PANIMALAR ENGINEERING COLLEGE

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

B.E - COMPUTER AND COMMUNICATION ENGINEERING

REGULATION 2021

CURRICULUM & SYLLABUS

PANIMALAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Bangalore Trunk Road, Varadharajapuram,
Poonamallee, Chennai – 600 123.

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

B.E–COMPUTER AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABUS

REGULATION-2021

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Computer and Communication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAM OUTCOMES (PO)

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

PO2 (Problem Analysis): Identify, formulate, research literature, and analyze complex engineering problem reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3(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.

PO4 (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.

PO5(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.

PO6(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.

PO7 (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.

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

PO9 (Individual and team work): Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10(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.

PO11 (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.

PO12 (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.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: To analyze, design and develop solutions by applying foundational concepts of computer and communication engineering.

PSO 2: To apply design principles and best practices for developing quality products for scientific and business applications.

PSO 3: To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel problems.

PANIMALAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

B.E. Computer and Communication Engineering

CHOICE BASED CREDIT SYSTEM CURRICULA AND SYLLABI R-2021

SEMESTER I

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21HS1101	Communicative English and Language Skills Lab I Integrated	HS	5	3	0	2	4
2.	21MA1101	Engineering Mathematics –I	BS	4	3	1	0	4
3.	21PH1101	Engineering Physics	BS	3	3	0	0	3
4.	21CY1101	Engineering Chemistry	BS	3	3	0	0	3
5.	21ES1101	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	21ES1102	Engineering Graphics	ES	5	3	0	2	4
PRACTICALS								
7.	21ES1111	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
8.	21BS1111	Physics and Chemistry Laboratory	BS	4	0	0	4	2
TOTAL				**31**	**18**	**1**	**12**	**25**

SEMESTER II

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21HS1201	Communicative English &Language Skills Lab II Integrated	HS	5	3	0	2	4
2.	21MA1201	Engineering Mathematics - II	BS	4	3	1	0	4
3.	21PH1201	Physics for Electronics Engineering	BS	3	3	0	0	3
4.	21ES1201	Basic Electrical, Electronics and Measurements Engineering	ES	3	3	0	0	3
5.	21IT1201	Programming in C	PC	3	3	0	0	3
6		Mandatory Course - I	MC	2	2	0	0	0
PRACTICALS								
7.	21IT1211	C Programming Laboratory	PC	4	0	0	4	2
8.	21ES1211	Engineering Practices Laboratory	ES	4	0	0	4	2
TOTAL				**28**	**17**	**1**	**10**	**21**

SEMESTER III

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21MA1302	Linear Algebra and Numerical Analysis	BS	4	3	1	0	4
2.	21IT1301	Data Structures	PC	3	3	0	0	3
3.	21CC1301	Electron Devices and Circuits	PC	3	3	0	0	3
4.	21IT1304	Object Oriented Programming	PC	3	3	0	0	3
5.	21EC1304	Signals and Systems	PC	4	3	1	0	4
6.		Mandatory Course-II	MC	2	2	0	0	0
PRACTICALS								
7.	21IT1311	Data Structures Laboratory	PC	4	0	0	4	2
8.	21IT1312	Object Oriented Programming Laboratory	PC	4	0	0	4	2
TOTAL				**26**	**17**	**2**	**8**	**21**

SEMESTER IV

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21MA1403	Probability and Random Processes	BS	4	3	1	0	4
2.	21CS1402	Design and Analysis of Algorithms	PC	3	3	0	0	3
3.	21CS1401	Database Management Systems	PC	3	3	0	0	3
4.	21CS1303	Software Engineering	PC	3	3	0	0	3
5.	21CB1202	Digital Principles and Computer Organization	PC	3	3	0	0	3
6.		Open Elective- I	OE	3	3	0	0	3
PRACTICALS								
7.	21CS1411	Database Management Systems Laboratory	PC	4	0	0	4	2
8.	21CC1411	Digital System Design Laboratory	PC	4	0	0	4	2
TOTAL				**27**	**18**	**1**	**8**	**23**

SEMESTER V

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21MA1501	Algebra and Number Theory	BS	4	3	1	0	4
2.	21CS1403	Computer Networks	PC	3	3	0	0	3
3.	21EC1503	Microcontrollers and Computer Architecture	PC	3	3	0	0	3
4.	21CS1501	Object Oriented Analysis and Design (Lab Integrated)	PC	5	3	0	2	4
5.	21EC1501	Analog and Digital Communication	PC	3	3	0	0	3
6.	21CS1602	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
PRACTICALS								
7.	21CS1412	Networks Laboratory	PC	4	0	0	4	2
8.	21EC1511	Microcontrollers and Interfacing Laboratory	PC	4	0	0	4	2
9.	21CC1511	Socially Relevant Mini Project	EEC	2	0	0	2	1
TOTAL				**31**	**18**	**1**	**12**	**25**

SEMESTER VI

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21CS1502	Internet Programming	PC	3	3	0	0	3
2.	21EC1502	Digital Signal Processing	PC	3	3	0	0	3
3.	21EC1601	Wireless Communication	PC	3	3	0	0	3
4.		Open Elective II	OE	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	21CS1511	Internet Programming Laboratory	PC	4	0	0	4	2
8.	21EC1512	Digital Signal Processing Laboratory	PC	4	0	0	4	2
TOTAL				**26**	**18**	**0**	**8**	**22**

SEMESTER VII

Sl.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	21CS1701	Cryptography and Network Security	PC	3	3	0	0	3
2.	21EC1703	Optical Communication and Networks	PC	3	3	0	0	3
3.	21EC1701	Embedded Systems and Robotics	PC	3	3	0	0	3
4.		Professional Elective III	PE	3	3	0	0	3
5.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
6.	21EC1712	Advanced Communication Laboratory	PC	4	0	0	4	2
7.	21CS1712	Cryptography and Network Security Laboratory	PC	4	0	0	4	2
TOTAL				**23**	**15**	**0**	**8**	**19**

SEMESTER VIII

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
PRACTICALS								
1.		Professional Elective V	P E	3	3	0	0	3
2.		Professional Elective VI	P E	3	3	0	0	3
3.	21CC1811	Project Work	EEC	16	0	0	16	8
TOTAL				**22**	**6**	**0**	**16**	**14**

Total No. of Credits: 170

CREDIT DISTRIBUTION

S.No.	Subject Area	Credits Per Semester								Credits Total	Percentage %
	Semester	I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Studies(HS)	4	4							8	4.71
2.	Basic Sciences(BS)	12	7	4	4	4				31	18.24
3.	Engineering Sciences(ES)	9	5							14	8.24
4.	Professional Core (PC)		5	17	16	20	13	13		84	49.41
5.	Professional Electives(PE)						6	6	6	18	10.59
6.	Open Electives(OE)				3		3			6	3.53
7.	Project Work (PR/EEC)					1			8	9	5.29
8.	Non-Credit/(Mandatory)									0	0
	Total	25	21	21	23	25	22	19	14	170	100

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Full Stack Development	Vertical III Cloud Computing and Data Center Technologies	Vertical IV Cyber Security and Data Privacy	Vertical V Creative Media Technologies	Vertical VI Emerging Technologies	Vertical VII Wireless Networks and IoT	Vertical VIII Radio Communication and Broadband Networks
Exploratory Data Analysis	Open Source Technologies	Cloud Tools and Techniques	Ethical Hacking	Augmented Reality/Virtual Reality	Augmented Reality/Virtual Reality	Wireless Networks	Broad Band Access Technologies
Recommender Systems	App Development	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Robotic Process Automation	Adhoc and Wireless Sensor Networks	Software Defined Networks
Neural Networks and Deep Learning	Cloud Services Management	Cloud Services Management	Social Network Security	Video Creation and Editing	Neural Networks and Deep Learning	Cooperative Communications and Networking	Cognitive Radio Networks
Text and Speech Analysis	UI and UX Design	Storage Technologies	Modern Cryptography	UI and UX Design	Cyber Security	IoT and its Applications	Wireless Broadband Networks
Business Analytics	Software Testing and Automation	Site Reliability Engineering	Engineering Secure Software	Digital Marketing	Quantum Computing	IoT Based System Design	Massive MIMO Networks
Image and Video Analytics	Web Application Security	Stream Processing	Cryptocurrency and Blockchain	Visual Effects	Cryptocurrency and Blockchain	Industrial IoT 4.0	5G and beyond communication Networks
Computer Vision Techniques	DevOps	DevOps	Cyber Physical Systems	Game Development	Game Development	Wireless Sensor Network Design	Photonic Networks
Data Visualization	Principles of Programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Multimedia Data Compression	3D Printing and Design		

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21AD1901	Exploratory Data Analysis	PE	3	0	0	3	3
2.	21AD1902	Recommender Systems	PE	3	0	0	3	3
3.	21AD1918	Neural Networks and Deep Learning	PE	3	0	0	3	3
4.	21AD1919	Text and Speech Analysis	PE	3	0	0	3	3
5.	21AD1920	Business Analytics	PE	3	0	0	3	3
6.	21AD1906	Image and Video Analytics	PE	3	0	0	3	3
7.	21AD1921	Computer Vision Techniques	PE	3	0	0	3	3
8.	21AD1922	Data Visualization	PE	3	0	0	3	3

VERTICAL 2: FULL STACK DEVELOPMENT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21IT1901	Open Source Technologies	PE	3	0	0	3	3
2.	21IT1902	App Development	PE	3	0	0	3	3
3.	21CS1903	Cloud Services Management	PE	3	0	0	3	3
4.	21IT1903	UI and UX Design	PE	3	0	0	3	3
5.	21IT1904	Software Testing and Automation	PE	3	0	0	3	3
6.	21IT1905	Web Application Security	PE	3	0	0	3	3
7.	21IT1906	DevOps	PE	3	0	0	3	3
8.	21IT1907	Principles of Programming Languages	PE	3	0	0	3	3

VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS1901	Cloud Tools and Techniques	PE	3	0	0	3	3
2.	21CS1902	Virtualization	PE	3	0	0	3	3
3.	21CS1903	Cloud Services Management	PE	3	0	0	3	3
4.	21CS1904	Storage Technologies	PE	3	0	0	3	3
5.	21CS1905	Site Reliability Engineering	PE	3	0	0	3	3
6.	21CS1906	Stream Processing	PE	3	0	0	3	3
7.	21IT1906	DevOps	PE	3	0	0	3	3
8.	21CS1907	Security and Privacy in Cloud	PE	3	0	0	3	3

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21IT1908	Ethical Hacking	PE	3	0	0	3	3
2.	21IT1909	Digital and Mobile Forensics	PE	3	0	0	3	3
3.	21IT1910	Social Network Security	PE	3	0	0	3	3
4.	21IT1911	Modern Cryptography	PE	3	0	0	3	3
5.	21IT1912	Engineering Secure Software Systems	PE	3	0	0	3	3
6.	21IT1913	Cryptocurrency and Block chain Technologies	PE	3	0	0	3	3
7.	21IT1914	Cyber Physical Systems Security	PE	3	0	0	3	3
8.	21CS1907	Security and Privacy in Cloud	PE	3	0	0	3	3

VERTICAL 5: CREATIVE MEDIA TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS1908	Augmented Reality/Virtual Reality	PE	3	0	0	3	3
2.	21CS1909	Multimedia and Animation	PE	3	0	0	3	3
3.	21CS1910	Video Creation and Editing	PE	3	0	0	3	3
4.	21IT1903	UI and UX Design	PE	3	0	0	3	3
5.	21CS1911	Digital Marketing	PE	3	0	0	3	3
6.	21CS1912	Visual Effects	PE	3	0	0	3	3
7.	21CS1913	Game Development	PE	3	0	0	3	3
8.	21CS1914	Multimedia Data Compression and Storage	PE	3	0	0	3	3

VERTICAL 6: EMERGING TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS1908	Augmented Reality/Virtual Reality	PE	3	0	0	3	3
2.	21CS1915	Robotic Process Automation	PE	3	0	0	3	3
3.	21AD1918	Neural Networks and Deep Learning	PE	3	0	0	3	3
4.	21IT1915	Cyber Security	PE	3	0	0	3	3
5.	21CS1916	Quantum Computing	PE	3	0	0	3	3
6.	21IT1913	Cryptocurrency and Block chain Technologies	PE	3	0	0	3	3
7.	21CS1913	Game Development	PE	3	0	0	3	3
8.	21CS1917	3D Printing and Design	PE	3	0	0	3	3

VERTICAL 7: WIRELESS NETWORKS AND IoT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21EC1929	Wireless Networks	PE	3	0	0	3	3
2.	21EC1930	Adhoc and Wireless Sensor Networks	PE	3	0	0	3	3
3.	21EC1931	Cooperative Communications and Networking	PE	3	0	0	3	3
4.	21EC1932	IoT and its Application s	PE	3	0	0	3	3
5.	21EC1933	IoT Based System Design	PE	3	0	0	3	3
6.	21EC1934	Industrial IoT 4.0	PE	3	0	0	3	3
7.	21EC1935	Wireless Sensor Network Design	PE	3	0	0	3	3

