Testing and Test Tools:JUNIT and SELENIUM-benefits-Test Tools-Software Test Automation-Bug Bashes and Beta Testing-Writing and Tracking Test Cases: Goals-Test Case Planning Overview-Bug's Life cycle-Bug-Tracking System-Software Quality Assurance.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, "Software Testing Principles and Practices" Pearson Education, 2017.
2. Ron Patton, "Software Testing", Sams Publishing, Pearson Education, 2<sup>nd</sup> Edition, 2014.
3. Renu Rajani, Pradeep Oak, "Software Testing Effective Methods, Tools and Techniques", Tata McGraw Hill, 2017.

**REFERENCES**

1. M.G.Limaye, "Software Testing: Principles, Techniques and Tools", Tata McGraw-Hill, 1<sup>st</sup> Edition, 2009.
2. Ilene Burnstein, "Practical Software Testing: A Process-Oriented Approach", Springer International Edition, 2003
3. Boris Beiser, "Software Testing Techniques", Dreamtech press, New Delhi, 2009.
4. Paul Ammann and Jeff Offutt, "Introduction to Software Testing" Cambridge University Press, 2<sup>nd</sup> Edition, 2016.
5. <https://www.softwaretestingmaterial.com/manual-testing-tutorial/>
6. <https://learn-automation.com/selenium-webdriver-tutorial-for-beginners/>
7. <https://www.springboottutorial.com/junit-tutorial-for-beginners>

<b>19CS38E</b>	<b>ADVANCED DATABASE TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Realize the concepts of distributed databases. (K2)
- CO2: Develop queries for ODMG model using SQL and oracle. (K3)
- CO3: Analyze the various intelligent databases. (K3)
- CO4: Acquire knowledge about emerging database models. (K2)
- CO5: Develop queries for deductive databases. (K3)

**UNIT I      DISTRIBUTED DATABASES      9**

Introduction – Functionality of Distributed DBMS (DDBMS) – Architecture – Distributed data storage –query processing –Transaction Management – Concurrency control – Replication Servers – Case study on distributed database design.

**UNIT II      OBJECT ORIENTED DATABASES      9**

Concepts of Object Oriented Databases – Need for complex Datatype – Collection Types and Structured Types – ODMG Model – Object Definition Language - Object Query Language – Conceptual Design - Object Relational features in SQL, Oracle.

**UNIT III      INTELLIGENT DATABASES      9**

Active Databases - Concepts and Triggers –Syntax and Semantics – Temporal Databases – Overview – NoSQL: Overview– Characteristics -Storage Types – Pros– Cons–Comparative Study of NoSQL Products - Case Study.

**UNIT IV      EMERGING DATABASES      9**

Multimedia Databases – Types – Structure – Multimedia database design – Web databases - Case studies on web databases – Mobile Databases: Location and Handoff Management - MONGO DB : Setup and Configuration - CRUD Operations- POSTGRE SQL: Data types -CRUD Operations

**UNIT V DEDUCTIVE DATABASES 9**

Deductive Databases: Logic of Query Languages – Datalog - Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion- Recursive Queries in SQL

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education, Global Edition, 2017.
2. Dr.Sanjeev Sharma, Dr.JitendraAgrawal, Dr.ShikaAgrawal, “Advanced Database Management System”, Dreamtech press, New Delhi, 2017.
3. Dan Sullivan, “NoSQL for Mere Mortals”,Addison-Wesley Professional, 1<sup>st</sup> Edition 2015.

**REFERENCES**

1. Hans-Jürgen Schonig, “Mastering PostgreSQL 13: Build, administer, and maintain database applications efficiently with PostgreSQL 13”, 4<sup>th</sup> Edition, 2020.
2. Henry F Korth, Abraham Silberschatz and S. Sudharshan, “Database System Concepts”, McGraw Hill, 6<sup>th</sup> Edition, 2013.

<b>19CS39E</b>	<b>SQL PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Understand the fundamental DDL statements in SQL (K2)
- CO2: Understand the fundamental DML statements in SQL(K2)
- CO3: Exemplifying the advanced Query structures in SQL (K2)
- CO4: Apply Basic and Advanced SQL statements on real time Scenario’s using Joins and Procedures(K3)
- CO5: Integrating the NO SQL Structures to construct real time application (K3)

**UNIT I DATA DEFINITION LANGUAGE 9**

Introduction –SQL Syntax – Data types – Operators - Databases: Create – Drop – Rename- Select - Tables: Create – Rename – Alter –Truncate – Delete – Drop – Copy – Temp table –SQL Keys : Primary Key –Foreign Key – Composite key – Unique Key – Alternate Key.

**UNIT II DATA MANIPULATION LANGUAGE 9**

DML Statements – Select Statement –Insert Statement – Where clause –Sql Aliases – Operators - In – Between- Like -And – Or –Not -Union - Any- All –Exist – Some – Update

Statement – Delete Statement: Data Base - Table –Rows–SQL Aggregate Functions.

**UNIT III                    ADVANCED QUERY STRUCTURES                    9**

SQL Clauses: Order by- Asc – Desc-Random - Limit - Group By – Having - Sub Query – Nested Sub Query –Data Control Language: Privileges – Grant –Revoke – SQL Case statements -Null Functions –Indexes - Sequences – Auto Increment /Decrement – Clone tables –SQL Injections.

**UNIT IV                    SQL JOINS AND PROCEDURES                    9**

SQL Joins – Basics -Types:Self Join -Inner Join - Outer Join - Left Join – Right Join-Full outer Join – views – Case studies: Customer Sale Scenario –SQL Procedures - PL/SQL Functionalities - Control statements –Functions – Cursor -Triggers – Exceptions - Case Study: Banking Transactions (Front End : Html5 /Php/Asp/Jsp Back End : WAMPP / SQL Server).

**UNIT V                    ADVANCED NOSQL TRENDS                    9**

FIRE BASE: Real time Database & Firebase Fire Store – Setup and Configuration –Data Organization – CRUD Operations – MONGO DB : Setup and Configuration - CRUD Operations – Case Study : Real time applications using FIREBASE / Mongo DB – Reading web contents using neo4j.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Pearson Education/Addison Wesley, 6<sup>th</sup> Edition, 2017.
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, —Database System ConceptsII, Tata McGraw Hill, 6<sup>th</sup> Edition, 2013.

**REFERENCES**

1. HousseYahiaoui, “Firebase Cookbook: Over 70 recipes to help you create real-time web and mobile applications with Firebase”, Packt publishing, 2017.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Pearson Education, 5<sup>th</sup> Edition, 2009.
3. Peter Membrey, “MongoDB Basics”, Apress; 1<sup>st</sup> Edition, 2014.
4. Ian Robinson, Jim Webber, Emil Eifrem “Graph Databases: New Opportunities for Connected Data” "O'Reilly Media, Inc.", 10-Jun-2015
5. <https://docs.microsoft.com/en-us/sql/?view=sql-server-ver15>
6. <https://www.w3schools.com>
7. <https://www.geeksforgeeks.org>

<b>19CS40E</b>	<b>BLOCKCHAIN FUNDAMENTALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

- CO1: Understand a broad overview of the essential concepts of blockchain technology.(K2)
- CO2: Describe the concepts of cryptographic primitives. (K2)
- CO3: Recognize different types of consensus algorithms (K2)
- CO4: Apply mining process in blockchain network. (K3)
- CO5: Understand about the applications and Limitations of blockchain (K2)

### UNIT I INTRODUCTION TO BLOCKCHAIN 9

Centralized Vs Decentralized Systems- Limitations of Centralized Systems- Components of Blockchain-Layers of Blockchain-Block Structure- Blockchain Functionality - Tiers of Blockchain Technology: Blockchain 1.0- Blockchain 2.0- Blockchain 3.0- Types of Blockchain: Public Blockchain- Private Blockchain- Semi-Private Blockchain- Sidechains- Blockchain Wallets.

### UNIT II BASIC CRYPTO PRIMITIVES 9

Cryptographic Hash Functions- Attacks on Hash Functions- Hash Pointers and Data Structures- Public Key Cryptography- Digital Signatures using Public Key Cryptography - Elliptic Curve Cryptography

### UNIT III CONSENSUS ALGORITHMS 9

Distributed Consensus-Types of Consensus Algorithms: Proof of Work- Proof of Stake- - Delegated Proof of Stake-Proof Elapsed Time- Proof of Burn- Byzantine Fault Tolerance- Practical Byzantine Fault Tolerance- Blockchain Forks-Soft Fork - Hard Fork

### UNIT IV MINING IN BLOCKCHAIN 9

Mining Hardware-CPU Mining- GPU Mining-FPGA Mining-ASIC Mining-Mining Pools-Solo Mining-Pool Mining-Mining incentives and strategies- Mining puzzles

### UNIT V BLOCKCHAIN APPLICATIONS 9

Blockchain Applications - Supply Chain Management and Trade Finance - Challenges and Limitations in Blockchain- Cryptocurrency Regulation: Governing the digital economy- Stakeholders-Legal Aspects-Crypto currency Exchange- Global Market and Global Economy.

**L:45; TOTAL:45 PERIODS**

## TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks" Packt Publisher, 2017.

## REFERENCES





Possible Reasons for Ban - Virtual Currency Regulations - Global Perspective of Regulations on Blockchain - Future needs for Regulations.

**L:45; TOTAL:45 PERIODS**

### TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", Princeton University, 2016.
2. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, First Edition, 2014.
3. Richard Hayen, "Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology. - Bitcoin, FinTech, Smart Contracts, Cryptocurrency", Risk Books Publisher, 2017

### REFERENCES

1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019.
2. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System", Whitepaper
3. <https://www.eduonix.com/blockchain-and-cryptocurrencies-for-beginners>
4. <https://www.coursera.org/learn/cryptocurrency>
5. <https://www.globallegalinsights.com/practice-areas/blockchain-laws-and-regulations/india#chaptercontent1>

<b>19CS42E</b>	<b>SMART CONTRACT AND SOLIDITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>A</b>

### COURSE OUTCOMES

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

- CO1: understand the working and importance of smart contracts.(K2)
- CO2: develop Smart Contracts on the Ethereum Block chain (K3)
- CO3: understand the basics of solidity programming (K2)
- CO4: present different Smart Contract development platforms (K2)
- CO5: create and deploy a DApp on a Ethereum network (K3)

### UNIT I INTRODUCTION 12

Introduction to Smart Contracts- Definitions – Features - Life Cycle - Smart Contract execution- Virtual Machine of a Block chain- Source code of a Smart Contract- Useful Terminologies

### UNIT II ETHEREUM SMART CONTRACT 12

Ethereum Smart Contracts - Ethereum Higher-Level Languages -Developing Smart Contracts - The Solidity language: An object-oriented, high-level language for implementing smart contract - Designing a Solidity Smart Contract- Ether and Gas – Mining Ethereum.

### UNIT III SOLIDITY PROGRAMMING 12

Solidity – Contracts- Constructors – Functions- Variables-Getters – Setters- Arrays -

Memory vs Storage - Mappings in Solidity – Structs - Error Handling and Restrictions – Libraries - Global Variables - Abstract Contracts – Inheritance- Interfaces-Events Installing Solidity - Solc Compiler - Ethereum Contract Application Binary Interface - Remix-IDE for Smart Contract Development.

#### **UNIT IV SMART CONTRACT PLATFORMS 12**

Smart Contract programming languages - Execution Environments - Environment Setup for Truffle and Ganache - Truffle Project Creation - Writing Smart Contracts - Developing Smart Contract - Programmer's responsibility - Cost of running smart Contracts - Smart Contract development platforms - Picking the right block chain.

#### **UNIT V BUILDING ETHEREUM DAPP 12**

DApp – Metamask - Setting up a Private Ethereum Network: Install go-ethereum – Create geth Data directory – Create a geth account – create genesis.json configuration File – Run the first Node of the Private Network – Run the second node of the Network – Creating Smart Contract – Deploying the Smart Contract – Client Application.

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

#### **TEXT BOOKS**

1. Tiana Laurence, "Blockchain for Dummies", 2<sup>nd</sup> Edition, John Wiley & Sons, 2019
2. Ritesh Modi, "Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and blockchain", Packt Publishing Ltd, 2018
3. Andreas Antonopoulos and Gavin Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", Shroff Publisher/O'Reilly Publisher, 2018
4. Michael J. Casey and Paul Vigna, "The Truth Machine: The Blockchain and the Future of Everything", Kindle Edition, St. Martin's Press, 2018.

#### **REFERENCES**

1. Kevin Solorio, Randall Kanna, David H. Hoover, "Hands-On Smart Contract development with Solidity and Ethereum", O'Reilly Media, Inc., 2019
2. Lee, Wei-Meng, "Beginning Ethereum Smart Contracts Programming", Apress, 2019
3. <https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/>

**19CS43E BLOCKCHAIN FRAMEWORKS LABORATORY L T P C**  
**0 0 4 2**

#### **COURSE OUTCOMES**

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

- CO1: Implement the basic concepts of Ethereum Smart Contract using Solidity (K3)
- CO2: Implement the mining process in blockchain using Kotlin (K3)
- CO3: Implement transaction and consensus mechanism using Golang (K3)
- CO4: Implement the distributed application using Hyperledger Fabric. (K3)

## LIST OF EXPERIMENTS

1. Implement a smart contract that stores and retrieves a value from blockchain.
2. Write a solidity program to call a function from another smart contract.
3. Deploy a smart contract on ethereum.
4. Build a smart contract for a simple open auction on ethereum.
5. Implement basic mining algorithm in blockchain using Kotlin.
6. Implement consensus mechanism in a blockchain using Golang.
7. Implement persistence process in blockchain application using Golang.
8. Demonstrate transactions with input and outputs to the blockchain using Golang.
9. Building a Basic Wallet Module using Golang.
10. Develop a Dapp using hyperledger fabric.

## Mini Project to be developed for any one of the following applications

1. Vote chain – Electronic Voting System based on Blockchain
2. Blockchain-based Patient Data Management System
3. Blockchain-based Land Registries System
4. Blockchain in KYC verification
5. Transparent and Genuine Charity Applications based on Blockchain

**P: 60; TOTAL: 60 PERIODS**

## SOFTWARE REQUIREMENTS

- Operating System: Linux /Windows
- Software: RemixIDE, JDK, IntelliJ IDEA 2021.2.3, LiteIDE /GoLand 2021.2.4
- Platform: Ethereum, Hyperledger Fabric

## Sample Question Bank (Exercises not limited to this)

1. Write and deploy a smart contract to change the value of the existing smart contract which is deployed earlier?
2. Create a smart contract to demonstrate how to store and retrieve the details of the employees of an organization using structure, arrays, and functions.
3. Consider the scenario where the number of users is participating in the auction. The general concept is that everyone can send their bids during a bidding period. The bids are in the form of ethers. If the highest bid is raised, the previously highest bidder gets her money back. After the end of the bidding period, the highest bidder should win the auction. Write the appropriate smart contract to choose the auction winner.
4. Write a Golang program to implement the proof of stake consensus mechanism.
5. Write a kotlin program to implement a simple blockchain.
6. Write a Golang program to build a basic wallet module for blockchain.
7. Write a Golang program to simulate the input and output process of blockchain.
8. Write a smart contract to design a trusted crowdfunding environment.
9. Write a smart contract to design a system that detects the product is a fake one or a real one.
10. Write a smart contract to develop peer to peer ride-sharing system to avoid intermediaries.