VERTICAL 8: RADIO COMMUNICATION AND BROADBAND NETWORKS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21EC1943	Broad Band Access Technologies	PE	3	0	0	3	3
2.	21EC1944	Software Defined Networks	PE	3	0	0	3	3
3.	21EC1945	Cognitive Radio Networks	PE	3	0	0	3	3
4.	21EC1946	Wireless Broadband Networks	PE	3	0	0	3	3
5.	21EC1947	Massive MIMO Networks	PE	3	0	0	3	3
6.	21EC1948	5G and beyond communication Networks	PE	3	0	0	3	3
7.	21EC1949	Photonic Networks	PE	3	0	0	3	3

HUMANITIES AND SOCIAL SCIENCES (HS)

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	21HS1101	Communicative English & Language Skills I Integrated	HS	5	3	0	2	4
2	21HS1201	Communicative English & Language Skills II Integrated	HS	5	3	0	2	4

BASIC SCIENCES (BS)

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	21MA1101	Engineering Mathematics -I	BS	4	3	1	0	4
2	21PH1101	Engineering Physics	BS	3	3	0	0	3
3	21CY1101	Engineering Chemistry	BS	3	3	0	0	3
4	21BS1111	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5	21MA1201	Engineering Mathematics -II	BS	4	3	1	0	4
6	21PH1201	Physics for Electronics Engineering	BS	3	3	0	0	3
7	21MA1302	Linear Algebra and Numerical Methods	BS	4	3	1	0	4
8	21MA1403	Probability and Random Processes	BS	4	3	1	0	4
9	21MA1501	Algebra and Number Theory	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

Sl. No	CourseCode	Course Title	Category	Contact Periods	L	T	P	C
1	21ES1101	Problem Solving and Python Programming	ES	3	3	0	0	3
2	21ES1102	Engineering Graphics	ES	5	3	0	2	4
3	21ES1111	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
4	21ES1201	Basic Electrical, Electronics And Measurements Engineering	ES	3	3	0	0	3
5	21ES1211	Engineering Practices Laboratory	ES	4	0	0	4	2

PROFESSIONAL CORE (PC)

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	21IT1201	Programming in C	PC	3	3	0	0	3
2.	21IT1211	C Programming Laboratory	PC	4	0	0	4	2
3.	21IT1301	Data Structures	PC	3	3	0	0	3
4.	21CC1301	Electron Devices and Circuits	PC	3	3	0	0	3
5.	21CS1401	Database Management Systems	PC	3	3	0	0	3
6.	21EC1304	Signals and Systems	PC	3	3	1	0	4
7.	21IT1311	Data Structures Laboratory	PC	4	0	0	4	2
8.	21CS1411	Database Management Systems Laboratory	PC	4	0	0	4	2
9.	21CS1402	Design and Analysis of Algorithms	PC	3	3	0	0	3
10.	21IT1402	Object Oriented Programming	PC	3	3	0	0	3
11.	21CS1303	Software Engineering	PC	3	3	0	0	3
12.	21CB1202	Digital Principles and Computer Organization	PC	3	3	0	0	3
13.	21IT1411	Object Oriented Programming Laboratory	PC	4	0	0	4	2
14.	21CC1411	Digital System Design Laboratory	PC	4	0	0	4	2
15.	21CS1403	Computer Networks	PC	3	3	0	0	3
16.	21EC1503	Microcontrollers & Computer Architecture	PC	3	3	0	0	3
17.	21CS1501	Object Oriented Analysis and Design(Lab Integrated)	PC	5	3	0	2	4
18.	21EC1501	Analog and Digital Communication	PC	3	3	0	0	3
19.	21CS1602	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
20.	21CS1412	Networks Laboratory	PC	4	0	0	4	2
21.	21EC1511	Microcontrollers and Interfacing Laboratory	PC	4	0	0	4	2
22.	21CS1502	Internet Programming	PC	3	3	0	0	3
23.	21EC1502	Digital Signal Processing	PC	3	3	0	0	3
24.	21EC1601	Wireless Communication	PC	3	3	0	0	3
25.	21CS1511	Internet Programming Laboratory	PC	4	0	0	4	2
26.	21EC1512	Digital Signal Processing Laboratory	PC	4	0	0	4	2
27.	21CS1701	Cryptography and Network Security	PC	3	3	0	0	3
28.	21EC1701	Embedded Systems and Robotics	PC	3	3	0	0	3
29.	21EC1703	Optical Communication and Networks	PC	3	3	0	0	3

30.	21EC1712	Advanced Communication Laboratory	PC	4	0	0	4	2
31.	21CS1712	Security Laboratory	PC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES
(EEC)

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	21CC1511	Socially Relevant Mini Project	EEC	2	0	0	2	1
2.	21CC1811	Project Work	EEC	16	0	0	16	8

SEMESTER-IV

OPEN ELECTIVE–I

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	21CE1010	Air Pollution and Control Engineering	OE	3	3	0	0	3
2.	21CE1001	Energy Conservation and Management	OE	3	3	0	0	3
3.	21CE1005	Geographic Information System	OE	3	3	0	0	3
4.	21GE1004	Hospital Waste Management	OE	3	3	0	0	3
5.	21CY1001	Industrial Nano technology	OE	3	3	0	0	3
6.	21ME1014	Industrial Safety Engineering	OE	3	3	0	0	3
7.	21EE1003	Logic and Distributed Control systems	OE	3	3	0	0	3
8.	21EC1009	Product Design and Development	OE	3	3	0	0	3
9.	21EC1011	Tele health Technology	OE	3	3	0	0	3

SEMESTER-VI

OPEN ELECTIVE II

Sl. No	Course Code	CourseTitle	Category	Contact Periods	L	T	P	C
1.	21EE1001	Basic Circuit Theory	OE	3	3	0	0	3
2.	21CY1002	Energy Technology	OE	3	3	0	0	3
3.	21EC1004	Electronic Devices	OE	3	3	0	0	3
4.	21CE1009	Environmental And Social Impact Assessment	OE	3	3	0	0	3
5.	21GE1003	Hospital Management	OE	3	3	0	0	3
6.	21EC1002	Medical Electronics	OE	3	3	0	0	3
7.	21EC1009	Signals And Systems	OE	3	3	0	0	3
8.	21ME1006	Systems Engineering	OE	3	3	0	0	3
9.	21ME1008	Supply Chain Management	OE	3	3	0	0	3
10.	21CY1003	Waste Water Treatment	OE	3	3	0	0	3

MANDATORY COURSES

Sl. No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	21MC1001	Environmental Science	MC	2	2	0	0	0
2.	21MC1002	Constitution of India	MC	2	2	0	0	0
3.	21MC1003	Human Values	MC	2	2	0	0	0
4.	21MC1006	Soft Skills and Personality Development	MC	2	2	0	0	0
5.	21MC1005	Essence of Indian Knowledge Tradition	MC	2	2	0	0	0

SEMESTER I

21HS1101	COMMUNICATIVE ENGLISH & LANGUAGE SKILLS LAB I INTEGRATED	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To induce the basic reading and writing skills among the first year engineering and technologystudents.
- To assist the learners to develop their listening skills, which will enable them listening to lectures and comprehend them by asking questions and seeking clarifications
- To succor the learners to develop their speaking skills and speak fluently in real contexts
- To motivate the learners to develop vocabulary of a general kind by developing their reading skills for meeting the competitive exams like GATE, TOFEL, GRE, IELTS, and other exams conducted by Central and State governments.

UNIT - I INTRODUCING ONESELF 9

Listening: Listening and filling details, Listening to Speeches by Specialists and Completing Activities such as Answering Questions, Identifying the Main Ideas, Style, etc. Speaking: Introducing Oneself – Introducing Friend/ Family. Reading: Descriptive Passages (From Newspapers / Magazines).Writing: Writing a Paragraph (Native Place, School Life), Developing Hints. Grammar: Noun, Pronoun & Adjective. Vocabulary Development: One Word Substitution

UNIT - II DIALOGUE WRITING 9

Listening: Listening to Conversations (Asking for and Giving Directions).Speaking: Making Conversation Using (Asking for Directions, Making an Enquiry), Role Plays, and Dialogues. Reading: Reading a Print Interview and Answering Comprehension Questions. Writing: Writing a Checklist, Dialogue Writing Grammar: Tenses and Voices. Vocabulary Development: Prefix &Suffix, Word formation.

UNIT - III DRAFTING OFFICIAL COMMUNICATIONS 9

Listening: Listening for specific information. Speaking: Giving Short Talks on a given Topic. Reading: Reading Motivational Essays on Famous Engineers and Technologists (Answering Open – Ended and Closed Questions).Writing: Writing Formal Letters / Emails. Grammar: Adverb, Prepositions & Conjunctions. Vocabulary Development: Collocations – Fixed Expressions.

UNIT - IV WRITTEN COMMUNICATION 9

Listening: Listening to Short Talks (5 Minutes Duration and Fill a Table, Gap-Filling Exercise) Note Taking/Note Making Speaking: Small Group Discussion, Giving Recommendations Reading: Reading Problem – Solution Articles/Essays Drawn From Various Sources Writing: Making Recommendations Note Making – Complaint Letters. Grammar: Subject-Verb Agreement, Framing Questions.

Vocabulary Development: Connectives, Reference Words, Technical Vocabulary.

UNIT - V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 9

Listening: Listening to a Product Description (Labeling and Gap Filling) Exercises. Speaking: Describing a Product and Comparing and Contrasting it with Other Products. Reading: Reading Graphical Material for Comparison (Advertisements).Writing: Writing Definitions (Short and Long) – Compare and Contrast Paragraphs, Essay writing. Grammar:- Phrasal Verbs – Cause and Effect Sentences –Compound Nouns Vocabulary Development: Use of Discourse Markers.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (GROUP SEMINAR/ MINI PROJECT/ ASSIGNMENT/ CONTENT PREPARATION/ QUIZ/ SURPRISE TEST /SOLVING GATE QUESTIONS /ETC.

Demonstration of cable architecture with cable samples of all types.

Understanding the cable manufacturing process through factory visit.

Familiarization of the cable laying procedure through field visits.

Familiarization of cable jointing / end termination techniques.

Understanding and familiarization of cable fault locating techniques through field visit to local distribution company or in house laboratory.

Understanding testing procedures and condition monitoring tests.

OUTCOMES:

On successful completion of the course student will be able to:

- The students will be able to comprehend conversations and short talks delivered in English
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions English
- Read articles of a general kind in magazines and newspapers
- Write short essays of a general kind and personal letters and emails in English
- Recognize the use of grammar in speech and writing

TEXT BOOKS:

- N P Sudharshana& C Savitha. English for Technical Communication Delhi: CUP, 2019. Board of Editors. English for Engineers and Technologists Volume 1 Orient Black Swan Limited, 2020.

REFERENCES:

- Board of Editors. Using English-A course book for Undergraduate engineers andTechnologists Orient Black SwanLimited, 2017
- Comfort, Jeremy, et al. *Speaking Effectively: Developing Speaking Skills for BusinessEnglish*. CambridgeUniversity Press, Cambridge: Reprint 2011
- Means,L. Thomas and Elaine Langlois. *English & Communication For Colleges*. CengageLearning ,USA:2007

- Redston, Chris & Gillies Cunningham *Face2Face* (Pre-intermediate Student's Book& Workbook)Cambridge University Press, New Delhi: 2005.

WEB REFERENCES:

- https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/word-formation
- https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316 21.pdf
- http://xn--englishclub-ql3f.com/grammar/parts-of-speech.htm
- https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES:

- https://basicenglishspeaking.com/wh-questions/
- https://agendaweb.org/verbs/modals-exercises.html
- https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/20180316 21.pdf
- https://www.ego4u.com/en/cram-up/grammar/prepositions

21HS1101	LANGUAGE SKILLS LAB

List of exercises
MINIMUM OF EXERCISES TO BE CONDUCTED

1	Reading: Different text type
2	Reading: Predicting content using pictures and title.
3	Reading: Use of graphic organizers to review
4	Reading: Aid comprehension.
5	Reading: Understanding reference words
6	Reading: Use of connectors in a passage-
7	Reading: Speed reading Techniques.
8	Reading and Comprehending the passages in the competitive exams like GATE, TOFEL, GRE,IELTS, and other exams conducted by Central and State governments.
9	Reading: Sentence Completion: Exercises used in competitive exams.
10	Writing- Error Detection:
11	Writing-Spotting and reasoning the errors found from the passages in competitive exams.
12	Writing-Email writing
13	Writing: Job Application: Resume
14	Writing- Elements of a good essay-
15	Writing: Types of essays- Descriptive-Narrative- issue based.
16	Writing: Statement of Purpose
17	Writing: Letter of recommendation
18	Writing: Vision statement
19	Writing- Verbal Analogy,
20	Writing- Phrases, and Idioms associated with competitive exams

TOTAL: 30 PERIODS

SOFTWARE REQUIRED: Globaren

REFERENCES:

1	SureshKumar.E and et al. Enriching Speaking and Writing Skills. Second Edition. OrientBlack swan: Hyderabad, 2012
2	Davis, Jason and Rhonda Liss. Effective Academic Writing (Level 3) Oxford University Press:Oxford, 2006
3	Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge UniversityPress: Cambridge, 2004
4	Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000

21MA1101	ENGINEERING MATHEMATICS- I	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Matrix transforms are very useful within the world of computer graphics. A matrix algebra can be readily applied to the structural properties of graphs from an algebraic point of view
- The aim of this course to get depth knowledge about calculus
- Familiarize the functions of two variables and finding its extreme points.
- To make the students understand various techniques of integration
- Apply multiple integral ideas in solving areas, volumes and other practical problems

UNIT - I MATRICES 9+3

Eigen values and Eigen vectors of a real matrix –Rank of the matrix – Characteristic equation – Properties of Eigenvalues and Eigen vectors – Cayley Hamilton theorem – Diagonalization of matrices– Reduction of a quadratic form to canonical form by orthogonal transformation and similarity transformation –Nature of quadratic forms.