**19CS44E                      PROFESSIONAL READINESS FOR INNOVATION,  
EMPLOYABILITY AND ENTREPRENEURSHIP**
**L T P C  
0 0 6 3**
**COURSE OBJECTIVES**

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

**COURSE OUTCOMES**

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

CO1: Upskill in emerging technologies and apply to real industry-level use cases

CO2: Understand agile development process

CO3: Develop career readiness competencies, Team Skills / Leadership qualities

CO4: Develop Time management, Project management skills and Communication Skills

CO5: Use Critical Thinking for Innovative Problem Solving

CO6: Develop entrepreneurship skills to independently work on products

**TABLE 1: ACTIVITIES**

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3

Activity Name	Activity Description	Time (weeks)
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
<b>TOTAL</b>		<b>16 WEEKS</b>

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

**TABLE 2: EVALUATION SCHEMA**

TECHNICAL SKILLS		SOFT SKILLS	
Criteria	Weightage	Criteria	Weightage
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
<b>Total</b>	<b>70</b>	<b>Total</b>	<b>30</b>
<b>Total Weightage</b>		<b>100</b>	
<b>Passing Requirement</b>		<b>50</b>	
<b>CONTINUOUS ASSESSMENT ONLY</b>			

**P: 90; TOTAL: 90 PERIODS**

19CS45E DESIGN OF VIRTUAL REALITY SYSTEMS L T P C

2 0 2 3

**COURSE OUTCOMES**

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

- CO1: Explore the fundamental components of VR systems. (K2)
- CO2: Elaborate geometric presentation of the virtual world and its operations. (K2)
- CO3: Realize the system of implication on perception and rendering. (K3)
- CO4: Design the concepts of motion and tracking in VR systems. (K3)
- CO5: Demonstrate the importance of interaction and audio in VR systems (K3)

**UNIT I INTRODUCTION TO VIRTUAL REALITY 6**

Human Physiology and Perception - Key Elements of Virtual Reality Experience - Virtual Reality System - Interface to the Virtual World - Input & output - Visual, Aural & Haptic Displays - Applications of Virtual Reality - Visual Representation, Aural Representation and Haptic Representation in VR

**UNIT II GEOMETRY OF VIRTUAL WORLDS 6**

Geometric Models - Changing Position and Orientation - Axis-Angle Representations of Rotation - Viewing Transformations - Chaining the Transformations

**UNIT III VISUAL PERCEPTION & RENDERING 6**

Visual Perception - Perception of Depth, Motion and Color - Combining Sources of Information Visual Rendering - Ray Tracing and Shading Models – Rasterization - Correcting Optical Distortions - Improving Latency and Frame Rates - Foveated rendering

**UNIT IV MOTION AND TRACKING 6**

Motion in Real and Virtual Worlds - Velocities and Accelerations - Vestibular System - Physics in the Virtual World - Mismatched Motion and Vection Tracking - Tracking 2D & 3D Orientation - Tracking Position and Orientation - Tracking Attached Bodies

**UNIT V INTERACTION AND AUDIO 6**

Interaction - Motor Programs and Remapping – Locomotion – Manipulation - Social Interaction- Audio -The Physics of Sound, The Physiology of Human Hearing - Auditory Perception - AuditoryRendering.

**LIST OF EXPERIMENTS: (30 periods)**

Prerequisite: Installation of Unity, Opening unity and exploring its interface

1. Set up a simple scene in Unity and experiment with adding different types of objects in the scene and change their axes and view the effect
2. Script a simple component in C# using Visual Studio
3. Add different materials to the objects look around the scene; adjust the cameras to modify your scene to our tastes. Build to VR for the first time
4. Generate a ray in unity, cast a ray into the scene and detect the hit

5. Create a simple movement script and test the script by changing the speed of movement
6. Create a basic level layout, create some obstacles, and add some teleport points to your game and make some final adjustments to adopt the game for desktop and mobile and finish building the game
7. Mini project on a real-world scenario

#### SOFTWARE REQUIREMENTS:

- Windows
- Unity 2022.2.1
- Visual Studio 2012 (Licensed)

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

#### TEXT BOOKS

1. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016
2. William R Sherman and Alan B Craig, "Understanding Virtual Reality", Interface, Application and Design, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2018
3. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2012.

#### REFERENCES

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2011.
3. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Inter science, India, 2017
4. <http://lavalle.pl/vr/book.html>
5. <https://nptel.ac.in/courses/106/106/106106138/>
6. <https://www.coursera.org/learn/introduction-virtual-reality>
7. <https://www.udemy.com/course/building-your-first-vr-experience-with-unity/>

**19CS46E**

**VISUAL EFFECTS**

**L T P C**  
**2 0 2 3**

#### COURSE OUTCOMES

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

- CO1: Acquire the core concepts of visual effects (K2)
- CO2: Realize the importance of VFX in Production (K2)
- CO3: Demonstrate various techniques used in visual effects (K3)
- CO4: Manipulate the concepts in digital images (K3)
- CO5: Explore the working principles of VR stitching process (K3)

- UNIT I VFX FUNDAMENTALS 6**  
 Core Concepts: Special Effects or Visual Effects – CGI – 2D, 3D, and Stereoscopic 3D – Realism and Photorealism – Animation, Games, and Visual Effects – VFX and the Digital Revolution- VFX as a film making Tool- Common types of VFX shots – Camera movement and VFX.
- UNIT II VFX IN PRODUCTION 6**  
 2D Workflow – 3D Workflow – Rotoscoping - Camera Tracking – Layout – Modeling – Animation – Pre Production: Preliminary VFX Breakdown – Preliminary Bidding – On Set: Shooting VFX Elements – Green Screens - Post Production: VFX Color Workflow – Image and Video Format – The Reviewing Process.
- UNIT III BLENDER FOR VISUAL EFFECTS 6**  
 Tracking – Screen Setup – Masking – Compositing - Texturing and Shading – Rigging - Rendering - Case studies: Piranha Attack –Tsunami Mayhem.
- UNIT IV VR STITCHING 6**  
 Workflow overview - Removing Lens Distortion – Building a matching computer Rig – The Stitching Process – Case studies: Visual Effects using AR, MR and VR – Ellis Island
- UNIT V SECURITY IN IMAGES 6**  
 Banner or Poster Creation – Reels Creation – Water Marking – Security in Images - Digital Marketing - Case studies: The Crane Dare - Background Cleanup – The Homestead Strike

**LIST OF EXPERIMENTS:**

1. Creating a 3D Model with color, shade effects
2. Develop an animated day and night scene of a street with the help of lighting effects.
3. Making Motion Tracking and Masking for the 3D object created in Ex.1
4. Adding various Texturing and Shading for the 3D object created in Ex.1
5. Building a dynamic VFX simulation with Rendering for the 3D object created in Ex.1
6. Creating 360 degree photos and videos using VR Stitching.

**SOFTWARE REQUIREMENT**

- **Operating System:** Windows / Linux
- **Software:** Blender / Natron

**L: 30; P: 30; TOTAL: 60 PERIODS****TEXT BOOKS**

1. Eran Dinur, "The Filmmaker's Guide to Visual Effects: The Art and Techniques of VFX for Directors, Producers, Editors and Cinematographers", Taylor and Francis Group, 2017.



2. Sam Vila, "Blender for Visual Effects", CRC Press, Taylor & Francis Group, 2015.
3. Steve Wright, "Digital Compositing for film and video", Focal Press, Fourth Edition, 2018.

## REFERENCES

1. Jeffrey Okun VES, Susan Zwerman VES, "The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", 3<sup>rd</sup> edition, 2017.
2. Bill Byrne, "The visual effects arsenal: VFX solutions for the independent filmmaker", 5<sup>th</sup> Edition, 2009.

## E-SOURCES

1. [https://onlinecourses.swyam2.ac.in/cec23\\_cs08/preview](https://onlinecourses.swyam2.ac.in/cec23_cs08/preview)
2. <https://mailchimp.com/marketing-glossary/digital-marketing/>
3. <https://www.geeksforgeeks.org/digital-watermarking-and-its-types/>

**19CS47E**

**GAME DEVELOPMENT**

**L T P C**  
**2 2 0 3**

## COURSE OUTCOMES

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

- CO1: explore different genres of video games and its components. (K2)
- CO2: recognize the usage of 2D and 3D graphic features in game engines. (K2)
- CO3: implement 3D character control and particle systems. (K3)
- CO4: apply animation and movement in 3D objects. (K3)
- CO5: design and demonstrate User Interface and Audio in gaming environment. (K3)

## UNIT I

### INTRODUCTION

**6**

Motivation - Types of games - Different aspects of game design –Game Objects – Working with components - Working with Prefabs - Working with Scenes - Managing Assets. Scripting: Working with MonoBehaviours - Using Callbacks - Accessing Components - Finding Objects - UsingCoroutines – Singletons - Loading a Level (Scene)

## UNIT II

### 2D AND 3D GRAPHICS

**6**

2D Graphics: Creating a sprite animation - Creating sprites with 2D physics – customizing sprite collision shapes - using a Composite Collider - using the Sprite Packer - Applying Forces to 2D Objects - Sprite Sorting 3D Graphics: Creating a Simple Material - Controlling a Material'sProperty - Creating an Unlit Material - Setting Up a Material Using Textures – Adding effects and colors.

## UNIT III

### PHYSICS AND CHARACTER CONTROL

**6**

Understanding Fixed Update - Implementing Mouse look - Controlling a 3D Character - Interacting with Switches and Objects - Picking Up and Putting Down Objects – Detecting objects -Implementing Moving Platforms - Implementing Platform Riding - Responding to Being Pushed by Objects – Particle system.

**UNIT IV ANIMATION AND MOVEMENT 6**

Animating an Object - Basic Character Movement - Inverse Kinematics - Masked Movement - Blended Movement - Navigation and Animating in Sync – Tracking and switching Camera - Keeping Multiple Objects in View – Dollying a camera.

**UNIT V USER INTERFACE AND AUDIO 6**

User Interface: UI controls – Theming controls – Animating the UI – creating and fading out list of items – Creating onscreen position indicators – custom editors – Property drawers – Attribute drawers – Asset processing. Audio: Playing sound – setting up a mixer – using audio effects, send and receive effects – ducking – using multiple audio zones.

**SOFTWARE REQUIREMENT**

- Windows
- Unity 2022.2
- Visual Studio 2012(licensed)

**L: 30, P:30; TOTAL:60 PERIODS****TEXT BOOKS**

1. Paris Buttfeld-Addison et al., Unity Game Development Cookbook: Essentials for Every Game, 1<sup>st</sup> Edition, O'Reilly Media, 2019.
2. Anthony Davis, Travis Baptiste, Russell Craig, Unity 3D Game Development, Packt publisher, 2022.

**REFERENCES**

1. <https://in.coursera.org/specializations/game-design-and-development>
2. Nystrom Robert, Game Programming Patterns, 3<sup>rd</sup> edition, Genever Benning, 2014.
3. Will Goldstone, Unity Game Development Essentials, Packt publisher, 2009.
4. Nicolas Alejandro Borromeo, Hands-On Unity 2020 Game Development, Packt publisher,2020.

<b>19CS48E</b>	<b>VIDEO CREATION AND EDITING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OUTCOMES**

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

- CO1: acquire the knowledge of video creation and editing (K2)
- CO2: comprehend the working techniques of video compression (K2)
- CO3: interpret the design concepts in 3D rendering (K2)
- CO4: describe the working characteristics of Hardware devices (K2)
- CO5: realize the basic concepts and applications of immersive technology application. (K2)

**UNIT I BASIC CONCEPTS AND TERMINOLOGY 9**

Frames and Frame Rates - Video Mathematics: Raster versus Vector - Movement in Digital Video: Timeline Editing - Digital Video Color Correction and resizing.

**UNIT II VIDEO COMPRESSION TECHNIQUES 9**

Basic concepts of Compression - Video Compression Algorithms -Codec's - MPEG-4 - H.264 AVC – HD –WEBM Format - Bit-Rates and Playback - Video Storage - Captive versus Streaming .

**UNIT III 3D RENDERING 9**

3D video Rendering Architecture - Rendering process - 3D modeling - Types of 3D video Rendering - Visual FX rendering - Video transcoding - Image processing - Motion detection - Uses and benefits of video Rendering.

**UNIT IV HARDWARE DEVICES 9**

DSLR- IR camera- Night vision camera- 360 degree camera - Insta360 Studio for ONE X software – DSC RX100 - QUBO Smart Cam 360 – Gopro max – Ricoh theta Z1.

**UNIT V REALWORLD APPLICATION 9**

Blender video editor software – Technical requirement - Video container compatibility - Embedding video to blender files - Properties to enhance videos - Animated properties of video effect - Immersive technology real-world applications - Augmented reality video simulation - Interface to the Virtual World.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. "The Technique of Film and Video Editing History, Theory, and Practice" 4<sup>th</sup> Edition KenDancyger, UK, 2013.
2. "Digital Video Editing Fundamentals" Wallace Jackson Lompoc, California, USA, 2016.
3. "Blinder for video production quick start guide" 2<sup>nd</sup> Edition Gavin Allan Brito, 2018.

**REFERENCES**

1. Chorianoopoulos, K. (2018). A Taxonomy of Asynchronous Instructional Video Styles. The International Review of Research in Open and Distributed Learning, 19(1). <https://doi.org/10.19173/irrodl.v19i1.2920>.
2. Cognition and Technology Group at Vanderbilt. (1992). The Jasper Experiment: An Exploration of Issues in Learning and Instructional Design. Educational Technology Research and Development, 40(1), 65–80.

**19CS49E METAVERSE DEVELOPMENT**

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

**COURSE OUTCOMES**

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

- CO1: apprehend the basic features of metaverse (K2)
- CO2: realize the importance of Blockchain technology with metaverse (K2)
- CO3: appreciate the technology support in web 3.0 for metaverse (K2)
- CO4: recognize the developments in Metaverse Security (K2)
- CO5: infer the role of metaverse in real-world scenario (K3)

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Rise of the metaverse – Layers of Metaverse - Milestones of Metaverse – Metaverse and Web 3.0- Virtual Reality in the Metaverse – Digital Twins – Augmented Reality in the Metaverse		
<b>UNIT II</b>	<b>BLOCKCHAIN FOR METAVERSE</b>	<b>9</b>
Basic concepts – Key components – Convergence of Blockchain - Challenges of Blockchain adoption-Virtual Lands and Currencies – Blockchain-Based Transactions – Bitcoin – Ethereum – Bitcoin versus Web3 – Decentralized Finance (DeFi) – Non-Fungible Tokens (NFT) – Play-to-Earn (P2E)		
<b>UNIT III</b>	<b>WEB 3.0</b>	<b>9</b>
Evolution of Web 3.0 – Architecture - Characteristics - Working– Applications – Decentralized apps: Social Network – Storage - Streaming - Web 3.0 and Metaverse – Connection between Web 3.0 andBlockchain		
<b>UNIT IV</b>	<b>METAVERSE SECURITY</b>	<b>9</b>
Blockchain and Metaverse -Confidentiality, Integrity and Availability – Challenges for Metaverse community - Public Key Cryptography – Self-Sovereign Identity		
<b>UNIT V</b>	<b>ATTACKS AND PREVENTION</b>	<b>9</b>
Ransomware Attack in Metaverse – Quantum Computing – Random Number Generation – Hash Functions – Public-Key Signatures		

**L: 45; TOTAL: 45 PERIODS**

#### TEXT BOOKS

1. Wiley, “Blockchain and Web3: Building the Cryptocurrency, Privacy, and Security Foundations of the Metaverse”, Wiley, 1<sup>st</sup> Edition, September 2022.
2. Blake Grant, “Web 3.0 for Beginners”, May 2022.
3. Padmaraj Nidagundi, “Metaverse Development: Handbook for Software Developer, Analyst,Consultant, Startups and Business Owners”, Feb 2022.

#### REFERENCES

1. Andrew Clemens, “Metaverse for Beginners: A Guide to Help You Learn about Metaverse,Virtual Reality and Investing in NFTs”, Feb 2022.
2. Edric Simonds, “Metaverse for Beginners”, Feb 2022.
3. <https://in.coursera.org/learn/what-is-the-metaverse>

<b>19CS50E</b>	<b>STATISTICAL ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

#### COURSE OUTCOMES

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

- CO 1: Apply the concepts of testing of hypothesis and design of experiments (K2)  
CO 2: Infer the principles of regression analysis (K2)

CO 3: Grasp the basic concepts of entropy (K2)

CO 4: Understand the ideas of decision tree. (K2)

CO 5: Describe basics of probability theory and Bayesian networks. (K2)

<b>UNIT I</b>	<b>HYPOTHESIS, ANOVA TESTS</b>	<b>6</b>
Test of means – Chi – Square Test – EDF Test – Analysis of Variance		
<b>UNIT II</b>	<b>REGRESSION AND CORRELATION ANALYSIS</b>	<b>6</b>
Simple Linear Regression – Non Linear Regression – Multiple Linear Regression		
<b>UNIT III</b>	<b>ENTROPY</b>	<b>6</b>
Entropy Classification – Problem formulation, Learning Stage, Testing Stage – Maximum Entropy		
<b>UNIT IV</b>	<b>DECISION TREE ANALYSIS</b>	<b>6</b>
Decision Trees – Building a decision tree – Tree induction algorithm – Splitting of nodes based on information gain		
<b>UNIT V</b>	<b>BAYESIAN RULE AND BAYESIAN NETWORK</b>	<b>6</b>
Bayes' and minimax estimation : The structure of Bayes' rules, minimax estimation, interval estimation – Definition of Bayesian Network – Chain Rule for Bayesian Network		

**LIST OF EXPERIMENTS: (30 PERIODS)**

1. Study of Python basic libraries such as Statistics, Math, Numpy and Scipy
2. Study of Python libraries for ML applications such as Pandas and Matplotlib
3. Write a Python program to implement simple linear regression.
4. Write a python code to find correlation.
5. Implementation of multiple linear regression for house price prediction.
6. Write a python code for chi square test and ANOVA test.
7. Write a python code to find the information gain and entropy
8. Write a program to demonstrate the working of the decision tree. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
9. Write a program to implement the Naïve Bayes classifier for the sample training data stored as a .csv file. Compute the accuracy of the classifier considering few data sets.
10. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart disease data set.

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

**19CS51E      STATISTICAL FOUNDATIONS FOR MACHINE LEARNING      L T P C**  
**2 0 0 2**

### **COURSE OUTCOMES**

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

CO1: Apply the various statistical techniques in data collection and preparation (K3)

CO2: Examine appropriate features for building an efficient machine learning model (K3)

### **UNIT I              ROLE OF STATISTICS IN MACHINE LEARNING              15**

Introduction to Machine learning and Statistics -Data Collection – Population and Samples – Sampling and Types – Different types of Data and features - Data Cleaning - Handling Missing Values , Irregular Cardinality –Outlier using Descriptive Statistics of Continuous and Categorical features.

### **UNIT II              STATISTICAL TECHNIQUES FOR EFFICIENT MODELING              15**

Feature Selection – Distribution of data - Normal Distribution – Measuring Covariance and Correlation – Principal Component Analysis - Normalization – Binning. Data Modeling – Case Study Analysis.

**L:30 TOTAL: 30 PERIODS**

### **TEXT BOOKS**

1. John D Kelleher, Brain Mac Namee and Aoife D'Arcy, Fundamentals of Machine Learning for Predictive Data Analytics, MIT Press, 2015.
2. Pratap Dangeti, "Statistics for Machine Learning", Packt Publishing, 2017.

### **REFERENCES**

1. Marc Peter Deisenroth, Aldo Faisal, Cheng Soon Ong, —"Mathematics for Machine Learning", Cambridge university Press, 2020.
2. Bruce Ratner, Statistical and Machine-Learning Data Mining, CRC press, 2017.

### **WEB REPOSITORIES**

1. Kaggle – <https://www.kaggle.com/datasets>
2. CV Online – <https://homepages.inf.ed.ac.uk/rbf/CVonline/Imagedbase.htm>
3. Physionet - <https://physionet.org/data/>

19CS52E

FRONT END DEVELOPMENT

L T P C QP  
3 0 0 3 A

### COURSE OUTCOMES

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

CO1: Apply JavaScript frameworks to save time while writing custom code.

CO2: Implement client-side interfaces using DOM and AJAX

CO3: Develop client side rendering using Angular.js

CO4: Build elegant webpages using node.js for real world problems

### UNIT I JAVA SCRIPT FRAMEWORKS 10

Introduction to JavaScript - syntax - Variables - data types - operators - conditionals and loops - Functions - DOM manipulation - DOM elements - selectors - DOM events - event listeners - Modifying DOM elements, attributes and Events - Arrays and objects - Higher-order functions and array methods, Closures and scope, Prototypes, and inheritance.

### UNIT II DOM and AJAX 10

Asynchronous JavaScript - AJAX - Promises - async/await - Objects - Object methods - "this" - Object Chaining - Garbage Collection - Classes - Error Handling - Proxy and Reflect - Currying - ES6 features:(arrow functions, template literals, etc.) - Modules - import/export - Typescript.

### UNIT III ANGULAR.js 15

Basics of Angular JS - Introduction to MVC - Filters and Modules - Directives - Working with forms - viwes - animation - Server communication - Deployment.

### UNIT IV NODE.js 10

Node.js - Node.js architecture - Setting up a Node.js - Node.js basics and modules - File system and streams - Events - event driven programming - Creating a basic server with Node.js

L: 45; TOTAL: 45 PERIODS

### TEXT BOOKS

1. Marijn Haverbeke, "Eloquent JavaScript", 3<sup>rd</sup> edition, 2018.
2. David Flanagan, "JavaScript: The Definitive Guide", 7<sup>th</sup> Edition, O'Reilly Media, 2020.
3. Andrew Grant, "Beginning AngularJS", Apress, 2014.

### REFERENCE BOOKS

1. Mario Casciaro - Node.js Design Patterns, Packt Publishing, 2014
2. Scott Chacon and Ben Straub, "Pro Git", 2<sup>nd</sup> Edition, Apress, 2014.

**R-2019    B.E-CSE**  
**ONE CREDIT ELECTIVE COURSES**



<b>19CS01L</b>	<b>STATISTICAL FOUNDATIONS FOR DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

### COURSE OUTCOMES

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

CO1: Understand the fundamentals of statistics for data science. (K2)

CO2: Deploy statistical foundations on data science. (K3)

### UNIT I                    FOUNDAMENTALS OF DESCRIPTIVE STATISTICS                    6

Introduction – types of data – types of variables – histogram charts – scatter plots - measures of central tendency: mean, median and mode, measuring asymmetry: skewness - Measuring variability: Variance. Standard deviation, Covariance. Correlation coefficient.

### UNIT II                    INFERENCEAL STATISTICS                    9

Distributions: Normal distribution , standard normal distribution, Central Limit Theorem - Estimations: Confidence Intervals- Hypothesis Testing

**L:15; TOTAL:15 PERIODS**

### REFERENCES

1. Jianqing Fan, Runze Li ,Cun-Hui Zhang Hui Zou “Statistical Foundations of Data Science”, Chapman and Hall/CRC,1<sup>st</sup> Edition,2017.
2. Walter W. Piegorsch ,“Statistical Data Analytics: Foundations for Data Mining, Informatics, and Knowledge Discovery”, Wiley, 1<sup>st</sup> Edition, 2015.

<b>19CS02L</b>	<b>DATA VISUALIZATION USING TABLEAU</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### COURSE OUTCOMES

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

CO1: Understand the basic concepts of data visualization using tableau platform.(K2)

CO2: Assess the quality of the data and perform exploratory analysis.(K3)

### LIST OF EXERCISES

1. Creation of Charts using Show me feature for data visualizations, Crosstabs and Heat Maps.
2. Creation of visualization using Bar, Stacked Bar, and Side by Side Bar Charts, Pie Charts
3. Creating Line and Area Charts for data visualizations.
4. Creation of visualization using
  - Packed Bubbles
  - Tree Maps, creating a Basic Scatter Plot and Creating a Basic Map.
5. Calculations in Tableau
  - Understanding String Calculations, Boolean, if-then Calculations, and case Statements, Date and Time Calculations and Understanding Aggregations and Disaggregation.
6. Implementation of Mapping functionalities in Tableau.

- Creating a Standard Map View to identify geographic roles and assemble a standard map view.
7. Execution of Dashboards and Stories.
    - Finding the working of dashboard actions and Ensuring the formatting of dashboards.
    - Understanding the various elements to the story user interface and assembling the dashboards into a story and Learning about how to size dashboards to fit into a story.
  8. Develop visualization in Tableau and Export the dashboard to a pdf and Export the data into an Excel spread sheet.

**P:30; TOTAL:30 PERIODS**

### SOFTWARE REQUIREMENTS

- **Operating System:** Windows
- **Software:** Tableau.
- **Memory Space:** 2 GB

### REFERENCES

1. Daniel G.Murray, "Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software", John Wiley & Sons, Inc., 1<sup>st</sup> Edition, 2013.
2. Ryan sleeper, "Practical Tableau", O'Reilly Media, 1<sup>st</sup> Edition, 2018.

<b>19CS03L</b>	<b>DATA VISUALIZATION USING POWER BI</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### COURSE OUTCOMES

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

- CO1: Understand the basic concepts of data visualization using Power BI platform.(K2)  
 CO2: Assess the quality of the data and perform exploratory analysis.(K3)

### LIST OF EXERCISES

1. Implementation of Data refresh in Power BI environment.
  - Implementing the Power BI refresh.
  - Implementing Power BI Desktop.
  - Configuring automatic refresh.
2. Creation of workspace and groups in Power BI
3. Modelling Power BI dashboards by using recent datasets
4. Visualization of data using Line, Column Charts and Area charts.
5. Creation of a multi row card for Improving reports by using custom visualizations.
6. Development of visualizations standard using Tables in Power BI.
7. Improving the report by using measures and using DAX in data models.
8. Develop a data visualization by creating a map showing total units sold by state and adding a Slicer for Sub-categories of products

**P:30; TOTAL:30 PERIODS**

## SOFTWARE REQUIREMENTS

- **Operating System:** Windows
- **Software:** Microsoft Power BI.
- **Memory Space:** 2 GB

## REFERENCES

1. Alberto Ferrari and Marco Russo “Introducing Microsoft Power BI”, Microsoft Press, 1<sup>st</sup> Edition, 2016.
2. Chris Webb, ” Power Query for Power BI and Excel”. Apress; 1<sup>st</sup> Edition, 2014.
3. [https://www.tutorialspoint.com/power\\_bi/power\\_bi\\_pdf\\_version.htm](https://www.tutorialspoint.com/power_bi/power_bi_pdf_version.htm)
4. <https://data-flair.training/blogs/table-in-power-bi/>

<b>19CS04L</b>	<b>PYTHON FOR DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

## COURSE OUTCOMES

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

CO1: Understand the basic concepts Python Programming(K2)

CO2: Apply the Data mining algorithms using python packages(K3)

## LIST OF EXERCISES

1. Implementation of data manipulation with pandas
2. Mathematical Computations with NumPy
3. Implementation of Pre-processing Techniques.
4. Implementation of Classification Algorithms
5. Implementation of Clustering Algorithms
6. Implementation of data visualization using matplotlib
7. Analysis of Time Series data

**P:30; TOTAL:30 PERIODS**

## SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** Python IDLE 2.0/3.0, Anaconda.

## REFERENCES

1. Samir Madhavan, “Mastering python for data science”, Packt Publishers, 1<sup>st</sup> Edition 2015.
2. <https://www.programiz.com/python-programming>
3. <https://jakevdp.github.io/PythonDataScienceHandbook/>

<b>19CS05L</b>	<b>R PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OUTCOMES**

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

CO1: Understand the basic concepts R Programming(K2)

CO2: Apply the Data mining algorithms using R packages(K3)

**LIST OF EXERCISES**

1. Programs on data type in R
2. Programs on Build-in Functions in R
3. Creating and Manipulating Vector,Matrix,Factors in R.
4. Operations on Data Frames and Lists in R.
5. Programs on Operators in R
6. Programs on If-else statements, for loops, while loops in R.
7. Implementation of Classification Algorithms using R Packages
8. Implementation of Clustering Algorithms using R Packages.

**P:30; TOTAL:30 PERIODS**

**SOFTWARE REQUIREMENTS**

- **Operating System:** Windows.
- **Software:** RStudio.

**REFERENCES**

1. Norman Matloff , “The Art of R Programming: A Tour of Statistical Software Design”, No Starch Press, 2<sup>nd</sup> Edition, 2012.
2. <https://www.r-project.org>
3. <http://heather.cs.ucdavis.edu/~matloff/R/RProg/>

<b>19CS06L</b>	<b>PR.OOF SYSTEMS IN CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

CO1: Explore the Zero-Knowledge Proofs. (K3)

CO2: Apply Zero-Knowledge Proofs in real time problems. (K3)

<b>UNIT I</b>	<b>INTERACTIVE PROOFS AND ZERO-KNOWLEDGE PROOFS</b>	<b>8</b>
---------------	---	----------

Interactive Proofs - Intuitive notion of proofs - Zero-Knowledge (ZK) Proofs: Properties - Computational ZK - Chaum-Pederson ZK protocol - ZK-Proofs for NP Problems.

<b>UNIT II</b>	<b>APPLICATIONS</b>	<b>7</b>
----------------	---------------------	----------

Discrete log of a given value - Hamiltonian cycle for a large graph - Authentication systems - Blockchains.