UNIT - II DIFFERENTIAL CALCULUS 9+3

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules (Sum, Product & Quotient rule, Chain rule, logarithmic and implicit differentiation) – Maxima and Minima of functions of one variable-Rolle's theorem- Mean value theorem.

UNIT - III FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables –Lagrange's method of undetermined multipliers

UNIT - IV INTEGRAL CALCULUS 9+3

Definite and Indefinite integrals – Substitution rule – Techniques of Integration – Integration by parts – Bernoulli's formula- Trigonometric integrals – Trigonometric substitutions – Integration of rational functions by partial fraction – Integration of irrational functions – Improper integrals.

UNIT - V MULTIPLE INTEGRALS 9+3

Double integrals in modelling and polar coordinates – Change of order of integration in modelling coordinates- Area enclosed by plane curves – Change of variables in double integrals – Triple integrals –Volume of Solids.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1	Able to find eigen values and eigen vectors, diagonalization of a matrix, symmetric matrices,positive definite matrices and similar matrices
2	Apply limit definition and rules of differentiation to differentiate functions.
3	Understand familiarity in the knowledge of Maxima and Minima, Jacobian, Taylor series and apply the problems involving Science and Engineering.
4	Understand the knowledge of Integration by parts, Trigonometric integrals, Trigonometricsubstitutions, Integration of rational functions by partial fraction.
5	Understand the knowledge of Area enclosed by plane curves, Change of variables in doubleintegrals, Triple integrals, Volume of Solids.

TEXT BOOKS:

1 Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, NewDelhi,43rdEdition,2014

2 James Stewart, ―Calculus: Early Transcendentals‖, Cengage Learning,7thEdition, NewDelhi, 2015

3 Bali N., Goyal M. and Walkins C., ―Advanced Engineering Mathematics‖, Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.,), New Delhi, 7th Edition, 2009

REFERENCES:

1 Anton, H, Bivens, I and Davis, S, ―Calculus‖, Wiley, 10th Edition, 2016

2 Jain R.K. and Iyengar S.R.K., ―Advanced Engineering Mathematics‖, NarosaPublications,NewDelhi, 3rd Edition, 2007

3 Narayanan, S. and Manicavachagom Pillai, T. K., ―Calculus‖ Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007

4 Srimantha Pal and Bhunia, S.C, ―Engineering Mathematics‖ Oxford University Press, 2015

5 Weir, M.D and Joel Hass, ―Thomas Calculus‖, 12th Edition, Pearson India, 2016.

6 B.V. Ramana, ― Higher Engineering Mathematics‖, McGraw Hill Education, India.

7 Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley sons,10thedition,2015

ONLINE COURSES / RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc21_ma60/preview

2 https://onlinecourses.nptel.ac.in/noc21_ma58/preview

21PH1101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

MECHANICS **9**

UNIT - I

System of particles: centre of mass in one and two dimensions – rotational motion of continues system – torque – moment of inertia – conservation of angular momentum – Newton's laws for rotation – equations of rotational motion – work energy theorem for rotational motion. Stress, strain, Hooke's law and elastic moduli – twisting couple per unit twist for solid and hollow cylinders – torsional pendulum theory – bending moment of beam – cantilever and non-uniform bending theory – uniform bending theory – I shape girder.

UNIT - II ELECTROMAGNETIC THEORY **9**

Divergence – curl – integral calculus – Gauss divergence theorem – Stoke's theorem – equation of continuity – displacement current – Maxwell's equations – Gauss's laws – Faraday's law –Ampere- Maxwell law – mechanism of electromagnetic wave propagation – Hertz observation – production and detection of electromagnetic wave – electromagnetic waves in free space and matter – energy carried by electromagnetic wave – momentum and radiation pressure – properties of electromagnetic waves.

UNIT - III THERMAL PHYSICS **9**

Mode of heat transfer: conduction, convection and radiation – thermal expansion of solids – bimetallic strips – thermal conductivity – heat conduction through compound media (series & parallel) – Forbe's and Lee's disc method; theory and experiment – thermal insulation – applications – heat exchangers – refrigerators, solar water heater.

UNIT - IV OSCILLATORY MOTION, LASERS AND FIBER OPTICS **9**

Spring mass system – differential equation-simple harmonic motion-damped oscillation-forced oscillation –analogy with LCR circuits and mechanical oscillation – plane wave equation – equations of wave motion in a rope and velocity of wave. Population of energy levels, Einstein's A and B coefficients derivation – optical amplification (qualitative) – Semiconductor lasers: homo junction and heterojunction – components and principle of fiber optics – numerical aperture and acceptance angle derivation – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers – fiber as pressure and displacement sensors.

UNIT - V QUANTUM MECHANICS **9**

Blackbody radiation – Planck's hypothesis and derivation – wave particle duality of light: concepts of photon – Compton effect: theory and experiment – de Broglie hypotheses concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-

dimensional box – tunnelling (qualitative) – scanning tunnelling microscope.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Upon completion of this course, the students will understand the basics of mechanics and especially elastic properties of materials.

2 Upon completion of this course, the students will gain knowledge on the basic concepts of electromagnetic waves and its properties.

3 Upon completion of this course, the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in heat exchangers

4 Upon completion of this course, the students will acquire knowledge on the concepts of oscillations, lasers and fiber optics and their technological applications

5 Upon completion of this course, the students will get knowledge on advanced physics concepts of quantum theory and its applications in modelling microscopes

TEXT BOOKS:

1 Gaur, R.K. & Gupta, S.L. ―Engineering Physics‖. Dhanpat Rai Publishers, 2012.

2 Santhosam, K. Russel Raj, K. & Maheswaran, A. ―Engineering Physics, KRAM Publications, 2021

3 Pandey, B.K. & Chaturvedi, S. ―Engineering Physics‖. Cengage Learning India, 2012.

REFERENCES:

1 Halliday, D., Resnick, R. & Walker, J. ―Principles of Physics‖. Wiley, 2015

2 Tipler, P.A. & Mosca, G. ―Physics for Scientists and Engineers with Modern Physics'.W.H.Freeman, 2007

3 Arthur Beiser, ―Concepts of Modern Physics‖, Mc Graw Hill, Sixth edition, 1994.

4 Douglas. C., Giancoli. ―Physics: Principles with applications‖, Pearson, 2014.

WEB REFERENCES:

1 https://kluniversity.in/physics/pdfs/crypdf.pdf

2 https://mrcet.com/downloads/digital_notes/ECE/III%20Year/FIBER%20OPTICAL%20COM MUNICATIONS.pdf

3 https://nptel.ac.in/content/storage2/courses/117101002/downloads/Lec01.pdf

4 https://nptel.ac.in/content/storage2/courses/117101002/downloads/Lec19.pdf

5 https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture- notes/MIT8_04S16_LecNotes3.pdf

6 https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture- notes/MIT8_04S16_LecNotes5.pdf

ONLINE COURSES / RESOURCES:

1 https://nptel.ac.in/courses/115/102/115102023/

2 https://nptel.ac.in/courses/115/106/115106066/

21CY1101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the importance of Chemistry in Engineering domain
- To understand the Chemistry background of industrial process
- To apply Chemistry knowledge for Engineering disciplines.

UNIT - I WATER TECHNOLOGY 9

Hardness -Types of hardness – Estimation by EDTA method – Boiler troubles-scale, sludge, priming, foaming, caustic embrittlement, Boiler corrosion – Internal Conditioning – Carbonate, phosphate, Calgon conditioning – External Conditioning – Zeolite and Demineralization process – Desalination, Reverse Osmosis Method – Domestic water treatment.

UNIT - II HIGH POLYMERS AND NANOCHEMISTRY 9

Polymers – Introduction – Classification of Polymers (Origin/Source, Structure, Monomers, Inter- molecular Forces, Synthesis) – Commercial Polymers (Poly Vinyl Chloride (PVC), Polytetrafluoroethylene (PTFE), Nylon-6 6, Nylon-6, Polyethylene Terephthalate (PET) – Conducting Polymers – Polyaniline, Polythiophene, Trans-Polyacetylene – Basic definition – FRP – General Engineering applications of FRP (Civil Engineering Structures).**Nanomaterials –** Introduction, size dependent properties (Surface area, Electrical, Optical, Catalytic and Thermal properties). Synthesis of nanomaterials: Top-down and bottom-up approaches, Chemical Synthesis – Co precipitation, Sol-Gel process and Chemical vapor deposition, Nanoscale materials: Fullerenes, Carbon nanotubes and 8odellin – Characterization, properties and applications. Green synthesis of Nanoparticles.

UNIT - III INSTRUMENTAL METHODS AND ANALYSIS 9

Introduction to Spectroscopy – Types of spectroscopy – Absorption spectra – Emission spectra – Wave length and Wave number- Electromagnetic radiation – Flame Photometry, Atomic Absorption Spectroscopy, UV-Visible spectrum. Introduction – basic principles – Instrumentation& Applications – Infrared Spectroscopy. Chromatographic methods – Types (column, Thin layer, paper, Gas, High Performance Liquid Chromatographic methods) – principle- Separation and quantification of Organic compounds by GC and HPLC. Conductometric Titrations: Instrumentation – Advantages – Applications Potentiometric Titrations: Instrumentation -Advantages-Applications. Measurement of pH: pH metry – Instrumentation – Applications.

UNIT - IV ELECTROCHEMISTRY AND CORROSION 9

Introduction- Electrode potentials-Electrochemical series-Electrochemical cell-redox reaction – measurement and applications – Nernst Equation Derivation-Electrochemical extraction of metals – Electrolytic refining of metals -Nano electrochemical Sensors. Corrosion – causes, factors, types, Chemical and Electrochemical Corrosion (Galvanic, Differential aeration) – Corrosion Control,

Electrochemical Corrosion (Galvanic, Differential aeration) – Corrosion Control, Electrochemical protection – Sacrificial Anodic method – Impressed Current Cathodic Protection – Corrosion Inhibitors – Biocorrosion.Protective Coatings – Paints, Constituents, Functions- Surface preparation for metallic coatings, Electroplating and Electroless Plating.

UNIT - V ENERGY SOURCES AND STORAGE DEVICES 9

Introduction – Nuclear energy – Nuclear fission – Controlled Nuclear fission – Nuclear Fusion – Differences – Nuclear chain reactions –Nuclear Reactor – Classification of Nuclear Reactor – Light WaterNuclear Reactor, Breeder Reactor – Solar Energy, Conversion, Solar Cells – Wind Energy.

Batteries and Fuel Cells – Types of batteries – Zinc – carbon dry cell –Lead Storage battery– Nickel- Cadmium Battery – Lithium battery – Battery Engineering – Battery hazards – Biological Batteries.Fuel Cells – Hydrogen-Oxygen Fuel Cell – Hondas cell- Supercapacitors (elementary idea)

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Analyze the water quality parameters in purification and significance in industries, daily life.

2 Explain the types, fabrication and engineering applications of polymers. Develop economically new methods of synthesizing nano materials and their applications.

3 Demonstrate the knowledge of analytical techniques using spectroscopy..

4 Relate the electrode potential for its feasibility in electrochemical reaction. Illustrate the causes, cocorrosion and to achieve its protection.

5 Compare the economic and efficient usage of non-conventional and conventional energy sourceand various storage devices.

TEXT BOOKS:

1 P.C.Jain and Monika Jain, ―Engineering Chemistry‖, Dhanpat Rai Publishing Company(P)LTD., New Delhi.

2 S. S. Dara and S.S. Umare, ―A Textbook of Engineering Chemistry‖ S. Chand and Company Ltd, New Delhi.

3 V.R.Gowariker, N.V.Viswanathan and JayadevSreedhar, ―Polymer Science‖, New Age International P (Ltd.,), Chennai, 2006

4 P. Kannan and A. Ravikrishnan, ―Engineering Chemistry‖, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.

5 S. Vairam, P. Kalyani and Suba Ramesh, ―Engineering Chemistry‖, Wiley India, 2011

REFERENCES:

1 Friedrich Emich, ―Engineering Chemistry‖, Scientific International Pvt. Ltd., NewDelhi

2 PrasanthaRath, ¯Engineering Chemistry‖, Cengage Learning India Pvt., Ltd., Delhi.

3 P.W. Atkins and de Paula Julio, ¯Physical Chemistry‖, Oxford University Press, 8th Ed.,(Indian Student Edition) (2009).