**L:15; TOTAL:15 PERIODS**

## REFERENCES

1. Sanjeev Arora and Boaz Barak, "Computational complexity: A Modern Approach", Cambridge University Press, 2<sup>nd</sup> edition 2009.
2. <https://crypto.stanford.edu/cs355/18sp/lec3.pdf>
3. <https://crypto.stanford.edu/pbc/notes/crypto/zk.html>
4. [https://en.wikipedia.org/wiki/Zero-knowledge\\_proof](https://en.wikipedia.org/wiki/Zero-knowledge_proof)
5. [https://homepages.cwi.nl/~schaffne/courses/ZK/2015/4th\\_lecture\\_ZKforNP.pdf](https://homepages.cwi.nl/~schaffne/courses/ZK/2015/4th_lecture_ZKforNP.pdf)

<b>19CS07L</b>	<b>THEORETICAL FOUNDATIONS OF CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

## COURSE OUTCOMES

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

CO1: Understand the basic concepts of digital signature. (K2)

CO2: Explore about the pseudo-random generators in cryptography (K2)

### UNIT I DIGITAL SIGNATURES 6

Encryption- digital signatures- hash functions- commitments

### UNIT II PSEUDO-RANDOM GENERATORS 9

One-way functions- pseudo-random generators- pseudo-random functions- trapdoor permutations.

**L:15; TOTAL:15 PERIODS**

## REFERENCES

1. Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography", Chapman and Hall/CRC Press, 3<sup>rd</sup> Edition 2020
2. Oded Goldreich, the Foundations of Cryptography, Volume 2, Cambridge University Press, 2009.
3. Wenbo Mao, Modern Cryptography: Theory and Practice, Pearson Education, 1<sup>st</sup> Edition, 2004.

<b>19CS08L</b>	<b>RANDOMNESS IN CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

## COURSE OUTCOMES

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

CO1: Understand the notions of entropy in cryptography. (K2)

CO2: Explore about the leakage-resilient cryptography (K2)

### UNIT I ENTROPY NOTION 6

Entropy notions - min-entropy- Shannon entropy- Computational variants of notions and the challenges in analyzing the notions.

**UNIT II LEAKAGE-RESILIENT CRYPTOGRAPHY****9**

Randomness extractors- privacy amplification protocols- leakage-resilient Cryptography- Design of error correcting codes with specialized properties.

**L:15; TOTAL:15 PERIODS****REFERENCES**

1. Jonathan Katz and Yehuda Lindell, "Introduction to Modern Cryptography", Chapman and Hall/CRC Press, 3<sup>rd</sup> Edition 2020
2. Oded Goldreich, the Foundations of Cryptography, Volume 2, Cambridge University Press, 1<sup>st</sup> Edition 2009.
3. Wenbo Mao, Modern Cryptography: Theory and Practice, Pearson Education, 1<sup>st</sup> Edition, 2004.

**19CS09L****DEEP LEARNING ALGORITHMS**

L	T	P	C
0	0	2	1

**COURSE OUTCOMES**

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

CO1: Apply supervised CNN & RNN models for various datasets.(K3)

CO2: Build a classifier with pre-trained models and validate.(K3)

**LIST OF EXERCISES**

1. Build a classifier using k-Nearest Neighbour (kNN) algorithm for iris dataset to classify its class.
2. Create a Neural Network model to train and test the birds dataset to classify the bird species.
3. Construct a CNN model by considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set, then build an LENET algorithm and test the same.
4. Implement RNN model for smile detection. Print both correct and wrong predictions.
5. Design a LSTM network for sentiment analysis on a corpus of movie reviews. Label each phrase on a scale of zero to four. The sentiment corresponding to each of the labels are:
  - 0: negative
  - 1: somewhat negative
  - 2: neutral
  - 3: somewhat positive
  - 4: positive
6. Build and train the stacked Auto encoder for image classification. Use handwritten digits dataset

**P:30; TOTAL:30 PERIODS****SOFTWARE REQUIREMENTS**

- **Operating System:** Windows / Linux
- **Software:** Anaconda / Jupyter, Keras, Tensorflow, Google colab

## REFERENCES

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation, 1<sup>st</sup> Edition 2016.
2. Dr. Adrian Rosebrock,, "Deep Learning for Computer Vision with Python: Starter Bundle, PyImage Search", 1<sup>st</sup> Edition, 2017.

<b>19CS10L</b>	<b>MACHINE LEARNING WITH TENSORFLOW</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

## COURSE OUTCOMES

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

- CO1: Understand the basic concepts Tensorflow.(K2)
- CO2: Design and Build applications on Machine learning.(K3)

## LIST OF EXERCISES

1. Design and build a Tensor Flow 2.x input data pipeline and understand the key components.
2. Load CSV, Numpy Data and Image Data using Pandas and BigQuery
3. Perform preprocessing and explore features with Cloud Dataflow and Cloud Dataprep.
4. Preprocess data at scale using TF.Transform
5. Use the Keras Sequential and Functional APIs for simple model creation.
6. Train a TensorFlow model on Cloud ML Engine
7. Explore feature engineering using Keras and TensorFlow 2.x.
8. Optimize model performance with hyper parameter tuning.
9. Enhance ML model features with embedding layers.
10. Deploy a trained model to Cloud ML Engine
11. Experiment Feature Analysis Using Tensor Flow Data Validation and Facets
12. Build a custom estimator with all the tricks (convolutional layers, augmentation, batch normalization, etc.) that go into a good image classification model
13. Build a time-series forecasting model in Tensor Flow using a variety of techniques including CNNs and LSTMs
14. Use Tensor2Tensor to solve your own text problems, whether it is text summarization or text generation
15. Build a collaborative filtering recommendation system in Tensor Flow

**P:30; TOTAL:30 PERIODS**

## SOFTWARE REQUIREMENTS

- **Software:** Google Colab Account, Anaconda 3x

## REFERENCES

1. <https://www.coursera.org/specializations/machine-learning-tensorflow-gcp>
2. <https://towardsdatascience.com/machine-learning-with-tensorflow-on-google-cloud-platform-code-samples-7c1bc07cd265>

19CS11L

**DATA EXPLORATION USING PYTHON**

L	T	P	C
0	0	2	1

**COURSE OUTCOMES**

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

CO1: Understand the functions available in pandas library.(K2)

CO2: Explore various dataset using pandas framework and visualize it using various plots.(K3)

**LIST OF EXERCISES**

1. Importing Pandas Library and exploring the functions in it.
2. Reading Datasets in Different Formats.
3. Import Any dataset using Pandas and perform the following operations:
  - Creating Copy of original data
  - Finding the attributes
  - Indexing and selecting Data
  - Finding Datatype of a Particular Attribute
  - Counting Unique Datatypes
  - Selecting Data Based on Datatype.
  - Summary Report of DataFrame
  - Checking Format of each Column
  - Finding unique elements of each Column
4. Import Any dataset using Pandas and perform the following operations:
  - Finding Cross Tabulation for one or more attributes
  - Finding Joint Probability
  - Finding Marginal Probability
  - Finding Conditional Probability
  - Finding Co-Relational Association between two variables
5. Import Any dataset using Pandas and perform the following operations:
  - Identify missing values
  - Fill the missing values using mean and median for numerical data
  - Fill the missing values using maximum count for categorical data
  - Check missing values
6. Import Toyota.csv dataset using Pandas and perform the Data Visualization operations using Matplotlib library:
  - Plot Scatter Plot for Age and price of car.
  - Plot Histogram for Kilometer and frequency
  - Plot bar plot for fuel type and frequency
  - Plot Box plot for prices of car
  - Plot pair wise plot for fuel type

**P:30; TOTAL:30 PERIODS**



## SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** Annaconda / Jupyter/ Google colab

## REFERENCES

1. Ossama Embarak, "Data Analysis and Visualization Using Python Analyze Data to Create Visualizations for BI Systems", Apress, 1<sup>st</sup> Edition, 2018.
2. Fabio Nelli, "Data Analysis and Visualization Using Python Analyze Data to Create Visualizations for BI Systems", Jaico Publishing House, 1<sup>st</sup> Edition, 2015.

<b>19CS12L</b>	<b>MATHEMATICS FOR MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

## COURSE OUTCOMES

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

- CO1: Understand the mathematical concepts for Machine Learning (K2)
- CO2: Understand how the concepts extend for real world ML problems (K2)

### UNIT I      **LINEAR ALGEBRA** **6**

Scalars, Vectors, Matrices and Tensors - Vector and Matrix Norms - Eigen values and Eigen vectors - Norms and Eigen decomposition

### UNIT II      **MULTIVARIATE CALCULUS** **5**

Introduction to Derivatives - Basics of Integration - Gradients and Gradient Visualization - Optimization.

### UNIT III      **PROBABILITY THEORY** **4**

Introduction - Probability Distributions - Expectation, Variance and Covariance.

**L:15; TOTAL:15 PERIODS**

## REFERENCES

1. Marc Peter Deisenroth, A.Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2020.
2. "Mathematical Foundation For Machine Learning and AI", Udemy Course

<b>19CS13L</b>	<b>CYBER SECURITY TOOLS AND TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

## COURSE OUTCOMES

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

- CO1: Work with security tools for network analysis. (K3)
- CO2: Make use of recent security framework and techniques to detect security vulnerabilities and exploits. (K3)

**LIST OF EXERCISES**

1. Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following
  - Observer performance in promiscuous as well as non-promiscuous mode.
  - Show that packets can be traced based on different filters
2. Use the Nessus tool to scan the network for vulnerabilities
3. Use Metasploit Framework in Terminal Mode to exploit the Bind-Shell overflow vulnerability
4. Detect ARP spoofing using open source tool ARPWATCH
5. Use NMAP with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc.
6. Wireless Exploitation & Defenses -Cracking WPA2-PSK Passwords Using Aircrack-Ng

**P:30; TOTAL:30 PERIODS****SOFTWARE REQUIREMENTS**

- **Operating System:** Windows / Linux
- **Software:** wireshark, ethereal, tcpdump, Nessus Eclipse, Metasploit Framework, ARPWATCH, NMAP, Aircrack-Ng

**REFERENCES**

1. <http://webpages.eng.wayne.edu/~fy8421/19sp-csc5290/labs/lab1-Instruction.pdf>
2. <https://www.javatpoint.com/wireshark>
3. <https://www.cs.cmu.edu/~dwendlan/personal/nessus.html>
4. <https://docs.rapid7.com/metasploit/msf-overview/>
5. <https://www.cyberciti.biz/faq/how-to-detect-arp-spoofing-under-unix-or-linux/>
6. <https://nmap.org/book/man-port-scanning-techniques.html>
7. <http://webpages.eng.wayne.edu/~fy8421/16sp-csc5991/labs/lab7-instruction.pdf>

<b>19CS14L</b>	<b>VEHICULAR CLOUD NETWORKING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

- CO1: Understand the basic concepts of vehicular network and vehicular cloud network (K2)
- CO2: acquire the correlation of vehicular networking on cloud environment. (K3)

<b>UNIT I</b>	<b>VEHICULAR NETWORK</b>	<b>5</b>
Vehicular Network: Introduction, Components of Vehicular Network, Issues and challenges, Applications and Simulation Tools.		
<b>UNIT II</b>	<b>VEHICULAR CLOUD NETWORKING</b>	<b>5</b>

Cloud Computing Introduction-Vehicular cloud computing Introduction – Architecture-Service Types: Computing as a service-Storage as a service- Network as a service-Application as a service- Cooperation as a service- Cloudlets types: Static and Dynamic.

**UNIT III APPLICATIONS OF VEHICULAR CLOUD NETWORKING 5**

Vehicular Cloud Applications: Data Centers, Optimizing traffic signals, Parking lot data cloud, Shopping mall data center and Dynamic traffic light management

**L:15; TOTAL:15 PERIODS**

**REFERENCES**

1. Nanhay Singh, Omprakash Kaiwartya, Ram Shringar Rao, Sanjoy Das, “Cloud-Based Big Data Analytics in Vehicular Ad-Hoc Networks”, IGI Global, 1<sup>st</sup> Edition, 2020.
2. <https://jwcn-urasipjournals.springeropen.com/articles/10.1186/s13638-018-1315-y>
3. <https://www.sciencedirect.com/science/article/abs/pii/S1084804513001793>.
4. <https://www.sciencedirect.com/science/article/abs/pii/S1389128618300057>

<b>19CS15L</b>	<b>SPECKLED COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

CO1: Understand the basic concepts of speckled computing.(K2)

CO2: Identify the applications of Speckled computing .(K3)

**UNIT I INTRODUCTION 5**

Specks- Specknet - Comparing Sensor networks and Specknets- Localization of specks- Programmable Specks- Architecture

**UNIT II DESIGN ENVIRONMENT 5**

Speck Net: Network services, Protocols, Distributed algorithms, Power Optimization.

**UNIT III APPLICATIONS 5**

Capturing movements of dancer, Data sensing and Information extraction, Physiological condition monitoring, Environment Monitoring.

**L:15; TOTAL:15 PERIODS**

**REFERENCES**

1. Bijo P Joy “speckled computing”, vinod gupta school of management IIT Kharagpur
2. [http://www.iraj.in/journal/journal\\_file/journal\\_pdf/12-410-155418809160-62.pdf](http://www.iraj.in/journal/journal_file/journal_pdf/12-410-155418809160-62.pdf).
3. [https://www.researchgate.net/publication/224570641\\_Speckled\\_Computing\\_Evolution\\_and\\_Challenges](https://www.researchgate.net/publication/224570641_Speckled_Computing_Evolution_and_Challenges).

<b>19CS16L</b>	<b>INTRODUCTION TO NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

- CO1: Build simple LANs, perform basic configurations for routers and switches.(K3)
- CO2: Implement IP addressing schemes.(K3)

**UNIT I INTRODUCTION 15**

Introduction and explore the network - Configure a network operating system - Network Protocol and Communications - Network Access – Ethernet - Network Layer - IP addressing - Subnetting IP Network - Transport layer - Application Layer - Build a small network

**L:15; TOTAL:15 PERIODS****REFERENCES**

1. <https://www.freeccnastudyguide.com/study-guides/ccna/ch1/intro-to-networks/>
2. <https://www.netacad.com/group/resources/ccna-rs-itn/6.0>

<b>19CS17L</b>	<b>ROUTING AND SWITCHING ESSENTIAL</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

- CO1: Recognize architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. (K2)
- CO2: Build simple LANs, perform basic configurations for routers and switches, and implement IP. (K3)

**UNIT I ROUTING ESSENTIALS 8**

Routing Concepts - Routing Initial configuration - Routing Operation - Static Routing - Configuration & Troubleshooting - Dynamic Routing - Protocols and Routing Tables - Switched Networks - Switch Configuration - Device Configuration.

**UNIT II SWITCHING ESSENTIALS 7**

LAN Design and Switched Environment - VLANs - Segmentation - Implementation - VLAN Routing - Access Control Lists - ACL Operation - Standard IPv4 ACL - DHCP - DHCP v4 - DHCP v6 - NAT for IPv4 -Operation - Configuration - Device Discovery - Management and Maintenance.

**L:15; TOTAL:15 PERIODS****REFERENCES**

1. Todd Lammle , „CCNA Routing and Switching Complete Study Guide“, John Wiley & Sons, 2<sup>nd</sup> Edition, 2016.
2. <https://www.netacad.com/group/resources/ccna-rs-rse/6.0>

<b>19CS18L</b>	<b>SCALING NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

CO1: Configure and troubleshoot routers and switches for advanced functionality .(K3)

CO2: Resolve common issues with protocols in both IPv4 and IPv6 networks. (K2)

**UNIT I LAN DESIGN 8**

LAN Design: Campus Wired LAN Designs - Campus Network Device Selection. Scaling VLANs: VTP, Extended VLANs, and DTP - Troubleshoot Multi-VLAN Issues. Spanning Tree Protocol (STP): Spanning Tree Concepts - Varieties of Spanning Tree Protocols. Ether Channel and HSRP: Link Aggregation Concepts - Link Aggregation Configuration - First Hop Redundancy Protocols.

**UNIT II DYNAMIC ROUTING 7**

Dynamic Routing: Dynamic Routing Protocols - Distance Vector Dynamic Routing - Link-State Dynamic Routing. EIGRP: features and characteristics - Implement EIGRP for IPv4 - EIGRP Tuning and Troubleshooting. OSPF: Single-Area OSPF Operation - Varieties of Spanning Tree Protocols - Multiarea OSPF - OSPF Tuning and Troubleshooting.

**L:15; TOTAL:15 PERIODS**

**REFERENCES**

1. „Scaling Networks Companion Guide“, CISCO Press, 2014.
2. <https://www.netacad.com/group/resources/ccna-rs-scaling/6.0>

<b>19CS19L</b>	<b>CONNECTING NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

**COURSE OUTCOMES**

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

CO1: Configure and troubleshoot network devices .(K3)

CO2: Implement Virtual Private Networks.(K3)

**UNIT I WAN CONCEPTS 8**

WAN Concepts - WAN Technologies Overview - Selecting a WAN Technology - Point-to-Point Connections - Serial Point-to-Point Overview - PPP Operation - Troubleshoot WAN Connectivity - Branch Connections - Remote Access Connections – VPNs.

**UNIT II ACCESS CONTROL LISTS 7**

Access Control Lists - Standard ACL Operation and Configuration Review - Extended IPv4 ACLs - LAN Security - SNMP - QoS Overview - QoS Mechanisms - Network Evolution - Network Troubleshooting - Troubleshooting Methodology - Troubleshooting Scenarios

**L:15; TOTAL:15 PERIODS**

**REFERENCES**

1. "Connecting Networks Companion Guide", CISCO Press, 2014.
2. <https://www.netacad.com/group/resources/ccna-rs-connect/6.0>

<b>19CS20L</b>	<b>SERVER SIDE DEVELOPMENT USING NODE.JS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OUTCOMES**

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

CO1: Understand the basic concepts of Node.js Environment and Node Modules.(K2)

CO2: develop Node.js based real world web application development. (K3)

**LIST OF EXERCISES**

1. Installing Node, Node Hosting Environments
2. Exploring Node Building Blocks
  - Global and Process objects, buffers, Typed arrays and Strings, Streams
  - Event Handling- Event Queue, Event Emitter, Event Loop and Timers, Nested Callback
3. Creating and Publishing Node Modules
  - Installation and configuration of Node Package Manager
  - Program development using built-in Node Modules
  - Commander and Underscore,
  - OAuth configuration
4. Node and the File System
  - The fs.Stats class, The File System Watcher, File Read and Write,
  - Directory access and Maintenance,
  - Program development using File Streams
5. Resource Access with Path
  - The HTTP Module: Server and Client
  - Using APACHE to proxy a Node Application Query String Parsing and DNS Resolution.

**P:30; TOTAL:30 PERIODS**

**SOFTWARE REQUIREMENTS**

- **Operating System:** Windows / Linux
- **Software:** NodeJS4.0.0, Notepad++, Java 7, Browser

**REFERENCES**

1. Shelley Powers, "Learning Node: Moving to the Server-Side", O'Reilly Media; 2<sup>nd</sup> Edition, 2016.
2. David Thompson, "Getting Started with GEO, CouchDB, and Node.js", O'Reilly Media, Inc., 1<sup>st</sup> Edition, 2011.

**19CS21L      WEB APPLICATION DEVELOPMENT USING ANGULARJS      L   T   P   C**  
**0   0   2   1**

### **COURSE OUTCOMES**

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

- CO1: Build optimized user interface applications. (K3)
- CO2: Explore the Component and apply filter in the angularJS application. (K3)

### **LIST OF EXERCISES**

1. Setup angular framework in local environment.
  - Create your first application using angular framework
  - Understanding ng attributes for building the applications
2. Implement expressions and data binding
3. Create and implement modules and controllers
4. Build and implement custom pipes
5. Develop a form with various input controls and perform validation for the same using HTML5 attributes (minlength, maxlength, pattern etc...).
6. Build and implement Custom directives
7. Create a Single page application (SPA) using angular framework
8. Develop a real time application involving the above concepts in angular JS

**P:30; TOTAL:30 PERIODS**

### **SOFTWARE REQUIREMENTS**

- **Operating System:** Windows / Linux
- **Software:** Sublime Text / Aptana Studio 3/ Eclipse (Windows environment)  
Node.js and NPM,Angular CLI,PM2 Packages (Linux environment)

### **REFERENCES**

1. Agus Kurniawan, "AngularJS Programming by Example", PE Press, 1<sup>st</sup> Edition, 2014.
2. Andrew Grant, "Beginning AngularJS", Apress, 1<sup>st</sup> Edition, 2014.

**19CS22L                                      NOSQL on MONGODB                                      L   T   P   C**  
**0   0   2   1**

### **COURSE OUTCOMES**

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

- CO1: Understand the basic structure of NoSQL Components (K2)
- CO2: Implement database navigation operations using ODBC /JDBC (K3)

### **LIST OF EXERCISES**

1. Study of Open Source NOSQL Database: Mongo DB (Installation, Basic CRUD operations, Execution)

2. Design and Develop Mongo DB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)
3. Implement aggregation and indexing with suitable example using Mongo DB
4. Implement Map reduces operation with suitable example using Mongo DB
5. Create simple objects and array objects using JSON
6. Implement Database navigation operations using ODBC/JDBC by connecting PHP/PYTHON/JAVA

**P:30; TOTAL:30 PERIODS**

### SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** Mongo DB

### REFERENCES

1. Peter Membrey, "MongoDB Basics", Apress; 1<sup>st</sup> Edition, 2014.
2. <https://docs.mongodb.com/manual/tutorial/>
3. <https://www.tutorialspoint.com/mongodb/index.htm>

<b>19CS23L</b>	<b>APPLICATION DEVELOPMENT USING FLUTTER DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### COURSE OUTCOMES

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

- CO1: Understand the basic concepts of Flutter development (K2)  
 CO2: Develop the applications in various environment using the flutter (K3)

### LIST OF EXERCISES

1. Flutter installation and dart introduction
  - a. Install Android studio
  - b. Install flutter SDK
  - c. Install Flutter plugins for Android Studio and setup SDK path
  - d. Learn dart basics
2. Running the Counter app in all platforms(Android & Web)
  - a. Change flutter channel to support web
  - b. Enable web in flutter config
  - c. Run in both android and chrome
3. Create the Calculator app by using the grid view/List view with the flutter
4. Design the Registration form app by using different form fields and form validation with the flutter
5. Creating the authentication for registration and Log in page by using SQL Lite database with the flutter
6. Create a To-do list app for doing the daily scheduled activities by using the flutter



7. Explore the different animations available in the Flutter such as Fading widget, Moving Widget and Bouncing button.

**P:30; TOTAL:30 PERIODS**

### SOFTWARE REQUIREMENTS

- **Operating System:** Windows/Linux
- **Software:** Android Studio, Flutter SDK

### REFERENCES

1. Alessandro Biessek, "Flutter for beginners" An introductory guide to building cross-platform mobile applications with Flutter, Packt publishing Ltd., 2019.
2. Marco L. Napoli, "Beginning Flutter: A Hands On Guide to App Development", John wiley and sons, Inc., 2020.

<b>19CS24L</b>	<b>APPLICATION DEVELOPMENT USING FIREBASE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### COURSE OUTCOMES

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

- CO1: Understand how to simplify a database by using Firebase data modelling (K2)  
CO2: Build interactive web applications using firebase. (K3)

### LIST OF EXERCISES

1. Setup a new project using the Firebase console
  - Install and use the Firebase SDK
2. Configuring Firebase in a website.
3. Adding firebase functionalities in a website.
4. CRUD your data in Real-time
  - Adding and Retrieving data in the Firestore database.
  - Updating and deleting data in the Firestore database.
5. Build and implement user authentication methods using crashlytics.
6. Controlling the Firebase.
  - Sorting and limiting the data
7. Create a Real-time web application using Firebase

**P:30; TOTAL:30 PERIODS**

### SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** Sublime Text and Firebase CLI

### REFERENCES

1. Housseem Yahiaoui, "Firebase Cookbook: Over 70 recipes to help you create real-time web and mobile applications with Firebase", Packt publishing, 2017.
2. Andrew Grant, "The Definitive Guide to Firebase: Build Android Apps on Google's Mobile Platform", Apress, 1<sup>st</sup> Edition, 2017.
3. <https://www.udemy.com/course/learning-firebase/>

19CS25L

**LINUX ADMINISTRATION**

L	T	P	C
0	0	2	1

**COURSE OUTCOMES**

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

CO1: Demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment. (K2)

CO2: Evaluate the concept of shell scripting programs.(K3)

**LIST OF EXERCISES**

1. Installation of Red HAT Linux operating system.
  - a. Partitioning drives
  - b. Configuring boot loader
  - c. Network configuration
  - d. Setting time zones
  - e. Creating password and user accounts
  - f. Shutting down
2. Explore the all Linux Directory Management and File Management commands with syntax and its usages
3. Develop a script to check whether the given input is a number or a string
4. Create a shell script that accepts a numerical value N and displaying the decrementing value of N till it reaches 0
5. Develop a basic math calculator using case statement in Linux
6. Design a Shell script that displays list of all the files in the current directory to which the user has read, write and execute permissions Sorting and limiting the data
7. Create a Linux shell script to find the number of characters, words and lines in a file

**P:30; TOTAL:30 PERIODS****SOFTWARE REQUIREMENTS**

- **Operating System:** Windows 7,8,10 / Linux (Ubuntu).
- **Software:** Chrome, Firefox Browsers, Java

**REFERENCES**

1. N.Matthew, R.Stones, Wrox "Beginning Linux Programming", Wily India Edition. 4<sup>th</sup> Edition, 2011.
2. N.B.Venkateswarlu, "Advanced Unix Programming", BS Publications, 2016.

19CS26L

**SOFTWARE TESTING USING SELENIUM**

L	T	P	C
0	0	2	1

**COURSE OUTCOMES**

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

CO1: Understand the basic concepts of automation testing IDE Selenium K2)

CO2: Design and evaluate the test cases using TestNG Framework. (K3)

## LIST OF EXERCISES

1. Access and installation of Selenium IDE for Automated Testing
  - a. Understanding the components
  - b. Driver requirements
  - c. Browser Manipulations and waits
  - d. Supported Classes
2. Practicing with Basis Driver Scripts in Selenium
  - a. Alerts
  - b. Prompts
  - c. Confirmations
  - d. Proxy Setup
  - e. Page Loading
  - f. Element Finding
3. Developing the driver scripts to perform operations on GUI Elements
  - a. Text Box
  - b. Submit Button
  - c. Send keys()
  - d. Click()
  - e. Checkbox
  - f. Radio Buttons
  - g. Image
  - h. Dropdown
4. Build a driver scripts to handle the Events
  - a. Mouse and Keyboard Events
  - b. File Upload and Download Events
  - c. Alert and Popup handling
  - d. Web tables and Dynamic tables
5. Access and installation of TESTNG IDE for Automated Testing
  - Add the TestNG Framework in Eclipse
6. Create a TestNG sample project for real time applications
  - Create and code test cases
  - Create TestNG Testfile
  - Running the test
  - Export the report

**P:30; TOTAL:30 PERIODS**

## SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** JAVA, Eclipse, Selenium, TestNG

## REFERENCES

1. [https://www.selenium.dev/documentation/en/getting\\_started/](https://www.selenium.dev/documentation/en/getting_started/)
2. Dimo Kovalenko, "Selenium Design Patterns and Best Practices", Packet Publishing Limited, 2014.
3. <https://www.guru99.com/selenium-tutorial.html>

**19CS27L      PREDICTIVE ANALYTICS USING MACHINE LEARNING      L   T   P   C**  
**0   0   2   1**

### **COURSE OUTCOMES**

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

- CO1: Understand the basic concepts of machine learning and predictive analytics. (K2)
- CO2: Deploy applications using machine learning and predictive analytics (K3)

### **LIST OF EXERCISES**

1. Interpret the data using python libraries-Numpy, pandas, matplotlib
2. Predicting the home rate using the linear regression technique
3. Predict the weather forecasting using regression technique
4. Speech emotion recognition using CNN
5. Sentimental analysis on Twitter data
6. Credit card Fraud detection using historical transaction data
7. Predicting the yield estimation in a garden using images

**P:30; TOTAL:30 PERIODS**

### **SOFTWARE REQUIREMENTS**

- **Operating System:** Windows / Linux
- **Software:** Anaconda, Google colab , Jupiter

### **REFERENCES**

1. John D.Kellehar, "Fundamentals of Machine Learning for Predictive Data Analytics", 2015.
2. <https://www.educba.com/machine-learning-vs-predictive-modelling/>
3. <https://towardsdatascience.com/top-9-data-science-projects-for-a-beginner-in-2020-26eb7d42b116>

**19CS28L                      PYTHON FOR MACHINE LEARNING                      L   T   P   C**  
**0   0   2   1**

### **COURSE OUTCOMES**

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

- CO1: Interpret the dataset with virtualization techniques.(K2)
- CO2: Apply machine algorithms for classification and prediction.(K3)

### **LIST OF EXERCISES**

1. Interpret the Numpy operations using python
2. Creating data frames and reading data from CSV/JSON using python pandas
3. Data visualization using python matplotlib
4. Classify the data using classification algorithms (KNN/SVM) in python
5. Weather forecasting using k-means clustering algorithm
6. Image classification using decision tree/random forest using python
7. Face recognition using Neural network in python

**P:30; TOTAL:30 PERIODS**

## SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** Anaconda, Google colab , Jupiter

## REFERENCES

1. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, 1<sup>st</sup> Edition, 2017.
2. Ethem Alpayd, "Introduction to machine learning", MIT press, 2<sup>nd</sup> Edition, 2015.

<b>19CS29L</b>	<b>FULL STACK DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

## COURSE OUTCOMES

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

- CO1: Build the Data base tables with proper user authentications (K3)
- CO2: Develop simple interactive static and dynamic web applications (K3)

## LIST OF EXERCISES

1. Create Database and entities with different user access privileges
2. Create a table with necessary attributes, key and Domain constraints. Perform CRUD operations.
3. Create a simple spring boot web service to get and post user data.
4. Create a web service to fetch the information from DB and display the data as JSON.
5. Create the simple static web pages and apply the necessary CSS Layouts and styles.
6. Create an enriched static webpage design by applying Bootstrap 5 and Perform essential DOM Event handlings.
7. Create a dynamic Single page web application to get and post user form data from DB.
8. **MINI PROJECT:** Develop an enriched dynamic website for handling student"s personal and performance data.