4 K. K. Rohatgi-Mukherjee, ¯Fundamental of Photochemistry‖ New Age International (P) Ltd., New Delhi, 1986

5 G.A. Ozin and A.C. Arsenault, ¯Nanochemistry: A Chemical Approach toNanomaterials‖, RSC Publishing, 2005 Nanomaterials, B.Viswanathan, Alpha Science , ISBN: 9781842654941.

WEB REFERENCES:

1 http://www.mhhe.com/engcs/compsci/forouzan/dcn/student/olc.

ONLINE COURSES / RESOURCES:

1 https://nptel.ac.in/courses/103/108/103108100

2 https://nptel.ac.in/courses/121/106/121106014

3 https://nptel.ac.in/courses/104/105/104105039

21ES1101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the basic programming constructs –data types, decision structures, and control structures in python
- To know how to use libraries for string manipulation
- To Use python data structures – Lists, Tuples and Dictionary
- To know the basic concepts of Object-Oriented Programming
- To learn about input/output with files in Python

UNIT - I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language); Python: Data types, variables, expressions, precedence of operators, algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi

SUGGESTED ACTIVITIES:

- Developing Pseudo codes and flowcharts for real life activities such as railway ticket Booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic Operations
- Installing Python
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems
- Quizzes on simple python programs

UNIT - II CONTROL FLOW, STRINGS & FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; functions, function definition and use; Fruitful functions: return values, parameters and arguments, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

SUGGESTED ACTIVITIES:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.

- Developing simple applications like calculator, calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and
- Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:

- Quizzes on strings
- Assignments on illustrative problems
- Quizzes on control flow and functions.

UNIT - III LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Lists as arrays. Illustrative programs: selection sort, insertion sort, merge sort, histogram.

SUGGESTED ACTIVITIES:

- Implementing python program using lists, tuples, sets for the following scenario:
- Simple sorting techniques
- Student Examination Report
- Billing Scheme during shopping.
- Implementing any application using List and Tuple data structures.

SUGGESTED EVALUATION METHODS:

- Quizzes on list slices.
- Assignments on illustrative problems.
- Quizzes on tuples and dictionaries.

UNIT - IV OBJECT ORIENTED PROGRAMMING WITH PYTHON 9

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data 11odelling; persistent storage of objects - inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block. Illustrative programs: demonstrate the concept of class and objects.

SUGGESTED ACTIVITIES:

- Features of OOP.
- Persistent storage of objects
- Operators and its usage.
- Simple programs using OOP concepts

SUGGESTED EVALUATION METHODS:

- Quizzes on basic OOP concepts.
- Assignments on illustrative problems.

- Quizzes on inheritance and exception handling

UNIT - V 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; Illustrative programs: word count, copy file.

SUGGESTED ACTIVITIES:

- Developing modules using Python to handle files and apply various operations onfiles.
- Usage of exceptions, multiple except blocks – for applications that use delimiters likeage,range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:

- Quizzes on basic file operations.
- Assignments on illustrative problems.
- Quizzes on packages and modules.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Develop algorithmic solutions to simple computational problems

2 Write and execute simple Python programs

3 Familiarize with python string handling techniques and user defined functions

4 Represent compound data using Python lists, tuples and dictionaries.

5 Understand the concept of object oriented programming techniques.

6 Read and write data from/to files in Python Programs.

TEXT BOOKS:

1 Reema Thareja, ``Problem Solving and Programming with Python'', 2nd edition, OXFORDUniversity Press, New Delhi, 2019.(UNIT 1,2,3,4(Exception Handling) and 5).Bill Lubanovic, ¯Introducing Python-Modern Computing in Simple Package‖, 2nd edition, O'REILLY, 2019.(UNIT 4(Object Oriented Programming)).

2 Bill Lubanovic, ¯Introducing Python-Modern Computing in Simple Package‖, 2nd edition, O'REILLY, 2019.(UNIT 4(Object Oriented Programming)).

REFERENCES:

1 Steven F. Lott, ¯Modern Python Cookbook'', 2nd Edition, O'REILLY, 2020.

2 Ryan Marvin, Mark Ng'ang'a, Amos Omondi, ¯Python Fundamentals, Packt Publishing.,2018.

3 Paul J. Deitel, Python for Programmers, Pearson India Education Services Pvt. Ltd,2020. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education; Forth edition, 2018.

REFERENCES:

1 https://greenteapress.com/thinkpython2/thinkpython2.pdf

2 https://freecomputerbooks.com/An-Introduction-to-Python-Guido-van-Rossum.html#downloadLinks

3 http://marvin.cs.uidaho.edu/Teaching/CS515/pythonTutorial.pdf.

ONLINE COURSES / RESOURCES:

1 https://docs.python.org/3/tutorial/

2 https://www.w3schools.com/python/

3 https://www.tutorialspoint.com/python/index.htm

4 https://www.javatpoint.com/python-tutorial

5 https://nptel.ac.in/courses/

21ES1102	ENGINEERING GRAPHICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

- Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
- Drawing orthographic projections of lines and planes.
- Drawing orthographic projections of solids.
- Drawing development of the surfaces of objects.
- Drawing isometric and perspective views of simple solids

UNIT - I CONCEPTS AND CONVENTIONS (Not for Examination): 9

Importance of graphics in engineering applications – Use of drafting instruments.BIS conventions and specifications. Size, layout and folding of drawing sheets – Lettering and dimensioning. Introduction to drafting packages like CAD and demonstration of their use in engineering fields.

UNIT - II PROJECTION OF POINTS, LINES AND PLANE SURFACES 9

Orthographic projection- principles-Principle planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths eg and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT - III PROJECTION OF SOLIDS 9

Projection of simple solids like prisms, pyramids, cylinder, and cone when the axis is inclined to one principle planes by rotating object method and auxiliary plane method.

UNIT - IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple solids and frustum and truncated solids – Prisms, pyramids cylinders and cones.

UNIT - V ISOMETRIC AND PERSPECTIVE PROJECTIONS 9

Principles of isometric projection – isometric scale –Isometric projections of simple solids and frustum and truncated solids – Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

- Draw free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines and planes
- Draw orthographic projections of solids
- Draw development of the surfaces of objects
- Draw isometric and perspective views of simple solids

TEXT BOOKS:

1 Natarajan, K. V., ―A text book of Engineering Graphics‖, 28th Ed., DhanalakshmiPublishers, Chennai, 2015.

2 Venugopal, K. and Prabhu Raja, V., ―Engineering Graphics‖, New Age, 2008.

REFERENCES:

1 Bhatt, N.D.,Panchal V M and Pramod R. Ingle, ―Engineering Drawing‖, CharotarPublishing House, 53rd Edition, 2014

2 Parthasarathy, N. S. and Vela Murali, ―Engineering Drawing‖, Oxford University Press,2015.

3 Agrawal, B. and Agrawal C.M., ―Engineering Drawing‖, Tata McGraw, N.Delhi, 2008.

WEB REFERENCES:

1 https://nptel.ac.in/courses/105/104/105104148/

2 https://www.youtube.com/channel/UCkCk0nvNyWhEOLge9JtDLDg

ONLINE COURSES / RESOURCES:

1 https://nptel.ac.in/courses/112/103/112103019/

21ES1111	PROBLEM SOLVING AND PYTHONPROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditions and loops.
- To use functions for structuring Python programs.
- To represent compound data using Python lists, tuples, dictionaries.
- To use OOPS concepts in Python.
- To read and write data from/to files in Python

LIST OF EXPERIMENTS

1. Write programs to demonstrate different number data types in python.
2. Basic Python Programs.
3. Develop python programs to demonstrate various conditional statements.
4. Implement user defined functions using python.
5. Develop python scripts to demonstrate functions.
6. Develop python programs to perform operations on List & Tuple.
7. Demonstrate the concept of Dictionary with python programs.
8. Develop python codes to demonstrate concept of class and objects.
9. Demonstrate OOPS concepts like inheritance and polymorphism with python programs.
10. Demonstrate python codes to print try, except and finally block statements.
11. Implement python programs to perform file operations.
12. Implement python programs using modules and packages.
13. Simulate bouncing ball using Pygame.

Mini Project :Suggested Topics(but not limited to)

1. Dice roll simulator
2. Guess the number game
3. Sending emails using python.
4. Random password generator.
5. Alarm clock.
6. URL shortener

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditions and loops.
3. To use functions for structuring Python programs.
4. To represent compound data using Python lists, tuples, dictionaries.

5	To use OOPS concepts in Python.
6	To read and write data from/to files in Python

WEB REFERENCES:

1	https://www.programiz.com/python-programming/examples
2	https://www.geeksforgeeks.org/python-programming-examples/
3	https://beginnersbook.com/2018/02/python-programs/
4	https://www.javatpoint.com/python-programs
5	https://www.w3schools.com/python/python_examples.asp
6	https://www.sanfoundry.com/python-problems-solutions/

21ES1111	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS (Minimum of experiments to be conducted: 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
   a) Determination of wavelength, and particle size using Laser
   b) Determination of acceptance angle in an optical fiber
2. Determination of thermal conductivity of a bad conductor – Lee's Disc method
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of band gap of a semiconductor
6. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Upon completion of the course, the students will be able to apply principles of elasticity,optics and thermal properties for engineering applications.

TEXT BOOKS

1. Ruby Das, C.S. Robinson, Rajesh Kumar, Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, University Science Press, Delhi, II Edition (2016), ISBN978-93-80386-86-7
2. Harnam Singh, Dr.P.S. Hemne, B.Sc., Practical Physics, S.Chand & Company Ltd, NewDelhi, Edition 2011, ISBN 81-219-0469-2

WEB REFERENCES:

1. https://www.vlab.co.in/broad-area-physical-sciences
2. https://vlab.amrita.edu/?sub=1

CHEMISTRY LABORATORY

OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters such as, alkalinity, hardness, DO and chloride.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry,potentiometry and conductometry in the determination of aqueoussolutions.

LIST OF EXPERIMENTS(Minimum of experiments to be conducted: 5 Experiments)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Determination of DO content of water sample by Winkler‟s method.
4. Determination of chloride content of water sample by argentometric method
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Determination of total, temporary & permanent hardness of water by EDTA method
10. Estimation of iron content of the water sample using spectrophotometer (1, 10-26, Phenanthroline / thiocyanate method).
11. Estimation of sodium and potassium present in water using flame photometer.
12. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
13. Pseudo first order kinetics-ester hydrolysis.
14. Corrosion experiment-weight loss method.
15. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOME:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To quantitatively analyse the aqueous solution by electroanalytical techniques.

TEXT BOOKS

1 Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).

2 Vogel’s Textbook of Quantitative Chemical Analysis (8th edition, 2014).

SEMESTER II

21HS1201	COMMUNICATIVE ENGLISH & LANGUAGE SKILLS LAB II INTEGRATED	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To develop linguistic and strategic competence in workplace context and to enhance language proficiency and thereby the employability of budding engineers and technologists.
- To help learners to develop their listening skills, which will, enable them to listen to lectures and comprehend them by asking questions; seeking clarification and developing their speaking skills and to speak fluently in real contexts.
- To improve the relevant language skills necessary for professional communication.
- To Introduce them to life skills, their importance in leading Personal & professional life, key concepts of business communication and Communicative skills.

UNIT – I INTERPERSONAL COMMUNICATION 9

Listening: Listening to Telephone Conversations. **Speaking**: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks. **Reading:** Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting). **Writing:** Writing a Short Biography of an Achiever Based on Given Hints, **Grammar:** Adjective, Sentence pattern. **Vocabulary** Development: Idioms and Phrases.

UNIT - II TECHNICAL COMMUNICATION 9

Listening: Listening to Talks/Lectures Both General and Technical and Summarizing the Main Points. **Speaking:** Participating in Debates ,TED Talks **Reading:** Reading Technical Essays/ Articles and Answering Comprehension Questions **Writing:** Summary Writing ,Minutes of the meeting **Grammar:** Participle Forms, Relative Clauses **Vocabulary Development:** Compound Words, Abbreviations and Acronyms.

UNIT - III PROCESS DESCRIPTION 9

Listening: Listening to a Process Description and Drawing a Flowchart **Speaking:** Participating in Group Discussions, Giving Instructions ,Presentation **Reading:** Reading Instruction Manuals **Writing:** Process Descriptions – Writing Instructions **Grammar:** Use of Imperatives, Active and Passive Voice, Sequence Words **Vocabulary Development:** Misspelt words , Homophones and Homonyms.

UNIT - IV REPORT WRITING 9

Listening: Listening to a Presentation and Completing Gap-Filling Exercises **Speaking:** Making Formal Presentations **Reading:** Reading and Interpreting Charts/Tables and diagrams **Writing:** Interpreting Charts/Tables and Diagrams,

Writing a Report **Grammar:** Direct into IndirectSpeech, Use of Phrases **Vocabulary Development:** Reporting Words, Technical Jargon.