## SOFTWARE REQUIREMENTS

- Operating Systems: Windows 8 or above / Ubuntu 14 or above
- Software"s: VS Code, PostgreSQL 12, Java 8, Spring Boot 2.6, React JS / Angular, Bootstrap 5

## PREREQUISITES

Basic Knowledge in HTML, CSS, Java Script, Java, DBMS

**P: 30; TOTAL: 30 PERIODS**

## REFERENCES

1. Julie C. Meloni, Jennifer Kyrnin "Sams Teach Yourself HTML, CSS, and JavaScript All in One," 3<sup>d</sup> Edition, 2020.
2. Juha Hinkula , " Hands-On Full Stack Development with Spring Boot 2 and React: Build modern and scalable full stack applications using Spring Framework 5 and React with Hooks, 2nd Edition 2nd Edition, Kindle Edition", Packt Publishing,2021.

3. <https://www.udemy.com/course/full-stack-project-spring-boot-20-react-redux/>
4. <https://www.udemy.com/course/full-stack-angular-spring-boot-tutorial/>
5. <https://www.coursera.org/learn/front-end-react.>

<b>19CS30L</b>	<b>MICROPROCESSOR AND MICROCONTROLLER</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>C</b>

### COURSE OUTCOMES

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

- CO1: Understand the working principles of internal organizational units of microprocessor and microcontroller (K2)

#### UNIT I      8085 PROCESSOR      8

Hardware Architecture, pin diagram - Functional Building Blocks of Processor - Memory organization - I/O ports and data transfer concepts - Timing Diagram - Interrupts- I/O interfacing - Serial & Parallel communication interface - D/A and A/D Interface - Case studies: Traffic Light control, LED display, LCD display

#### UNIT II      8051 MICROCONTROLLER      7

Architecture of 8051 - Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming - Timer/Counter and Serial Communication, Programming Timer Interrupts, Programming External H/W interrupts-Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections

**L:15; TOTAL:15 PERIODS**

### TEXT BOOKS

1. Muhammed Ali Mazidi, Janice Gillisple Maudi, Rolin.D. McKinlay, "The 8051 Microcontroller and Embedded Systems, Using Assembly and C", Pearson Prentice Hall, 2<sup>nd</sup> Edition, 2015.
2. K.Uma Rao, Andhe Pallav, The 8051 Microcontrollers, Architecture and Programming and Applications, Pearson, 3<sup>rd</sup> Edition, 2014.

### REFERENCES

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, 5<sup>th</sup> Edition, Penram International Publishing, 2002.
2. Kenneth J Ayala, "The 8051 Microcontroller", Cengage Learning, Reprint, 3<sup>rd</sup> Edition 2014.
3. A.K.Ray and K.M. Bhurchandi, "Advanced Microprocessor and Peripherals", Tata McGraw Hill, 3<sup>rd</sup> Edition, 2013.
4. Andrew N. Sloss, Dominic Symes, Chris Wright and John Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software", Elsevier, 2009.

<b>19CS31L</b>	<b>GOLANG PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### COURSE OUTCOMES

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

CO1: Implement the basic concepts of Golang (K3)

CO2: Build a basic framework for blockchain using Golang (K3)

### LIST OF EXPERIMENTS

1. Write a program to calculate the year given the date of birth and age.
2. Write a program to get a number from the console and check if it's between 1 and 10.
3. Write a program that divides x by 2 if it's greater than 0.
4. Write a program to create a new file containing names and read it into an array.
5. Write a program to take the string „hello world“ and slice it in two.
6. Write a program that rolls a dice (1 to 6).
7. Write a program to create a struct house with variables noRooms, price and city.
8. Write a program to create a variadic function that prints the names of students.
9. Write a program to create a method that calls another method.
10. Write a program to generate Fibonacci series using recursive functions.
11. Build the basic framework for a blockchain using Golang module system.

**P: 30; TOTAL:30 PERIODS**

### SOFTWARE REQUIREMENTS

- Operating System: Linux/ Windows
- Software: LiteIDE /GoLand 2021.2.4

### REFERENCES

1. Shubhangi Agarwal , “Learning Go Programming : Build Scalable Next -Gen Web Application using Golang”, BPB Publications; 1<sup>st</sup> edition, 2021.
2. Prithvial Singh and Sachchidanand Singh, “Hands-on Go Programming: Learn Google Golang Programming, Data Structures, Error Handling and Concurrency”, BPB Publications; 1<sup>st</sup> edition, 2021.
3. <https://www.udemy.com/topic/go-programming-language/>

**19CS32L**

**KOTLIN PROGRAMMING**

**L T P C**

**0 0 2 1**

### COURSE OUTCOMES

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

CO1: Implement the basic concepts of Kotlin (K3)

CO2: Build a simple block chain using Kotlin (K3)

### LIST OF EXERCISES

1. Write a program to find the roots of a quadratic equation using conditional statement
2. Write a program to check whether the given number is a positive or a negative number using conditional statement
3. Write a program to display Fibonacci series using for loop statement.
4. Write a program to check Palindrome number using loop
5. Write a program to display Armstrong numbers between two integers using functions.

6. Write a program to display prime numbers between intervals using functions.
7. Write a program to find GCD of two numbers using recursive functions.
8. Write a program to find sum of natural numbers using recursive functions.
9. Write a program to find transpose of a matrix using arrays.
10. Write a program to add two matrices using multi-dimensional arrays.
11. Write a program to create a genesis block of a blockchain.
12. Write a program to build a simple blockchain for an application (Supply Chain Management / Medical Systems Management / Land Registration).

**P: 30; TOTAL: 30 PERIODS**

### SOFTWARE REQUIREMENTS

- Operating System: Linux / Windows
- Software: JDK, IntelliJ IDEA 2021.2.3

### REFERENCES

1. Aleksei Sedunov, "Kotlin In-Depth: A Comprehensive Guide To Modern Multi-Paradigm Language", BPB Publications, 2020.
2. <https://www.geeksforgeeks.org/kotlin-programming-language/>
3. <https://www.udemy.com/course/kotlin-course/>
4. <https://www.coursera.org/projects/learn-kotlin-1>
5. <https://amarszalek.net/blog/2018/03/20/simple-blockchain-in-kotlin/>

**19CS33L**

**ETHICAL HACKING**

**L T P C**  
**0 0 2 1**

### COURSE OUTCOMES

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

- CO1: Understand the basics of ethical hacking and installation of hacking tool (K3)
- CO2: Build the simple experiments using the hacking tool (K3)

### LIST OF EXERCISES

1. Study Kali Linux tool, types, installation and configuration procedure of VMware/Kali linux.
2. Analysis your network to track resources, mapping visualization and security auditing using Information Gathering Tool
3. Simulate login cracker process using Jhonny/ Hydra/ John
4. How to use Wi-Fi cracking tools in wireless attacks
5. Implement program for scanning, fingerprinting, and exploitation of router using Cisco torch
6. Scan and test the security of web applications.

**P: 30; TOTAL: 30 PERIODS**

### SOFTWARE REQUIREMENTS

- Operating System: Linux
- Software: VMWare, Kali linux Tool



## REFERENCES

1. Raphael Hertzog , Mati Aharoni, Jim O'Gorman, "Kali Linux Revealed: Mastering the Penetration Testing Distribution", Offsec Press, ISBN-13-978-0997615609, 2017.
2. Vivek Ramachandran & Cameron Buchanan, "Kali Linux Wireless Penetration Testing: Master wireless testing techniques to survey and attack" ,
3. MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction", 3rd Edition, Prentice Hall, 2020.
4. Mary Manjikian, Cybersecurity Ethics - An Introduction, Routledge - Taylor & Francis Group, 2018.
5. Markus Christen, Bert Gordijn, Michele Loi, "The Ethics of Cybersecurity", Springer, 2020.

<b>19CS34L</b>	<b>AUGMENTED REALITY FOR DEVELOPERS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

## COURSE OUTCOMES

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

- CO1: Articulate the basic terminologies involved in Augmented Reality. (K2)
- CO2: Create and deploy Augmented Reality mobile applications to solve real world problems. (K3)

## LIST OF EXPERIMENTS

1. Create Marker based Augmented Reality mobile application.
2. Create Markerless Augmented Reality mobile application.
3. Create Cylinder Target Augmented Reality mobile application.
4. Create Multi Target Augmented Reality mobile application.
5. Create UI, Virtual Buttons, Animation and Interaction with 3D game objects.
6. Create an Augmented Reality Mobile application for any one of the real-world use cases. The application must include at least 2 scenes which can be changed dynamically, a good UI, Animation and Interaction with 3D game objects.

**P:30; TOTAL:30 PERIODS**

**HARDWARE REQUIREMENTS** - Mobile/Tablet - Web Camera - Desktop PC / Laptop (i5 Processor - 8 GB RAM) Equivalent or above.

**SOFTWARE REQUIREMENTS** - Unity 3D, Vuforia, AR Foundation, Visual Studio, C#.NET, Blender.

## REFERENCES

1. Jonathan Linowes, "Augmented Reality with Unity AR Foundation: A Practical guide to cross-platform AR development with Unity 2020 and later versions", Packt Publishing, 2021.
2. Jonathan Linowes, Krystian Banilinski, "Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit and Vuforia", Packt Publishing, 2017.
3. Ashley Godbold, "Mastering UI Development with Unity", Packt Publishing, 2018.

4. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", Pearson Education India, 2016.
5. Augmented Reality in Tourism, Museums and Heritage: A New Technology to Inform and Entertain (Springer series on Cultural Computing) 1<sup>st</sup> Ed. 2021.
6. Brinis Hamza, Abderrahmen Brinis, "Udemy Course - Build your First AR application using Unity C# and Vuforia: Learn how to make AR Book or magazine for Kids with Vuforia and Unity", 2021.
7. <https://library.vuforia.com/getting-started/getting-started-vuforia-engine-unity>
8. <https://learn.unity.com/tutorial/setting-up-ar-foundation>
9. <https://www.coursera.org/learn/ar>
10. <https://www.udemy.com/course/develop-augmented-reality-book-ar-business-card-with-unity>

**19CS35L****3D MODELING AND DESIGN****L T P C****0 0 2 1****COURSE OUTCOMES**

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

CO1: acquire knowledge and skills in 3D modeling and design (K2)

CO2: develop 3D animation from modeling to rendering (K3)

**LIST OF EXPERIMENTS**

1. Creating a 3D scene (Eg. metropolitan landscape) from primitives
2. Populate the scene with at least three new sculpted polygon objects. One of the objects should be a vehicle of some form.
3. Setup the animated scene for rendering. Render the scene out as a sequence of images and then import the sequence into the post compositing program for final QuickTime output
4. A single piece of paper dropping through the air
5. Stirring a soup pot and tasting it using a spoon

**P:30; TOTAL:30 PERIODS****SOFTWARE REQUIREMENT:**

- Windows /macOS
- Autodesk Maya 2023

### COURSE OUTCOMES

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

- CO1: apply JavaScript with API interactions to design, build, and enhance dynamic web applications.
- CO2: demonstrate Git version control and Node.js with file system.

### Experiments:

1. Design the following form with input validation. After successful validation , print the given input data in the next page. In case of errors in validation, print as shown below

The image shows a web form with several input fields, each with a red border and a red error message to its right. The fields and their error messages are: 'UserName' (error: 'Please Enter Email Address'), 'Password' (error: 'Please Enter Password'), 'Confirm password' (error: 'Please Enter Confirm Password'), 'Country' (error: 'Please Select Country'), 'City' (error: 'Please Select City'), 'Address' (error: 'Please Enter Address'), and 'Mobile' (error: 'Please Enter Mobile No'). There is also a checkbox for 'I accept the terms & conditions' with the error message 'Please Accept the Terms & Conditions'. A 'Submit' button is located at the bottom left of the form. The background of the form is light gray.

2. Develop a form using HTML and javascript with two input textboxes for weight(w) and height(h).Write a javascript function computeBMI that takes as parameters a weight in pounds and a height in inches and returns the Body Mass Index (BMI) for an individual with these characteristics. BMI is calculated from the equation:  $703 * \text{weight} / (\text{height} * \text{height})$ . You should also describe the person's body type based on their BMI score using the following criteria: Underweight< 18, Normal: 18 - 25, Overweight: 25 - 30 Obese:> 30. Input validation should be performed.
3. Develop a form using HTML and compute grade point average for end semester examination
4. Implement intrinsic event handling using Document Object Model.
5. Design a form to accept and validate the fields. On successful submission get

text/ gif data from open source

6. Design a form to accept and validate the fields. On successful submission get custom API data as response.
7. Make a git repository for previous exercises. Pull a new branch as “Development” and make changes in it and merge the same to master.
8. Add Git ignore for the same repository, add environmental variable in .env file and add it to .gitignore
9. Using Asynchronous and synchronous FS module in nodejs and create a file and write a data.

## SOFTWARE REQUIREMENTS

Operating Systems: Windows 8 or above / Ubuntu 14 or above

Softwares: VS Code, Git, Bootstrap 5, Nodejs

TOTAL: 30 PERIODS

**R-2019    B.E – CSE**  
**OPEN ELECTIVE COURSES**

<b>19CS01N</b>	<b>COMPUTER GRAPHICS AND VIRTUAL REALITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

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

**UNIT I INTRODUCTION TO COMPUTER GRAPHICS 12**

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

**UNIT II GEOMETRIC OBJECTS AND TRANSFORMATIONS 12**

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

**UNIT III FRAGMENTATION, LIGHTING AND SHADING 12**

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

**UNIT IV 3D INTERACTION TECHNIQUES 12**

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

**UNIT V ADVANCES IN 3D USER INTERFACES 12**

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

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

**TEXT BOOKS**

1. Edward Angel, "Interactive Computer Graphics: A Top-Down Approach Using OpenGL", Addison-Wesley, 7<sup>th</sup> Edition, 2015.

2. Hearn Baker Carithers, "Computer Graphics with Open GL", Pearson Education Limited, 4<sup>th</sup> Edition 2014.
3. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

## REFERENCES

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

<b>19CS02N</b>	<b>MOBILE APPLICATION DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

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

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>12</b>
Mobile Applications - Characteristics and Benefits -Application Model - Infrastructure and Managing Resources - Mobile Software Engineering - Frameworks and Tools - Mobile devices Profiles.		
<b>UNIT II</b>	<b>INTRODUCING ANDROID</b>	<b>12</b>
The Android platform - Understanding the Android market - The layers of Android - Four kinds of Android components - Understanding the AndroidManifest.xml file - Mapping applications to processes.		
<b>UNIT III</b>	<b>TOOLS</b>	<b>12</b>
Android Platform - Eclipse Emulator - Android Application Architecture - Event based programming - iOS Platform - UI tool kit interfaces - Event handling and Graphics services - Layer Animation.		
<b>UNIT IV</b>	<b>ANDROID STUDIO DEVELOPMENT ENVIRONMENT</b>	<b>12</b>

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

**UNIT V APPLICATION DEVELOPMENT 12**

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

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

**REFERENCES**

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

<b>19CS03N</b>	<b>OBJECT ORIENTED PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: identify the differences of structured and object oriented programming features.(K3)
- CO2: develop programs using overloading and appropriate constructors. (K3)
- CO3: develop the applications using appropriate inheritance and polymorphism mechanisms (K3)
- CO4: use advance features like templates and exception to make programs supporting reusability and sophistication. (K3)
- CO5: Implement rich data handling through files and STL. (K3)

**UNIT I BASIC CONCEPTS 12**

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



**UNIT II CONSTRUCTORS AND OVERLOADING 12**

Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors - Function Overloading - Operator overloading, Rules for Operator overloading - overloading of binary and unary operators.

**UNIT III INHERITANCE AND POLYMORPHISM 12**

Introduction to inheritance - Defining Derived Classes - Single Inheritance - Multiple Inheritance - Multi-Level Inheritance - Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes - Abstract Classes - Constructors in Derived Classes - Introduction to pointers - Pointers to Objects - Virtual Functions - Pure Virtual Functions - Virtual Destructors.

**UNIT IV TEMPLATES AND EXCEPTION HANDLING 12**

Introduction - Class Templates - Class Templates with Multiple Parameters - Function Templates, Function Templates with Multiple Parameters -Member Function Templates - Basics of Exception Handling, Types of exceptions - Exception Handling Mechanism - Throwing and Catching Mechanism.

**UNIT V FILE HANDLING AND STL 12**

Files in C++: File handling in C++ - File I/O - Formatted and Unformatted I/O - STL.

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

**TEXT BOOKS**

1. Herbert Schildt, "C++: The Complete Reference", 5<sup>th</sup> Edition, Tata McGraw – Hill Publishers, 2014.
2. Paul Deitel, Harvey Deitel, "C++ How to Program", 8<sup>th</sup> Edition, Prentice Hall Publisher, 2016.
3. Trivedi, Bhushan "Programming with ANSI C++", 2<sup>nd</sup> Edition, Oxford University Press - NASW Press, 2013.

**REFERENCES**

1. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, 2<sup>nd</sup> Edition, Reprint 2004.
2. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Primer", Pearson Education, 4<sup>th</sup> Edition, 2012.
3. Bjarne Stroustrup, "The C++ Programming language", Pearson Education, 4<sup>th</sup> Edition, 2013.

<b>19CS04N</b>	<b>PROGRAMMING IN PYTHON</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

CO1: develop simple Python programs. (K3)

CO2: structure simple Python programs for solving problems and decompose a Python

program into functions. (K3)

CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)

CO4: understand file management concepts and develop packages in Python Programs. (K3)

CO5: design and Develop GUI Programming. (K5)

### **UNIT I DATA, EXPRESSIONS, STATEMENTS 12**

Python interpreter and interactive mode - values and data types: Variables - expressions - statements - Operators - precedence of operators - Input and Output - comments - Errors: Syntax Errors - Runtime errors - Logical Errors.

### **UNIT II CONTROL FLOW, FUNCTIONS 12**

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) - chained conditional (if-elif-else) - Iteration: state - while - for - break - continue - pass - Fruitful functions: Function argument and its types - return values - parameters - local and global scope - function composition - recursion.

### **UNIT III LISTS,TUPLES,DICTIONARIES 12**

Strings: string slices - immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop - mutability - aliasing - cloning lists - list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods.

### **UNIT IV FILES, MODULES, INTERPRETERS & PACKAGES 12**

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions - modules - Computer Numerical Controller (CNC) implementation using python - CNC G codes to stepper Motor - Python control of Linux CNC for prototyping machine- packages - Name space.

### **UNIT V GRAPHICAL USERINTERFACE PROGRAMMING 12**

Event driven programming - TkInterintroduction - Introducing callbacks - User input - Simple case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score.

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

#### **TEXT BOOKS**

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", O'Reilly Media, Inc., 2016.
2. Brian Heinold, "A Practical Introduction to Python Programming", Mount St. Mary's University, 2012.
3. Richard L. Halterman, "Learning to Program with Python", 2019.
4. Mark Pilgrim, "Dive into Python", Apress, 2012.

#### **REFERENCES**

1. Timothy A.Budd, "Exploring Python", Mc-Graw Hill Education (India) Limited, 2015.
2. PaulGries, Jennifer Campbell and Jason Montojo, "Practical Programming: An

- Introduction to Computer Science using Python 3.6”, Pragmatic Programmers, LLC, 2018.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd, 2016.
  4. <http://ce.sharif.edu/courses/96-97/2/ce153-6/resources/root/Learn-to-Program-with-Python.pdf>.

**19CS05N      FUNDAMENTALS OF JAVA PROGRAMMING      L   T   P   C   QP**  
**2   0   2   3   A**

### **COURSE OUTCOMES**

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

- CO 1: apply object oriented concepts to solve real world problems (K3)
- CO 2: explain the principles of packages and strings in java. (K2)
- CO 3: develop multi-thread applications with exception handling (K3)
- CO 4: create user interfaces for java application and applets using GUI (K3)
- CO 5: build real time applications with JDBC and Collections (K3)

### **UNIT I      JAVA BASICS      12**

OOPS Concepts-Java Programming Constructs - Objects and Classes - Methods - Constructors -Access Specifiers - Data Types - Variables - Operators - Control Statements - Arrays - Inheritance - Method Overriding - Abstract Class - Interfaces.

### **UNIT II      PACKAGES AND STRING      12**

Packages - Importing Packages- Access Protection -Wrapper Classes - String Handling - Character extraction - string comparison - Methods for Modifying and Searching String.

### **UNIT III      EXCEPTION HANDLING AND THREADS      12**

Exception Handling: Try, Catch, Finally Blocks - Throw - Throws - Class Throwable- Multithreaded Programming: Creating Threads - Creating Multiple Threads - Thread Priorities -Synchronization - Inter Thread Communication - Suspending, Resuming and Stopping of Threads.

### **UNIT IV      APPLETS AND EVENT HANDLING      12**

Applet Basics - Applet Architecture - Applet Class and Methods - Passing parameters to Applets - Event Handling - Delegation Event Model - Event Classes - Event Listener Interfaces – Adapter Classes.

### **UNIT V      JDBC AND COLLECTIONS      12**

The Design of JDBC - The Structured Query Language - JDBC Configuration - Executing SQL- -Collections: Wrapper classes - Collection framework.

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

**TEXT BOOKS**

1. Hortsman & Cornell, "CORE JAVA 2 Advanced Features – VOL-II", Pearson Education, 10<sup>th</sup> Edition, 2017.
2. Deitel H M and Deitel P I, Java - How to Program, Pearson Education, New Delhi, 11<sup>th</sup> Edition 2017.
3. Herbert Schildt, Java: The Complete Reference, 11<sup>th</sup> Edition, 2018.

**REFERENCES**

1. Anita Seth, B.L.Juneja, "JAVA one step ahead", Oxford University Press Publication, 2<sup>nd</sup> Edition, 2018.
2. Sachin Malhotra and Saurabh Choudhary, Programming in Java Oxford University, New Delhi, 2018.
3. Herbert Schildt, "Java: A Beginner's Guide", Tata McGraw Hill, 2007.

<b>19CS06N</b>	<b>PROGRAMMING FOR ROBOTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO 1: interpret the basic concepts of Robot programming. (K2)
- CO 2: enrich the robot programming through VAL. (K3)
- CO 3: develop robot with movement and motion instructions. (K3)
- CO4: understand the importance of operating and data processing. (K3)
- CO 5: explore the interfacing tools and testing of robot. (K3)

**UNIT I INTRODUCTION TO ROBOT PROGRAMMING 12**

Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation-Interlock commands Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

**UNIT II ROBOT PROGRAMMING LANGUAGES 12**

Robot Languages-Classifications, Structures, Variable Assembly Language (VAL) - VAL language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications.

**UNIT III RAPID LANGUAGE 12**

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command based programming. Move master command language-Introduction, syntax, simple problems.

#### UNIT IV AML LANGUAGE

12

ARC Macro Language (AML): AML Language-General description, elements and functions, Statements, constants and variables-Program control statements-Operating systems, Motion, Sensor commands-Data processing.

#### UNIT V PRACTICAL STUDY OF VIRTUAL ROBOT

12

Robot cycle time analysis-Multiple robot and machine Interference-Process Chart-Simple Problems-Virtual robotics, Robot studio online software- Introduction, Jogging, components, work planning, program modules, input and output signals-Singularities-Collision Detection-Repeatability measurement of robot-Robot economics.

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

#### REFERENCES

1. S. R. Deb, "Robotics technology and flexible automation", Tata McGraw Hill publishing company limited, 2010.
2. Mikell. P. Groover, "Industrial Robotics Technology, Programming and Applications", McGraw Hill Co, 2008.
3. Robotlcs Lab manual, 2007.
4. Klafter. R. D, Chmielewski. T. A. and Noggin"s., "Robot Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd., 2011.
5. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 2008.
6. Craig. J. J. "Introduction to Robotics mechanics and control", Addison-Wesley, 2018.

#### 19CS07N FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C	QP
2	0	2	3	A

#### COURSE OUTCOMES

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

- CO1: Understand intelligent agents for search and games (K2)
- CO2: Solve AI problems through programming with Python. (K3)
- CO3: Learning optimization and inference algorithms for model learning. (K2)
- CO4: Design and develop programs for an agent to learn and act in a structured environment. (K3)
- CO5: Design some of the applications that use Artificial Intelligence (K3)

#### UNIT I INTRODUCTION

12

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Basic terminologies of tree and graph structures, State space representation, Search graph and Search tree.

**UNIT II SEARCH ALGORITHMS 12**

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A\* algorithm, Game Search.

**UNIT III PROBABILISTIC REASONING 12**

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

**UNIT IV MARKOV DESIGN PROCESS 12**

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

**UNIT V LEARNING 12**

Supervised and Unsupervised learning, Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

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

**LIST OF PRACTICALS (Should be given as Assignments)**

1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3. Write a programme to construct a Bayesian network from given data.
4. Write a programme to infer from the Bayesian network.
5. Write a programme to run value and policy iteration in a grid world.
6. Write a programme to do reinforcement learning in a grid world.
7. Mini Project work

**TEXT BOOK**

1. S.Russel, P.Norvig, "Artificial Intelligence - A Modern Approach", Pearson Education, 3<sup>rd</sup> Edition, 2015.

**REFERENCES**

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", 3rd Edition Tata McGraw-Hill Education Pvt. Ltd, 2008.
2. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, 2018.
3. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

**19CS08N****SIMULATION AND MODELING**

L	T	P	C	QP
2	0	2	3	A

**COURSE OUTCOMES**

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

- CO1: understand the basics of simulation and modelling.(K2)  
CO2: generate random numbers and random variates using different techniques.(K3)  
CO3: develop simulation model using heuristic methods.(K3)  
CO4: identify the relevant input and output analyzer, verification and validation models and simulation software. (K3)  
CO5: simulate the models for the purpose of optimum control by using software. (K3)

**UNIT I INTRODUCTION 12**

Introduction to Simulation: Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System.

**UNIT II RANDOM NUMBERS GENERATION 12**

General Principles: Concepts in discrete -event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. Random Numbers: Properties, Generations methods, Tests for Random Number-Frequency test, Runs test, Autocorrelation test.

**UNIT III SIMULATION MODEL USING HEURISTIC METHODS 12**

Random Variate Generation: Inverse Transform Technique-Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods-Erlang distribution.

**UNIT IV SIMULATION MODELS USING INPUT AND OUTPUT ANALYZER 12**

Analysis of Simulation Data Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model -Model Building, Verification, Calibration and Validation of Models.

**UNIT V FUZZY AND GA 12**

Modeling Based on Expert Knowledge - Fuzzy sets, Membership functions, Fuzzy Inference systems, Expert Knowledge and Fuzzy Models, Design of Fuzzy Controllers. Simulation of Engineering Systems: Monte-Carlo simulation. Genetic Algorithm - operations - elitism.

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

**TEXT BOOKS**

1. Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation",. Academic press, 2<sup>nd</sup> Edition, 2000.

**REFERENCES**

1. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, Discrete Event system Simulation, Pearson Education, Asia, 4th Edition, 2007.
2. Geoffrey Gordon, System Simulation, Prentice Hall publication, 2<sup>nd</sup> Edition, 1978.
3. Ogata K, "Modern control Engineering", Prentice hall of India, 3<sup>rd</sup> Edition, 2001.

4. Jang J.S.R. sun C.T and Mizutani E, "Neuro-Fuzzy and soft Computing", Prentice hall of India, 3<sup>rd</sup> Edition, 2002.
5. Shannon, R. E., "System Simulation: The Art and Science", Prentice Hall Inc. 1990.
6. Pratab.R "Getting started with MATLAB" Oxford university Press 2009.
7. Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions -Industrial Engineering series, 4<sup>th</sup>Edition, 1991.
8. Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3<sup>rd</sup> Edition, 2004.

<b>19CS09N</b>	<b>COMPUTER ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### COURSE OUTCOMES

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

- CO 1: Realize the role of functional units and various architectural features (K2)
- CO 2: Examine data representation and execution procedure of an ALU (K2)
- CO 3: Identify the factors that degrade the pipeline performance and its counter measures (K4)
- CO 4: Evaluate and analyze the performance of memory. (K4)
- CO 5: To learn the different ways of communication with I/O devices and interfaces. (K2)

### UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional units - Basic operational concepts - Bus structures - Performance - Memory locations and addresses- Memory operations - Instructions and instruction sequencing - Instruction set architecture - Addressing modes- I/O Operations

### UNIT II BASIC PROCESSING UNIT 9

Fixed point arithmetic- Addition and subtraction of signed numbers -multiplication of positive Numbers- signed operand multiplication and fast multiplication -restoring and non-restoring division algorithm. Fundamental concepts - Execution of a complete instruction - Multiple bus organization - Hardwired control - Micro programmed control.

### UNIT III PIPELINING 9

A Basic MIPS implementation - Building a Data path - Control Implementation Scheme - Pipelining - Pipelined data path and control - Handling Data Hazards & Control Hazards - Exceptions.

### UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories -Improving cache performance - virtual memory, Flynn,s classification - SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading - Multi-core processors and other Shared Memory Multiprocessors.



## UNIT V I/O SYSTEMS

9

Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation - Arbitration - Interface circuits - USB. Input/output system, programmed I/O, DMA and interrupts, I/O processors

**L:45; TOTAL:45 PERIODS**

### TEXT BOOKS

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann / Elsevier, 5<sup>th</sup> Edition, 2014.
2. Carl Hamacher, Zvonko Vranesic, SafwatZaky and Naraig Manjikian, Computer Organization and Embedded Systems, Tata McGraw Hill, 6<sup>th</sup> Edition, 2012.
3. William Stallings, Computer Organization and Architecture – Designing for Performance, Pearson Education, 8<sup>th</sup> Edition, 2010.

### REFERENCES

1. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, 3<sup>rd</sup> Edition, 2012.
2. John L. Hennessey and David A. Patterson, Computer Architecture - A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, 5<sup>th</sup> Edition, 2012.

**19CS10N**

**DEEP LEARNING**

L	T	P	C	QP
3	0	0	3	A

### COURSE OUTCOMES

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

- CO1: Understand the basis of Machine Learning (K2)
- CO2: Explore various Deep feed forward Networks (K2)
- CO3: Implement and analyse Convolutional Neural Algorithms (K3)
- CO4: Build Recurrent Neural networks for various applications (K3)
- CO5: Understand optimization and generalization techniques in deep learning (K2)

## UNIT I MACHINE LEARNING BASICS

9

Introduction to machine learning - Linear models (SVMs and Perceptrons, logistic regression). Learning Algorithms - Capacity, Overfitting and underfitting - Hyperparameters and Validation Sets - Estimators, Bias and Variance - Maximum Likelihood Estimation - Bayesian Statistics - Supervised Learning Algorithms - Unsupervised Learning Algorithms - Stochastic Gradient Descent - Building a Machine Learning Algorithm - Challenges Motivating deep learning.