UNIT - V APPLYING FOR JOBS 9

Listening: Listening to a Job Interview and Completing Gap-Filling Exercises **Speaking:** Mock Interview, Telephone Interviews, GD **Reading:** Reading a Job Interview, SOP, Company Profile and Completing Comprehension Exercises **Writing:** Job Applications and Resumes **Grammar:** Conditional Clauses, Modal verbs **Vocabulary Development:** Technical Vocabulary, Purpose Statement.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

- Read and comprehend technical texts effortlessly.
- Write thoughts and insights of their own.
- Recognize the need for life skills, apply them to different situations, the basic communicationpractices in different types of communication.
- Gain confidence to communicate effectively in various situations to acquire employabilityskills.
- Become an active listener of professional contexts.

TEXT BOOKS:

1 Richards, C. Jack. *Interchange*, New Delhi: CUP, 2017.

2 Board of Editors. *English for Engineers and Technologists* Volume 2 Orient Black SwanLimited, 2020.

REFERENCES:

1 Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015

2 Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles andPractice.Oxford University Press: New Delhi, 2014.

3 Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford 2007.

4 Means, L. Thomas and Elaine Langlois, English & Communication For Colleges.CengageLearning, USA 2007.

5 Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

WEB REFERENCES:

1 https://learnenglishteens.britishcouncil.org/exams/grammar-and-vocabulary-exams/word-formation

2 https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/201803 1621.pdf

3 http://xn--englishclub-ql3f.com/grammar/parts-of-speech.html

4 https://www.edudose.com/english/grammar-degree-of-comparison-rules/

ONLINE COURSES / RESOURCES:

1 https://basicenglishspeaking.com/wh-questions/

2 https://agendaweb.org/verbs/modals-exercises.html

3 https://cdn.s3waas.gov.in/s347d1e990583c9c67424d369f3414728e/uploads/2018/02/201803 1621.pdf

4 https://www.ego4u.com/en/cram-up/grammar/prepositions

List of exercises

Minimum of exercises to be conducted:

1 Listen to lectures - articulate a complete idea as opposed to producing fragmented utterances –Tedtalks, Science Fiction – My fair lady.

2 Listening to a process information – General Competitive Examinations, GRE

3 Listening for specific information: accuracy and fluency – BEC.

4 Listening - following, responding to explanations, giving directions and instructions inacademic and business contexts – IELTS, TOEFL.

5 Listening to transcripts and answer to the questions.

6 Listening: Read aloud in class and gap - filling.

7 Listening: Recognizing and interpreting non - verbal cues.

8 Listen first, speak second - Having the mindset of a listener.

9 Speaking – sharing personal information - Self introduction

10 Speaking – Small talk or Pep Talk

11 Speaking – Group discussion, Visume –visual presentation of resume

12 Speaking – Presentation – Formal and Informal

13 Speaking – Mock interview

14 Listening: Recognizing and interpreting non - verbal cues.

TOTAL: 30 PERIODS

SOFTWARE REQUIRED:

Globarena.

TEXT BOOKS:

1 Brooks, Margret. Skills for Success. Listening and Speaking. Level 4 Oxford UniversityPress, Oxford:2011.

2 Richards, C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford:2010

REFERENCES:

1 Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers andProfessionals. Pearson: New Delhi, 2010.

2 Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014.

3 Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.

4 Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
5 E. Suresh Kumar et al. Communication for Professional Success, Orient Blackswan:Hyderabad, 2015.
6 Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford UniversityPress: Oxford, 2014.

21MA1201	ENGINEERING MATHEMATICS II	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Vectors are very helpful for the engineering students as it will give the insight into howto trace along the different types of curves.
- To develop an understanding of the standard technique of a complex variable theory inparticular of analytics functions and its mapping property.
- Complex integration is an intuitive extension of real integration. Complex variable techniques
- have been used in a wide variety of areas of engineering. This has been particularly true in areas such as electromagnetic field theory, fluid dynamics, aerodynamics and elasticity.
- To solve the linear differential equations with constant coefficients.

UNIT - I VECTOR CALCULUS 12

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green‟s theorem in a plane Gauss divergence theorem and Stokes‟ theorem (excluding proofs) – Simple applications involving cubes, rectangular parallel piped, sphere and cylinder.

UNIT - II ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions Cauchy-Riemann equations Necessary and sufficient conditions- Harmonic and orthogonal properties of analytic function – Harmonic conjugate- Construction of analytic functions by Milne Thomson method- Conformal mapping: w =z+c, cz, 1/z, z2 and bilinear transformation.

UNIT - III COMPLEX INTEGRATIONS 12

Line integrals- Cauchy‟s integral theorem-Cauchy‟s integral formula-- Singularities – Residues- Cauchy‟s residue theorem Taylor‟s and Laurent‟s series expansions –– Application of residue theorem for evaluation of real definite integrals – Use of circular contour and semi- circular contour (excluding poleson the real axis).

UNIT - IV ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients -- Method of variation of parameters – Homogenous equation of Euler‟s and Legendre‟s type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

UNIT - V LAPLACE TRANSFORMS 12

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions Derivatives and integrals of transforms Transforms of unit function, unit step function and unit impulse functions – Transform of periodic functions- Initial and final value theorems. Inverse Laplace transform--Convolution theorem- Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1	Can identify the Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green‟s theorems andtheir verification.
2	Understanding analytic functions, harmonic functions, conformal mapping.
3	Determine the types of singularities, residues, contour integration.
4	Apply various techniques in solving differential equations.
5	Able to solve differential equations using Laplace transforms.
6	Can identify the Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green‟s theorems and their verification.
7	Understanding analytic functions, harmonic functions, conformal mapping.

TEXT BOOKS:

1	Grewel. B.S, “Higher Engineering Mathematics”, 43rd Edition, Khanna Publications, Delhi, 2014.
2	B.V. Ramana, “ Higher Engineering Mathematics”, McGraw Hill Education, India.
3	Bali N., Goyal M. and Walkins C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.,), New Delhi, 7th Edition, 2009.

REFERENCES:

1	Kreyszig Erwin, Advanced Engineering Mathematics”, John wiley and Sons, 10th Edition,New Delhi.
2	Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, . New Delhi, 3rd Edition, 2007.
3	O‟Neil, P.V. “Advanced Engineering Mathematics”, Cengage Learning India Pvt. Ltd, NewDelhi, 2007.
4	Sastry, S.S, “Engineering Mathematics”, Vol.I & II, PHI Learnig Pvt. Ltd, 4th Edition, NewDelhi, 2014.
5	.Wyile, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw HillEducation Pvt Ltd,. 6th Edition, New Delhi, 2012.

ONLINE COURSES / RESOURCES:

1	https://onlinecourses.nptel.ac.in/noc21_ma69
2	https://onlinecourses.nptel.ac.in/noc21_ma57

21PH1201	PHYSICS FOR ELECTRONICS ENGINEERING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and Nano devices.

UNIT - I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory – postulates – expression for electrical conductivity – expression for thermal conductivity – Wiedemann-Franz law – success and failures – quantum free electron theory – postulates – Fermi-Dirac statistics – density of energy states – band theory of solids – postulates – Bloch theorem – energy bands from electron wave reflections – metals, semiconductors and insulators – electron effective mass (qualitative) – concept of hole.

UNIT - II SEMICONDUCTOR PHYSICS 9

Crystal structure of Si – Czochralski method Intrinsic Semiconductors – energy band diagram – carrier concentration in intrinsic semiconductors extrinsic semiconductors – carrier concentration in N-type & P-type semiconductors – variation of carrier concentration with temperature ·variation of Fermi level with temperature and impurity concentration drift and diffusion transport of carriers – Einstein's relation – Hall effect and applications – Zener and avalanche breakdown in p-n junctions – Ohmic contacts –Schottky diode – degenerate and non-degenerate semiconductors – tunnel diode.

UNIT - III MAGNETIC AND SUPERCONDUCTING PROPERTIES OF MATERIALS 9

Magnetism in materials – magnetic field and induction – magnetic permeability and susceptibility – classifications of magnetic materials – ferromagnetic domain theory – Mversus H behaviour ▪ hard and soft magnetic materials ▪ examples and uses ▪ magnetic principle in computer data storage ▪magnetic hard disc. Superconductivity – zero resistance and Meissner effect – critical field and critical current density – BCS theory (qualitative) – Type I and Type II superconductors – maglev train – Josephson junction.

UNIT - IV DIELECTRIC AND OPTICAL PROPERTIES OF MATERIALS 9

Relative permittivity – polarization processes – internal field and Clausius- Mosotti relation – dielectric loss – dielectric breakdown (definition only) – high-k dielectrics. Classification of optical materials – carrier generation and recombination processes – Absorption and emission of light in metals, insulators and semiconductors (concepts only) – photocurrent in a P-N diode – photo detectors – pin diode – solar cell – LED.

UNIT - V NANODEVICES 9

Introduction – electron density in bulk material – size dependence of Fermi energy – quantum confinement – quantum structures – density of states in quantum well, quantum wire and quantum dot structures – excitons – quantum confined Stark effect

resonant tunneling – quantum interference effects' – ballistic transport quantum resistance and conductance Coulomb blockade effects – single electron phenomena and single electron transistor – carbon nanotubes: properties and applications.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

- Upon completion of this course, the students will able to gain knowledge on classical and quantum electron theories, and energy band structures.
- Upon completion of this course, the students will able to acquire knowledge on basics of semiconductor crystalline materials and its applications in various devices.
- Upon completion of this course, the students will able to get knowledge on magnetic and dielectric properties of materials.
- Upon completion of this course, the students will able to have the necessary understanding on the functioning of optical materials for optoelectronics.
- Upon completion of this course, the students will able to understand the basics of quantum structures and their applications in spintronics and carbon electronics.

TEXT BOOKS:

1 Kasap, S.O., Principles of Electronic Materials and Devices, 4th Edition, McGraw-Hill Education, 2018.

2 Donald A. Neamen, Semiconductor Physics and Devices: Basic Principles, 4th edition, McGrawHill, 2012.

K. Santhosam, K. Russel Raj and A, Maheswaran, "Electrical Engineering Materials", Chess Educational Publishers, 2021.

REFERENCES:

1 Hanson, G.W. ¯Fundamentalsof Nanoelectronics.Pearson Education, 2009.

2 Rolf E. Hummel, "Electronic Properties of Materials", Springer, 2011.

3 Charles Kittel, "Introduction to Solid State Physics", Wiley, 2012.

4 A.J.Dekker, "Solid State Physics", Prentice – Hall, Inc., 1969.

5 Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems", CRC Press, 2014.

WEB REFERENCES:

1 http://tiiciiitm.com/profanurag/Semiconductors-Properties.pdf

2 https://nptel.ac.in/content/storage2/courses/112108150/pdf/Web_Pages/WEBP_M16.pdf

3 https://nptel.ac.in/content/storage2/courses/113106062/Lec16.pdf

ONLINE COURSES / RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc20_ph10/preview

2 https://nptel.ac.in/content/storage2/courses/115103038/module1/lec1/2.html

21ES1201	BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concepts related with electrical circuits.
- To study the concept of electrical machines.
- To understand the utilization of electrical power.
- To understand the basics of electronic devices.
- To learn the applications of Op-Amp.

UNIT - I BASIC ELECTRIC CIRCUITS 9

Current- Voltage- Power- Voltage Source – Current Source- Ohm‟s Law – KCL – KVL (Analysis with only independent source) – Resistors in series and parallel – Current Division – Voltage Division- Mesh analysis, nodal analysis, Phasors- RMS value of current and voltage – Active power- Apparent Power- Complex Power – Power Factor - Simple problems.

UNIT - II ELECTRICAL MACHINES 9

Construction and Working Principle of DC motor, Stepper Motor, BLDC motor, Transformer, Single phase induction motor Capacitor start and Capacitor run motor.

UNIT - III UTILIZATION OF ELECTRICAL POWER 6

Principle of wind and solar energy systems. Electrical wiring Domestic and Industrial Illumination-Fluorescent and LED lamps. Protection- Need for Earthing, fuses and circuit breakers Energy tariff.

UNIT - IV BASICS OF ELECTRONICS 6

PN Junction-VI Characteristics of Diode, Zener diode, Transistors configurations – amplifiers. Op amps- Amplifiers, oscillator, rectifiers, differentiator, integrator, ADC, DAC. Regulated power supply using 7805 and 7905.

UNIT - V MEASUREMENTS AND TRANSDUCERS 6

Fundamentals of moving coil and moving iron meters, Transducers- classification-thermo electric, RTD,Strain gauge, LVDT, LDR and piezoelectric. Smart sensors -- Data acquisition systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to:

1 Summarize the basic laws and concepts related to electrical circuits.
2 Explain the construction and working of electrical machines.
3 Discuss the utilization of electrical power.
4 Discuss the basic concepts of electronics
5 Learn the applications of Op-Amp.

6 Explain the concepts of measurement and transducers.

TEXT BOOKS

1 Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education, 2014.

2 Thomas L. Floyd, „Electronic Devices‟, 10th Edition, Pearson Education, 2018.

3 John Bird, “Electrical Circuit theory and technology”, Routledge, Fifth edition, 2013.

REFERENCES:

1 William Hayt, Jack Kemmerly, Steven Durbin and Jamie Phillips, :" Engineering Circuit Analysis", McGraw Hill, 2019.

2 Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, McGraw Hill, 2010.

3 A.K. Sawhney, Puneet Sawhney „A Course in Electrical & Electronic Measurements & Instrumentation‟, Dhanpat Rai and Co, New Delhi, Edition 2011.

4 B.L.Theraja, A.K. Theraja, "A Text book on Electrical Technology Vol. III & IV", S. Chand publications, Edition 2014.

5 Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearso Publication

COURSES / RESOURCES:

1 https://nptel.ac.in/courses/108/106/108106172/

2 https://nptel.ac.in/courses/108/102/108102146/

3 https://nptel.ac.in/courses/108/101/108101091/

4 https://nptel.ac.in/courses/108/105/108105153/

21IT1201	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the syntax for C programming
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop applications in C using functions, pointers
- To develop applications using structures and union

UNIT - I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms - Structure of C program C programming: Data Types – Storage classes - Constants – Enumeration Constants-- Keywords – Operators: Precedence and Associativity-Expressions- Input /Output statements, Assignment statements – Decision making statements Switch statement – Looping statements Pre-processor directives Compilation process.

SUGGESTED ACTIVITIES:

- Programs and Demonstration using integer type, arithmetic operators and basic input/output
- Programs and Demonstration using other data types and operators

SUGGESTED EVALUATION METHODS:

- Programs on integer type, arithmetic operators, basic input output, else-if, switch, do-while, break, continue, enum
- Assignments
- Quiz

UNIT - II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – ExampleProgram: Matrix Operations (Addition, Scaling, Determinant and Transpose) – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

SUGGESTED ACTIVITIES:

- Programs and Demonstration using arrays and string operations
- Develop an application to perform matrix operations using multi-dimensional arrays.
- Create an application that performs operations like concatenation, finding a substring from a given string, etc. using character arrays.
- Develop an application to perform Selection sort, linear and binary search

SUGGESTED EVALUATION METHODS:

- Programs on arrays and string operations with use of string library functions Assignments

UNIT - III FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

SUGGESTED ACTIVITIES:

- Programs and Demonstration using functions and concepts of recursion.
- Programs and Demonstration using pointers and arrays, address arithmetic
- Programs and Demonstration using Pointers and strings

SUGGESTED EVALUATION METHODS:

- Programs using functions and concepts of recursion
- Programs on pointers and arrays, address arithmetic..
- Programs using pointers and strings

UNIT - IV STRUCTURES AND UNION 9

Structure-Nestedstructures-PointerandStructures-Arrayofstructures-Example Program using structures and pointers-Self-referential structures-Dynamic memory allocation-Singly linked list-typedef and Union

SUGGESTED ACTIVITIES:

- Programs and Demonstration using array of structure, Pointers to structures, Self- referential structures
- Programs to demonstrate Dynamic Memory Allocation

SUGGESTED EVALUATION METHODS:

- Programs using array of structure , Pointers to structures, Self-referential structures
- Assignments

UNIT - V FILE PROCESSING 9

Files – Types of file processing: Sequential access, Random access – Sequential access file Example Program: Finding average of numbers stored in sequential access file Random acces file Example Program: Transaction processing using random access files – Command lin arguments

SUGGESTED ACTIVITIES:

- Programs and Demonstration using file operations in real-world applications.

SUGGESTED EVALUATION METHODS:

- Demonstration of real-world application using Files and Command Line arguments

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to:

1 Learn the syntax for C programming
2 Develop simple applications in C using basic constructs
3 Design and implement applications using arrays and strings
5 Develop and implement applications in C using functions and pointers.
6 Develop applications in C using structures and union.
Design applications using sequential and random access file processing.

TEXT BOOKS

1 ReemaThareja, ―Programming in C‖, Oxford University Press, Second Edition, 2016.
2 Kernighan, B.W and Ritchie,D.M, ―The C Programming language‖, Second Edition Pearson Education, 2006

REFERENCES:

1 Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearso Publication
2 Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd. 2011
3 Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorlin Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
4 Byron S. Gottfried, "Schism's Outline of Theory and Problems of Programming with C" McGraw-Hill Education, 1996.
5 Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearso Publication

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1 https://github.com/tscheffl/ThinkC/blob/master/PDF/Think-C.pdf
2 https://freecomputerbooks.com/langCBooks.html

COURSES / RESOURCES:

1 https://www.programiz.com/c-programming
2 https://www.tutorialspoint.com/cprogramming/index.htm
3 https://www.javatpoint.com/c-programming-language-tutorial
4 https://www.geeksforgeeks.org/c-programming-language/
5 https://en.wikibooks.org/wiki/C_Programming

21MC1001	ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	0

OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasizeon the biodiversity of India and its conservation
- To facilitate the understanding of global and Indian scenario of renewable and non- renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology.

UNIT - I ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solidwaste management: causes, effects and control measures of municipal solid wastes, biomedical wastes and e-wastes – role of an individual in prevention of pollution – pollution case studies.

UNIT - II ELECTRICAL MACHINES 9

Construction and Working Principle of DC motor, Stepper Motor, BLDC motor, Transformer, Single phase induction motor - Capacitor start and Capacitor run motor.

UNIT - III NATURAL RESOURCES 6

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineralresources, case studies – Food resources: World food problems, changes causedby agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity,case studies – Land resources.

UNIT - IV SOCIAL ISSUES AND THE ENVIRONMENT 6

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion. environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and

control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation-central and state pollution control boards- Public awareness.

UNIT - V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS women andchild welfare – role of information technology in environment and human health Case studies.

TOTAL: 30 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

- To recognize and understand the functions of environment, ecosystems and biodiversityand their conservation.
- To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- To demonstrate the knowledge of societal activity on the long and short term environmental issues and abides by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

1 Anubha Kaushik and C. P. Kaushik‟s “Perspectives in Environmental Studies”, 6th Edition, New Age International Publishers (2018).

2 Benny Joseph, „Environmental Science and Engineering‟, Tata McGraw-Hill, New Delhi, (2016).

3 Gilbert M.Masters, „Introduction to Environmental Engineering and Science‟, 2ndedition, Pearson Education (2004).

REFERENCES:

1 R.K. Trivedi, „Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards‟, Vol. I and II, Enviro Media.

2 Cunningham, W.P. Cooper, T.H. Gorhani, „Environmental Encyclopedia‟, Jaico Publ., House, Mumbai, 2001.

3 Dharmendra S. Sengar, „Environmental law‟, Prentice hall of India PVT. LTD, New Delhi, 2007.

4 Rajagopalan, R, „Environmental Studies-From Crisis to Cure", Oxford University Press (2005).

5 Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

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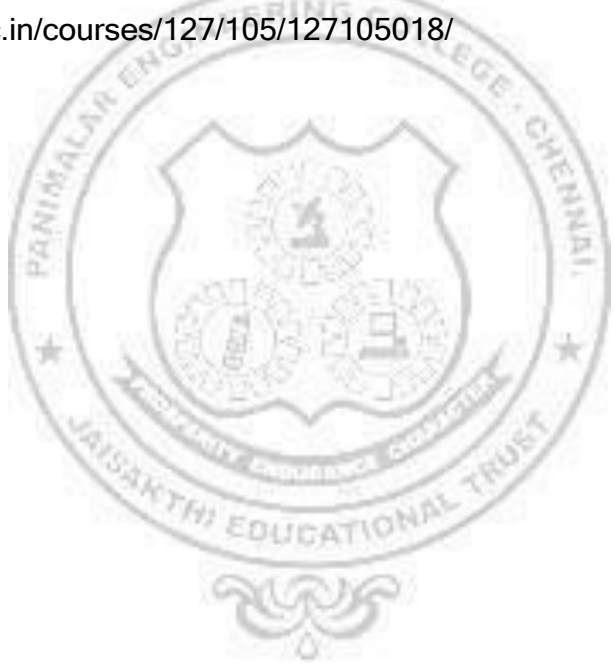
1. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-85-water-and- wastewater-treatment-engineering-spring-2006/lecture-notes/
2. https://www.slideshare.net/reavan/ce6605-environmental-engineering-ii-course- presentation

ONLINE COURSES / RESOURCES:

1. https://nptel.ac.in/courses/103/107/103107084/#
2. https://nptel.ac.in/courses/127/105/127105018/
3. https://nptel.ac.in/courses/103/107/103107084/#
4. https://nptel.ac.in/courses/127/105/127105018/



21IT1211	C PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To write, test, and debug simple C programs.
- To implement C programs with conditional and looping statement
- To develop applications in C using strings, pointers, functions.
- To implement C programs with structures and union.
- To develop applications in C using file processing
- To develop an application in real time situation

LIST OF EXPERIMENTS

1 Programs using I/O statements and expressions.

2 Programs using decision-making constructs.

3 Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)

4 Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.

5 Check whether a given number is Armstrong number or not?

6 Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions

i. if it is a perfect cube
ii. if it is a multiple of 4 and divisible by 6
iii. if it is a prime number
iv. Sort the numbers based on the weight in the increasing order as shown below <10,its weight>,<36,its weight><89,its weight>

7 Populate an array with height of persons and find how many persons are above the average height.

8 Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.

9 Given a string ¯a$bcd./fg‖ find its reverse without changing the position of special characters. (Example input:a@gh%;j and output:j@hg%;a)

10 Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.

11 From a given paragraph perform the following using built-in functions:

i. Find the total number of words.
ii. Capitalize the first word of each sentence.
iii. Replace a given word with another word.

12 Solve towers of Hanoi using recursion.

13 Sort the list of numbers using pass by reference.

14 Generate salary slip of employees using structures and pointers.

i. Programs using Pointers
ii. Pointer demonstration the use of & and *

iii. Access Elements of an Array Using Pointer
iv. Perform the string operations like Length of the String , Concatenation of string and compare the string using Pointer
v. Count number of words, digits, vowels using pointers
vi. Add two matrices using Multidimensional Arrays with pointers
vii. Multiply two matrices using pointers
viii. Multiply two numbers using Function Pointers

15 Compute internal marks of students for five different subjects using structures and functions.

16 Program to demonstrate the difference between unions and structures

17 Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

18 Count the number of account holders whose balance is less than the minimum balance using sequential access file.

MINI PROJECT

Create a ¯Railway reservation system‖ with the following modules

i. Booking
ii. Availability checking
iii. Cancellation
iv. Prepare chart

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Write, test, and debug simple C programs.

2 Implement C programs with conditionals and loops.

3 Develop C programs for simple applications making use arrays and strings.

4 Develop C programs involving functions, recursion, pointers, and structures andunion.

5 Design applications using sequential and random access file processing.

6 Perform task as an individual and / or team member to manage the task in time

WEB REFERENCES:

1 https://www.programiz.com/c-programming/examples

2 https://beginnersbook.com/2015/02/simple-c-programs/

3 https://www.programmingsimplified.com/c-program-examples

4 https://www.tutorialgateway.org/c-programming-examples/

5 https://www.javatpoint.com/c-programs

6 https://www.tutorialspoint.com/learn_c_by_examples/simple_programs_in_c.html

21ES1211	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A **CIVIL & ELECTRICAL**

I CIVIL ENGINEERING PRACTICES **15**

Plumbing Work:

i. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers,elbows and

ii. Other components which are commonly used in household.

a. Preparing plumbing line sketches.
b. Laying pipe connection to the suction side of a pump
c. Laying pipe connection to the delivery side of a pump.
d. Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances.

Wood Work:

i. Introduction to Tools and Equipments
ii. Simple Planning and sawing practice
iii. Making Half Lap, Dovetail, Mortise and Tenon joints

Wood Work Study:

i. Studying joints in door panels and wooden furniture
ii. Studying common industrial trusses using models.

ELECTRICAL ENGINEERING PRACTICES: **15**

II

i. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
ii. Fluorescent lamp wiring.
iii. Stair case wiring
iv. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
v. Measurement of energy using single phase energy meter.
vi. Measurement of resistance to earth of an electrical equipment.
vii. appliances.

GROUP B **MECHANICAL AND ELECTRONICS**

III MECHANICAL ENGINEERING PRACTICES **15**

Basic Machining Work:

i. Introduction to Lathe machine, Tools and Equipment
ii. Simple Turning and facing

iii. Step turning

Simple Drilling and Tapping of flat plate

Welding Work:

i. Introduction to Arc welding, Tools and Equipments
ii. Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

Assembly Work:

i. Assembling a centrifugal pump.
ii. Assembling an air conditioner.

Sheet Metal Work:

i. Demonstrating basic sheet metal operations

Foundry Work:

Demonstrating basic foundry operations.

IV	**ELECTRONICS ENGINEERING PRACTICES**	**15**

i. Study of Electronic components and equipments – Resistor, colour coding
ii. Measurement of AC signal parameter(peak-peak, rms period, frequency)using CRO.
iii. Study of logic gates AND, OR,EX-OR and NOT.
iv. Generation of Clock Signal.
v. Soldering practice-Components Devices and Circuits- Using general purpose PCB.
vi. Measurement to ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:

1 Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, (2006)

2 Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, (1999).