## UNIT II DEEP FEED FORWARD NETWORKS

9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets

**UNIT III DEEP CONVOLUTIONAL NEURAL NETWORKS 9**

Convolutional Neural Networks: The Convolution Operation - Motivation - Pooling - Variants of the basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Neuroscientific Basis - Applications: Computer Vision, Image Generation, Image Compression

**UNIT IV RECURRENT NEURAL NETWORKS 9**

Recurrent Neural Networks: Introduction - Recursive Neural Networks - Bidirectional RNNs - Deep Recurrent Networks - Applications: Image Generation, Image Compression, Natural Language Processing.

**UNIT V OPTIMIZATION AND GENERALIZATION 9**

Optimization in deep learning- Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM

**L:45; TOTAL:45 PERIODS****TEXT BOOKS**

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. 2<sup>nd</sup> Edition, 2016.
2. Dr.AdrianRosebrock, "Deep Learning for Computer Vision with Python: Starter Bundle", PyImage Search, 1<sup>st</sup> Edition, 2017.

**REFERENCES**

1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 1<sup>st</sup> Edition, 2013.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 1<sup>st</sup> Edition, 2015.

<b>19CS11N</b>	<b>FUNDAMENTALS OF MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO 1: To study the basics of machine learning (K1)
- CO 2: To learn linear models(K2)
- CO 3: To understand distance based clustering techniques(K2)
- CO 4: To know about tree and rule-based models (K2)
- CO 5: To understand ensemble learning (K2)

**UNIT I INTRODUCTION 9**

Machine learning - Task : problems solved with machine learning, Looking for structure, performance evaluation - Models: Geometric models, Probabilistic models, Logical models, Grouping and grading -Features - Binary Classification -Handling more than two classes - Regression-Movie genre identification and rating system

**UNIT II      LINEAR MODELS      9**

Concepts: Supervised, Unsupervised and Descriptive learning - Hypothesis space - Linear classification - univariate linear regression - multivariate linear regression - logistic regression - perceptron - multilayer neural networks - learning neural networks structures - support vector machines- Credit card approval system.

**UNIT III      DISTANCE-BASED MODELS      9**

Distance and measure - Neighbours and exemplars - Nearest neighbour classification - Distance based clustering: K-means algorithm, clustering around medoids -Document clustering.

**UNIT IV      TREE AND RULE MODELS      9**

Decision trees - learning decision trees - ranking and probability estimation trees - regression trees - clustering trees - spam filtering

**UNIT V      MODEL ENSEMBLES      9**

Features : Kinds of feature, Feature transformation , Feature Construction and Selection - Ensemble learning: bagging and random forests - Boosting: Boosted rule learning - Meta learning -Diabetes diagnosis system.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 1<sup>st</sup> Edition 2012.
2. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2<sup>nd</sup> Edition 2012.

**REFERENCES**

1. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
2. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012
3. <https://www.coursera.org/learn/machine-learning/>
4. <http://archive.ics.uci.edu/ml/>

<b>19CS12N</b>	<b>BLOCKCHAIN TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

**COURSE OUTCOMES**

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

- CO1: Identify blockchain, transactions, blocks, proof-of- work.(K1)
- CO2: Recognize the basic security mechanism with Cryptographic technique (K2)
- CO3: Recognize the significance of Bitcoin in BlockChain.(K2)
- CO4: Implement consensus protocol mechanisms and hyper ledger tools.(K3)
- CO5: Identify the important issues in blockchain technology.(K3)

**UNIT I INTRODUCTION 9**

History: Digital Money to Distributed Ledgers- Design Primitives: Protocols, Security, Consensus, Permissions, Privacy - Blockchain Architecture and Design- History of centralized services- Transactions-Trusted third party for transactions-Making a case for a trustless system - Decentralized transactions- Verifying and Confirming transactions.

**UNIT II BASICS OF CRYPTOGRAPHY AND BITCOIN 9**

Cryptography Hash Function - Properties of Hash Function - Hash pointer and Merkle tree - Digital Signature - Symmetric and Asymmetric Key Cryptography. Creation of Coins - Payments and Double Spending.

**UNIT III BIT COIN TRANSACTION 9**

Transaction in Bitcoin Network - Block Mining - Block propagation and Block relay- Proof of Work (PoW) - HashcashPoW - Attacks on PoW- Proof of Stack - Proof of Burn - Proof of Elapsed Time.

**UNIT IV CONSENSUS AND HYPERLEDGER 9**

Consensus: Basic consensus mechanisms-Requirements for the consensus protocols- Scalability aspects of Blockchain consensus protocols. Permissioned Blockchains: Design goals -Consensus protocols for Permissioned Blockchains. Hyperledger Fabric I: Decomposing the consensus process-Hyperledger fabric components-Chaincode Design and Implementation -Hyperledger composer tool

**UNIT V CHALLENGES AND SECURITY ISSUES 9**

Security and Safeguards- Protection from attackers - Hacks on exchanges - stopping adoption- Scalability problems - Bitcoin creation and economy - Network attacks to destroy bitcoin- Limited Supply and Deflation.

**L:45; TOTAL:45 PERIODS**

**TEXT BOOK**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press- 1<sup>st</sup> Edition, 2016.

**REFERENCES**

1. Roger Wattenhofer, "Distributed Ledger Technology: The Science of the Blockchain", 2<sup>nd</sup> Edition, 2017.
2. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies", 2<sup>nd</sup> Edition, 2015.

<b>19CS13N</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

### **COURSE OUTCOMES**

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

- CO1: Interpret the basic concepts and functions of DBMS and design E-R models for simple database application scenarios. (K2)
- CO2: Apply the relational algebra operations in a database design. (K3)
- CO3: Create database with appropriate constraints and query the database. (K3)
- CO4: Understand the Importance of logical database design. (K2)
- CO5: Analyze the database schema and apply the normalization rules and techniques to optimize the database. (K3)

### **UNIT I INTRODUCTION 9**

Purpose of Database System - Views of data - Data Models - Database Languages - Database System Architecture - Database users and Administrator - Entity - Relationship (E-R) model - Constraints - Keys - E-R Diagrams - Weak Entity Sets - Extended E-R features - Design of E-R database schema - E-R schema to tables.

### **UNIT II RELATIONAL DATABASE MODEL 9**

Structure of Relational Databases - Database Schema - Schema Diagrams - Relational Query Languages - Relational Algebra - Tuple Relational Calculus -- Domain Relational Calculus.

### **UNIT III STRUCTURED QUERY LANGUAGE (SQL) 9**

Overview of SQL query language - SQL Data definition - Basic Structure of SQL Queries - Additional Basic Operations - Set Operations - Null values - Aggregate Operations - Nested Subqueries - Joins - Views - Integrity Constraints - Authorization. Introduction to Advanced SQL: Functions and Procedures - Triggers.

### **UNIT IV LOGICAL DATABASE DESIGN 9**

Need for good database design - Functional Dependencies and Keys - Closure of Functional Dependencies Set - Closure of attributes - Dependency Preservation - Decomposition using functional dependencies - Canonical Cover - Atomic domains.

### **UNIT V NORMALIZATION 9**

Normal Forms: First Normal Form - Second Normal Form - Third Normal Form - Boyce Codd Normal Form - Multivalued Dependencies - Decomposition using Multivalued dependencies - Fourth Normal Form - Join Dependencies - Fifth Normal Form.

**L:45; TOTAL:45 PERIODS**

### **TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts- II, Sixth Edition, Tata McGraw Hill, 2013.
2. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education / Addison Wesley, Sixth Edition, 2010.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8<sup>th</sup>

Edition, Pearson Education, 2006

## REFERENCES

1. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education, Fifth Edition, 2009.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition, 2004.
3. Raghu Ramakrishnan, "Database Management Systems-||, 3<sup>rd</sup> Edition, TataMcGraw-Hill, 2003.
4. S.K.Singh, "Database Systems Concepts, Design and Applications-||, 1<sup>st</sup> Edition, Pearson Education, 2006.
5. Jeffrey Stanton, "An Introduction to Data Science-||, an interactive eBook from iTunes.

<b>19CS14N</b>	<b>STRUCTURED QUERY LANGUAGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>QP</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>A</b>

## COURSE OUTCOMES

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

CO1: Understand the fundamental DDL statements in SQL (K2)

CO2: Understand the fundamental DML statements in SQL (K2)

CO3: Exemplifying the advanced Query structures in SQL (K2)

CO4: Application of Basic and Advanced SQL statement on real time cases using joins (K3)

CO5: Integrating the advanced tools to construct real time application using SQL Procedures and all necessary SQL Statements (K3)

### UNIT I DATA DEFINITION LANGUAGE 9

Introduction -SQL Syntax – Data types – Operators - Databases: Create – Drop – Rename- Select - Tables: Create - Rename - Alter -Truncate - Delete - Drop - Copy - Temp table -SQL Keys : Primary Key -Foreign Key – Composite key – Unique Key – Alternate Key.

### UNIT II DATA MANIPULATION LANGUAGE 9

DML Statements - Select Statement -Insert Statement - Where clause -Sql Aliases - Operators - In - Between- Like -And - Or -Not -Union - Any- All -Exist - Some - Update Statement - Delete Statement: Data Base - Table -Rows-SQL Aggregate Functions.

### UNIT III ADVANCED QUERY STRUCTURES 9

SQL Clauses: Order by- Asc - Desc-Random - Limit - Group By - Having - Sub Query - Nested Sub Query -Data Control Language: Privileges - Grant -Revoke - SQL Case statements -Null Functions -Indexes - Sequences - Auto Increment /Decrement - Clone tables -SQL Injections.

**UNIT IV SQL JOINS 9**

SQL Joins - Basics -Types: Self Join -Inner Join - Outer Join - Left Join - Right Join-Full outer Join - views - Case studies: Student Library Scenario -Customer Sale Scenario - Employee Pay Scenario.

**UNIT V SQL PROCEDURES 9**

PL/SQL- Stored Procedures - Syntax - Functionalities - Control statements -Functions - Cursor -Triggers - Exceptions - Case Study: Banking Transactions (Front End : Html5 /Php/Asp/Jsp Back End : WAMPP / SQL Server).

**L:45; TOTAL:45 PERIODS**

**TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013.
2. James groff ,PaulWeinberg, Andy Opper – SQL The complete reference, Third Edition -Paper Back Illustrated , 2009
3. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education / Addison Wesley, Sixth Edition, 2010.

**REFERENCES**

1. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education, Fifth Edition, 2009.
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8<sup>th</sup> Edition, Pearson Education, 2006
3. <https://docs.microsoft.com/en-us/sql/?view=sql-server-ver15>
4. <https://www.w3schools.com/sql/>
5. <https://www.geeksforgeeks.org/sql-tutorial/>

**19CS15N FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE L T P C**  
**2 0 2 3**

**COURSE OUTCOMES**

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

- CO1: Understand intelligent agents for search and games (K2)
- CO2: Solve AI problems through programming with Python. (K3)
- CO3: Learning optimization and inference algorithms for model learning. (K2)
- CO4: Design and develop programs for an agent to learn and act in a structured environment. (K3)
- CO5: Design some of the applications that use Artificial Intelligence (K3)

**UNIT I INTRODUCTION 12**

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Basic terminologies of tree and graph structures, State space representation, Search graph and Search tree.

<b>UNIT II</b>	<b>SEARCH ALGORITHMS</b>	<b>12</b>
Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.		
<b>UNIT III</b>	<b>PROBABILISTIC REASONING</b>	<b>12</b>
Probability, conditional probability, Bayes Rule, Bayesian Networks - representation, construction and inference, temporal model, hidden Markov model.		
<b>UNIT IV</b>	<b>MARKOV DESIGN PROCESS</b>	<b>12</b>
MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.		
<b>UNIT V</b>	<b>LEARNING</b>	<b>12</b>
Supervised and Unsupervised learning, Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning - Q learning.		

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

**LIST OF PRACTICALS (Should be given as Assignments)**

1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3. Write a programme to construct a Bayesian network from given data.
4. Write a programme to infer from the Bayesian network.
5. Write a programme to run value and policy iteration in a grid world.
6. Write a programme to do reinforcement learning in a grid world.
7. Mini Project work

**TEXT BOOK**

1. S.Russel, P.Norvig, "Artificial Intelligence - A Modern Approach", 3<sup>rd</sup>Edition, Pearson Education, 2015.

**REFERENCES**

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", 3<sup>rd</sup> Edition Tata McGraw-Hill Education Pvt. Ltd, 2008.
2. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, 2018.
3. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

<b>19CS16N</b>	<b>ESSENTIALS OF MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**Course Outcomes**

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

- CO 1: Explain the features of Machine learning technique (K2)
- CO 2: Apply the Artificial Neural Network for solving practical problems (K3)



CO 3: Provide solution for clustering problems in real-world applications.(K3)

CO 4: Apply Support Vector Machines and Decision Tree for solving practical problems (K3)

CO 5: Apply Naive Bayes Classifier and K-Nearest Neighbors for solving practical problems (K3)

**UNIT I INTRODUCTION 12**

Machine Learning Process-Terminologies: Weight Space, Curse of Dimensionality, Overfitting, Training, Testing, Validation Sets-Performance Measures: Confusion Matrix, Measurement Precision- Model selection Validation Techniques- Feature Reduction/Dimensionality reduction- Principal components analysis.

**UNIT II ARTIFICIAL NEURAL NETWORK (ANN) 12**

ANN basics-Feed-forward Network - Training Algorithms- Transfer functions - Network Training - BackPropagation-Testing and Validation.

**UNIT III CLUSTERING 12**

Distance measures- Different clustering methods (Distance, Density, Hierarchical)- Iterative distance-based clustering - Dealing with continuous, categorical values in K-Means-Constructing a hierarchical cluster - K-Medoids.

**UNIT IV SUPPORT VECTOR MACHINES AND DECISION TREE 12**

Support Vector Machines: Linear learning machines and Kernel space, Making Kernels and working in feature space - SVM for classification and regression problems.  
Decision Trees: C4.5- Ensemble's methods: Random forest.

**UNIT V NAIVE BAYES CLASSIFIER AND K-NEAREST NEIGHBORS 12**

Naive Bayes Classifier: Model Assumptions, Probability estimation- Required data processing- M-estimates, Feature selection: Mutual information - Classifier - K-Nearest Neighbors: Computational geometry; Voronoi Diagrams; Delaunay Triangulations - K-Nearest Neighbor algorithm.

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

**REFERENCES**

1. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012.
2. Chris Albon "Machine Learning with Python Cookbook", O'Reilly Media, 2018
3. Wei-Meng Lee, "Python Machine Learning", John Wiley & Sons, 2019.
4. John Paul Mueller, and Luca Massaron, "Machine Learning", John Wiley & Sons, 2016
5. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python- A Guide for Data Scientists", O'Reilly publications, First Edition, 2016.