3 Jeyachandran K., Natarajan S. &Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).

4 S. Gowri& T. Jeyapoovan, "Enginering Practices Lab Manual 5/E", S. Chand Publishing, 2019

TEXT BOOKS:

1 Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, (2006)

2 Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, (1999).

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1 K.C. John, "Mechanical workshop practice", Second edition, PHI learning Pvt Ltd, New Delhi

2 Bawa H.S., “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, (2007).

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2 https://nptel.ac.in/courses/112/107/112107084/

SEMESTER III

21HS1201	LINEAR ALGEBRA AND NUMERICAL ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the concepts of vector space and Sub space.
- To understand the concepts of linear Transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real lifesituations.

UNIT - I VECTOR SPACES 9+3

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence andlinear dependence – Bases and dimensions.

UNIT - II LINEAR TRANSFORMATION AND DIAGONALIZATION 9+3

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of linear transformations – Eigen values and eigenvectors – Diagonalizability

UNIT - III INNER PRODUCT SPACES 9+3

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least squareapproximation.

UNIT - IV SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations : Fixed point theorem (without proof)– Newton Raphson method - Solution of linear system of equations : Gauss elimination method – Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method.

UNIT - V INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation - Interpolation with equal intervals: Newton's forward and backward difference formulae.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Understand the concepts of vector space.

2 Understand the concepts of linear transformations.

3 Understand the concepts of diagonalization

4 Apply the concept of inner product spaces in orthogonalization

5 Understand the basic concepts and techniques of solving algebraic and transcendental equations.

6 Apply the numerical techniques of interpolation and error approximations in various intervals in real life situations.

TEXT BOOKS:

1 Friedberg, A.H., Insel, A.J. and Spence, L., ¯Linear Algebra‖, Prentice Hall of India,New Delhi, 2004.

2 Grewal, B.S., and Grewal, J.S., " Numerical Methods in Engineering andScience", Khanna Publishers,10th Edition, New Delhi, 2015.

3 Kumaresan, S., ¯Linear Algebra – A Geometric Approach, Prentice – Hall of India,New Delhi, Reprint, 2010.

4 Kandasamy, P., Thilagavathy, K.,andGunavathy,S., 'Numerical Methods', Chand and Co.,2013.

REFERENCES:

1 Kolman, B. Hill, D.R., ¯Introductory Linear Algebra‖, Pearson Education, New Delhi, First Reprint, 2009.

2 Lay, D.C., ¯Linear Algebra and its Applications‖, 5th Edition, Pearson Education, 2015.

3 Burden, R.L. and Faires, J.D, " Numerical Analysis", 9th Edition, CengageLearning, 2016.

4 Sundarapandian, V. ¯Numerical Linear Algebra‖, Prentice Hall of India, New Delhi, 2008.

21IT1301	DATA STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of ADTs
- To design linear data structures – lists, stacks, and queues
- To understand sorting algorithms
- To Understand the concept of searching and hashing algorithms
- To apply Tree and Graph structures.

UNIT - I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

SUGGESTED ACTIVITIES:

- Developing any application (student's choice) using all the linear data structures.

SUGGESTED EVALUATION METHODS:

- Programs and Demonstration on applications of linear data structures.
- Checking output of programs implemented.
- Assignments

UNIT - II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations - Applications -- Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations Circular Queue – Priority Queue deQueue – applications of queues – Job Scheduling – Josephus problem

SUGGESTED ACTIVITIES:

- Demonstrating stack for Towers of Hanoi application.

SUGGESTED EVALUATION METHODS:

- Programs on applications of Stacks and Queues
- Quiz on various topics of the unit
- Assignments

UNIT - III NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT - Representation of Trees - Binary Tree-tree traversals expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree- B+ Tree – Trie-Heap – Applications of heap.

SUGGESTED ACTIVITIES:

- Solving expressions using expression trees by determining infix, prefix and postfix expressions
- Developing any application using trees.

SUGGESTED EVALUATION METHODS:

- Programs using tree traversal and binary tree
- Programs on binary search trees.
- Programs and Demonstration using AVL tree applications.
- Assignments

UNIT - IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal –Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – application of graphs Shortest path algorithms.

SUGGESTED ACTIVITIES:

- External learning Applications of graphs.
- Practical To choose and apply a suitable graph algorithm for solving a real timeproblem/scenario such as Network Routing

SUGGESTED EVALUATION METHODS:

- Assignments on representation of graphs for a given problem
- Quizzes on basics of graphs.
- Programs and Demonstration using application of graph and topological sort

UNIT - V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching- Linear Search - Binary Search. Sorting –Quick Sort Selection sort Heap Sort – Merge Sort - Insertion sort Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

SUGGESTED ACTIVITIES:

- External learning External sorting implementation.
- Implementation of phone directory using hash tables.
- Demonstration of searching techniques under best and worst case inputs.

SUGGESTED EVALUATION METHODS:

- Tutorials on external sorting.
- Tutorials on hashing.
- Check output of programs implemented.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

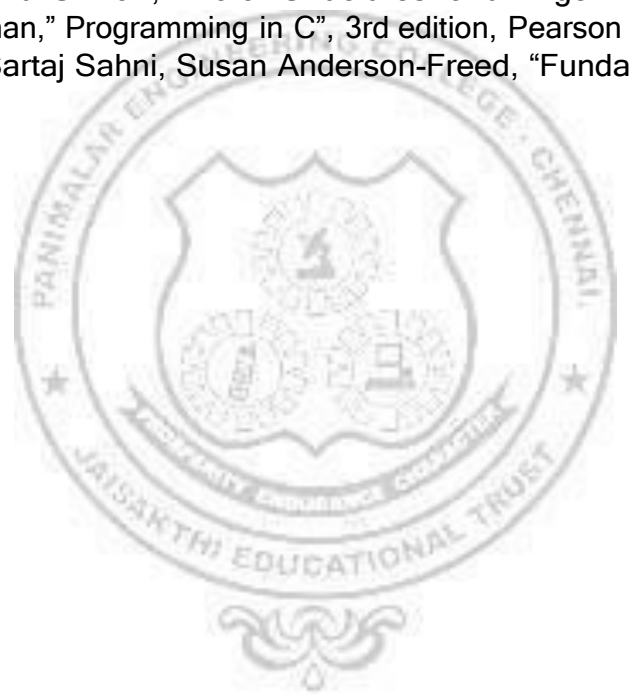
1 Implement abstract data types for linear data structures.
2 Apply the different linear data structures to problem solutions.
3 Model problems as Tree problems and implement efficient Tree algorithms to
4 Model problems as graph problems and implement efficient graph algorithms
5 Analyze the various sorting algorithms.
6 Analyze the various searching and hashing algorithms.

TEXT BOOKS:

1 Mark Allen Weiss, Data Structures and Algorithm Analysis in C‖, 2nd Edition,
2 Reema Thareja, 'Data Structures Using C', Second Edition , Oxford University Press, 2011.

REFERENCES:

1 Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein,
2 Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson
3 Stephen G. Kochan," Programming in C", 3rd edition, Pearson Education.
4 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data



21CC1301	ELECTRON DEVICES AND CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

UNIT - I PN JUNCTION DEVICES **9**

PN junction diode -structure, operation and V-I characteristics, diffusion and transition capacitance Rectifiers – Half Wave and Full Wave Rectifier,- Display devices- LED, Laser diodes, Zener diode characteristics --Zener Reverse characteristics – Zener as regulator.

SUGGESTED ACTIVITIES:

- Study of fundamental operation the diodes.
- Demonstration on identify the various diode and operation of Zener diode characteristics in the class.
- Study of V-I characteristics of Various PN junction diodes.

SUGGESTED EVALUATION METHODS:

- Quizzes on identify the diodes based on their characteristics.
- Assignments on V-I characteristics of various diodes'
- Verification of identify the various diode.

UNIT - II TRANSISTORS AND THYRISTORS **9**

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT Structure and characteristics.

SUGGESTED ACTIVITIES:

- Study of fundamental concepts of transistors such as biasing.
- Demonstration on identify the various transistor and operation of various transistor characteristics in the class.
- Study of stabilization for various transistors.

SUGGESTED EVALUATION METHODS:

- Quizzes on identify the transistor based on their characteristics.
- Assignments on Comparison of various transistors with their characteristics.
- Verification of identify the various transistor with their stability factor.

UNIT - III AMPLIFIERS **9**

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model- Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

SUGGESTED ACTIVITIES:

- Applications of various amplifier circuits - activity in class. For example: Identifying the role of the amplifier circuits.
- Study of gain and frequency response of the amplifier for the various configuration.
- Assignments on analysis of different sequential circuits.

SUGGESTED EVALUATION METHODS:

- Group discussion on applications of various amplifier circuits.
- Quizzes on different types of amplifiers with CB, CE, CC configuration .

UNIT - IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

SUGGESTED ACTIVITIES:

- Applications differential amplifier circuits - activity in class. For example: Differentiate the role of the amplifier circuits.
- Study of gain and frequency response of the amplifier and neutralization methods.
- Assignments on Single tuned amplifier.

SUGGESTED EVALUATION METHODS:

- Quizzes on cascade and differential amplifiers.
- Verifying the corrections in the design of amplifier circuits.

UNIT - V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current, series, Shunt feedback – positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

SUGGESTED ACTIVITIES:

- Study of various feedback amplifiers and oscillators.
- Assignments on designing various oscillators with different frequency.
- Identify the operation of various types of amplifier and oscillator.

SUGGESTED EVALUATION METHODS:

- Quizzes on cascade and differential amplifiers.
- Verifying the corrections in the design of amplifiers and oscillators.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Explain the structure and working operation of basic electronic devices.
2. Able to identify and differentiate both active and passive elements.
3. Analyze the characteristics of different electronic devices such as diodes and transistors.
4. Choose and adapt the required components to construct an amplifier circuit.
5. Employ the acquired knowledge in design and analysis of oscillators.

TEXT BOOKS:

1. David A. Bell ,‖Electronic devices and circuits‖, Oxford University higher education, 5th edition 2008.
2. Sedra and smith, ¯Microelectronic circuits‖,7th Ed., Oxford University Press.

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, ¯Electronic devices and circuits‖ PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, ¯Electronic devices‖ Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, ¯Electronic Circuit Analysis and Design‖ TataMcGraw Hill, 3rd Edition,2003.
4. Robert L.Boylestad, ¯Electronic devices and circuit theory‖, 2002.
5. Robert B. Northrop, ¯Analysis and Application of Analog Electronic Circuits to BiomedicalInstrumentation‖, CRC Press, 2004.

21IT1304	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To know the principles of packages, inheritance and interfaces.
- To define exceptions and use I/O streams.
- To develop a java application with threads and generics classes.
- To design and build simple Graphical User Interfaces.

UNIT - I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming Abstraction – Objects And Classes Encapsulation- Inheritance Polymorphism- OOP In Java -Fundamental Programming Structures In Java – Defining Classes In Java Constructors, Methods -Access Specifiers Static Members Arrays , Packages – Defining Packages Finding Packages And CLASSPATH -Importing Packages Packages Types , Javadoc Comments

SUGGESTED ACTIVITIES:

- Programs and Demonstration using simple Java programs Using Java Basic Constructs and Arrays
- Understanding JVM

SUGGESTED EVALUATION METHODS:

- Assignment problems
- Quizzes

UNIT - II INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes -Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces Object cloning inner classes, Array Lists- String Handling.

SUGGESTED ACTIVITIES:

- Programs and Demonstration of Java programs – use abstract classes, final methods and classes and interfaces
- Programs and Demonstration of Java programs – using String class, Array List , Creating class and objects
- Programs using Inheritance and Interfaces

SUGGESTED EVALUATION METHODS:

- Assignment problems

- Quizzes

UNIT - III EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy--throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics Streams – Byte streams and Character streams– Reading and Writing Console – Reading and Writing Files, Standard IDE like NETBEANS / ECLIPSE.

SUGGESTED ACTIVITIES:

- Programs and Demonstration using exception handling and Streams using any standard IDE like NETBEANS / ECLIPSE
- Develop an application threading

SUGGESTED EVALUATION METHODS:

- Demonstration of real-world application using exception handling and Streams
- Assignments

UNIT - IV MULTITHREADING AND GENERIC PROGRAMMING 9

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations

SUGGESTED ACTIVITIES:

- Programs and Demonstration of java program using multithreading and Generic programming

SUGGESTED EVALUATION METHODS:

- Assignment problems
- Quizze

UNIT - V EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components working with 2D shapes Using color, fonts, and images - Basics of event handling - event handlers adapter classes - actions mouse events – AWT event hierarchy Introduction to Swing – layout management Swing Components –Windows– Menus– Dialog Boxes– Study of Spring Framework , Hibernate Framework

SUGGESTED ACTIVITIES:

- Programs and Demonstration using graphics programming and components
- Programs and Demonstration of Mouse, key events, creating interactive forms using AWT/Swing and adding functionality
- Understand AWT and SWING

SUGGESTED EVALUATION METHODS:

- Assignments

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Develop Java programs using OOP principles
2 Develop Java programs with the concepts inheritance and interfaces
3 Build Java applications using exceptions and I/O streams
4 Develop Java applications with threads and generics classes
5 Design and build simple Graphical User Interface.
6 Develop interactive Java programs using swings.

TEXT BOOKS:

1 Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2 Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

REFERENCES:

1 Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2 Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3 Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000
4 Felipe Gutierrez , Introducing Spring Framework: A Primer 1st ed. Edition, Kindle Edition , 2014
5 Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.

21EC1304	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the basic properties of signals.
- To analyze the basic systems using properties.
- To analyze the characteristics of continuous time signals in the Fourier and Laplace domain
- To analyze LTI – Continuous time systems in Time domain and Frequency domain
- To analyze the characteristics of Discrete time signals in the Fourier and Z transform domain
- To analyze LTI - Discrete time systems in Time domain and Frequency domain.

UNIT - I CLASSIFICATION OF SIGNALS AND SYSTEMS 12

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time- invariant, Causal & Non-causal, Stable & Unstable.

UNIT - II ANALYSIS OF CONTINUOUS TIME SIGNALS 12

Fourier Series for periodic signals --Analysis of Continuous Time Signals using Fourier Transform – Inverse FT - Properties of FT, CT analysis using Laplace Transform-Unilateral LT and Bilateral LT-Inverse LT- Properties of Unilateral LT.

UNIT - III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12

Impulse response - convolution integrals – Graphical method --Properties of convolution integral- Overall impulse response for interconnected systems -- Fourier and Laplace transforms in Analysis of CT systems Solving of Differential Equation.

UNIT - IV ANALYSIS OF DISCRETE TIME SIGNALS 12

Baseband signal sampling Analysis of Discrete Time Signals using Discrete Time Fourier Transform (DTFT)- Inverse DTFT-Properties of DTFT- Analysis of Discrete Time Signals using Z-Transform – Inverse Z-Transform Properties of Z-Transform.

UNIT - V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12

Impulse response – Convolution sum –Graphical method - Properties of Discrete Convolution- Overall impulse response for interconnected systems Solving of Difference equations- Solution of Difference equation using DTFT- solution of difference equation using Z-transform.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the basics of signals and its classifications
2. Analyze the basic systems and its classifications
3. Determine the frequency Response for Deterministic signal and also analyze in S- domain.
4. Apply the Fourier and Laplace Transform for the analysis of LTI -Continuous Time systems
5. Analyze the Characteristics of DT signals by using DTFT and Z-transform
6. Apply the Fourier and Z- Transform for the analysis of LTI -Discrete Time systems

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”,Pearson,2015.
2. S. Haykin and B. Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2007.

REFERENCES:

1. B.P.Lathi,“Principles of Linear Systems and Signals”,Second Edition,Oxford,2009.
2. R.E.Zeimer,W.H.Tranter and R.D.Fannin,“Signals &Systems-Continuous and Discrete”,Pearson,2007.
3. John Alan Stuller,“An Introduction to SignalsandSystems”,Thomson,2007.

WEB REFERENCES:

1. http://www.nptelvideos.in/2012/12/signals-and-system.html
2. https://freevideolectures.com/course/3177/signals-and-systems

ONLINE COURSES / RESOURCES:

1. https://www.edx.org/course/signals-and-systems-part-1
2. https://www.edx.org/course/signals-and-systems-part-2

21IT1311	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To Understanding the importance of data structures, abstract data type, and their basic usability in different application.
- To implement linear and non-linear data structures.
- To understand the different operations of search trees.
- To implement graph traversal algorithms.
- To get familiarized to sorting and searching algorithms.

LIST OF EXPERIMENTS

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
   i. Singly Linked list
   ii. Circular Linked list
   iii. Doubly Linked list
4. Applications of List, Stack and Queue ADTs
   i. Polynomial operations
   ii. Infix to post fix
   iii. Josephus problem
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Expression tree
9. Implementation of Tree
10. Implementation of Heaps using Priority Queues.
11. Graph representation and Traversal algorithms
    i. Depth first search
    ii. Breadth first search
12. Applications of Graphs
    i. Dijkstra algorithm
13. Implementation of searching and sorting algorithms
14. Hashing-any two collision techniques

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. **CO1**:Write functions to implement linear and non-linear data structure operations
2. **CO2:** Suggest appropriate linear / non-linear data structure operations for solving a given problem

3 **CO3:** Appropriately use the linear / non-linear data structure operations for a given problem

4 **CO4:** Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval

5 **CO5:** Compare various kinds of searching and sorting techniques and hash tables and collisionresolution Techniques

6 **CO6:**Compare various kinds of hash tables and collision resolution Techniques.

WEB REFERENCES:

1 https://www.programiz.com/python-programming/examples

2 https://www.geeksforgeeks.org/python-programming-examples/

3 https://beginnersbook.com/2018/02/python-programs/

4 https://www.javatpoint.com/python-programs

5 https://www.w3schools.com/python/python_examples.asp

6 https://www.sanfoundry.com/python-problems-solutions/

21IT1312	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list
- To understand and apply the concepts of inheritance and polymorphism
- To understand exception handling and file processing.
- To develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1. Write a java program that prints all real solutions to the quadratic equation ax2 +bx+c=0. Read in a, b, c and use the quadratic formula.
2. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a java program that uses both recursive and non recursive functions.
3. Write a java program for sorting a given list of names in ascending order
4. Write a program that prompts the user for an integer and then prints out all prime numbers up to that integer.
5. Write a Java program to Multiply two given matrices
6. Write a Java program that checks whether a given string is a palindrome or not.
7. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection(i.e domestic or commercial).
8. 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.
9. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
10. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

11 Write a program to perform string operations using Array List. Write functions for the following
   i. Append - add at end
   ii. Insert – add at particular index
   iii. Search
   iv. List all string starts with given letter

12 Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

13 Write a Java program to implement exception handling.

14 Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

15 Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

16 Write a java program that correct implements of producer consumer program using the concept of inter thread communication

17 Write a java program to find the maximum value from the given type of elements using a generic function.

18 Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with “STOP “or “READY” or “GO” should appear above the buttons in selected color. Initially, there is no message shown.

19 Design a calculator using event-driven programming paradigm of Java using Scientific manipulations

20 Develop a mini project for any application using Java concepts

TOTAL: 60 PERIODS

ADDITIONAL PROGRAMS

21 Design a class to represent a Student details include the Student ID, Name of the Student, Branch, year, location and college. Assign initial values using constructor. Calculate average of marks of 6 subjects and calculate attendance percentage.

22 Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism

23 Write a program that creates three threads. First thread displays “Good Morning” every one second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.

24 Write a java programs to find factorial of a number. User is allowed to enter a number into the text field whose factorial is to be determined. On pressing the button the value of the text field is firstly converted into integer and then processed to find its factorial. The result will get displayed in another text field.(Hint: use swings).

OUTCOMES:

On successful completion of the course student will be able to:

1 **CO1:** Develop and implement Java programs for simple applications that make use of classes,packages and interfaces.

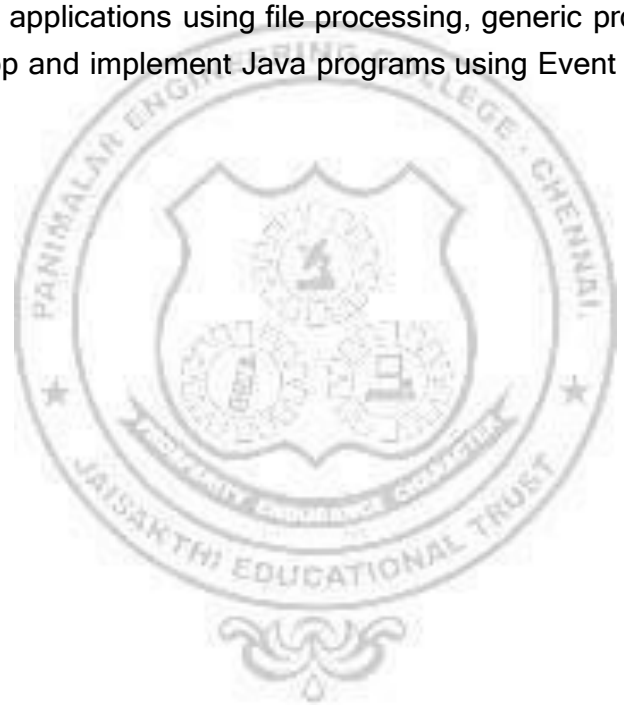
2 **CO2:** Develop and implement Java programs with array list, Strings**.**

3 **CO3:** Design applications using inheritance and polymorphism

4 **CO4:** Develop and implement Java programs with exception handling and multithreading.

5 **CO5:** Design applications using file processing, generic programming.

6 **CO6:** Develop and implement Java programs using Event Handling.



SEMESTER IV

21MA1403	PROBABILITY AND RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

UNIT - I RANDOM VARIABLES 9+3

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT - II TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear Regression – Transformation of random variables – Central limit theorem for Independent Identically Distributed random variable (Without Proof).

UNIT - III RANDOM PROCESSES 9+3

Classification – Stationary process – Markov process - Markov chain - Poisson process.

UNIT - IV CORRELATION AND SPECTRAL DENSITIES 9+3

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT - V LINEAR SYSTEMS WITH RANDOM INPUTS 9+3

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2	Understand the basic concepts of one dimensional random variables and apply in engineeringapplications.
3	Understand the basic concepts of two dimensional random variables and apply inengineering applications
4	Apply the concept random processes in engineering disciplines.
5	Understand and apply the concept of correlation and spectral densities
6	Analyze the response of random inputs to linear time invariant systems

TEXT BOOKS:

1. Ibe, O.C.," Fundamentals of Applied Probability and Random Processes ", 2nd Indian Reprint,Elsevier, 2014.
2. Peebles, P.Z.; "Probability, Random Variables and Random Signal Principles ", Tata McGrawHill, 4th Edition, 37th reprint 2016.
3. Veerarajan T, “Probability, Statistics and Random Processes with Queueing Theory”, Mc GrawHill, 4th Edition,7th reprint 2018.

REFERENCES:

1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", OxfordUniversity Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, "Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
3. Yates. R.D. and Goodman. D.J., ¯Probability and Stochastic Processes", Wiley India Pvt. Ltd.,Bangalore, 2nd Edition, 2012.

21CS1402	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the sameproblem
- To get accustomed with various programming constructs such as divide-and-conquer,dynamic Programming, Backtracking and Branch and Bound.
- To understand the limitations of Algorithmic power.
- To learn techniques for solving specific problems more efficiently and for analyzing spaceand time requirements

UNIT - I INTRODUCTION 9

Notion of an Algorithm - Fundamentals of Algorithmic Problem Solving Important Problem Types –Algorithm Design Technique- Fundamentals of the Analysis of Algorithmic Efficiency - Asymptotic Notations and their properties-Analysis Framework Mathematical analysis for Recursive and Non-recursive algorithms-Randomized algorithms-Las Vegas and Monte Carlo types.

SUGGESTED ACTIVITIES:

- Discussion on role of algorithms in computer science.
- Design of simple problems
- Basic method of calculating time and space complexity
- Design of Induction proof for recursive and non-recursive algorithms.

SUGGESTED EVALUATION METHODS:

- Quizzes on Asymptotic Notations
- Assignments on calculating time complexity using forward and Backward Approach

UNIT - II BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force - String Matching-KMP algorithm-- Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem Knapsack Problem Assignment problem. Divide and Conquer Methodology Binary Search - Merge sort - Quick sort – Randomized Quick Sort Multiplication of Large Integers, Strassen's Matrix Multiplication.

SUGGESTED ACTIVITIES:

- External Learning- Divide and Conquer based algorithms, Hacker rank divide and Conquer algorithms
- Practical : Implementation of Binary Search and Merge Sort
- To calculate time complexity using Master's theorem
- Design of Induction proofs for algorithm verification for Divide and Conquer Algorithms

SUGGESTED EVALUATION METHODS:

- Quizzes on brute force methods
- Assignments on Merge Sort and Multiplication of Large Integers.

UNIT - III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic programming - Principle of optimality Computing a Binomial Coefficient – Floyd's algorithm - Multi stage graph Optimal Binary Search Trees- Knapsack Problem. Greedy Technique - Container loading problem Prim's algorithm and Kruskal's Algorithm 0/1 Knapsack problems Huffman Trees.

SUGGESTED ACTIVITIES:

- External Learning- Dynamic Programming based algorithms like Longest common subsequence
- Practical : Implementation of Optimal Binary Search Tree
- External Learning- Greedy Techniques like Prim's and Kruskal's Algorithm
- Practical: Implementation of Huffman Trees.

SUGGESTED EVALUATION METHODS:

- Tutorials on Floyd's Algorithm
- Quizzes on greedy algorithms
- Assignments on Knapsack using Dynamic Programming method and Greedy method.

UNIT - IV ITERATIVE IMPROVEMENT AND BACKTRACKING 9

Iterative Improvement-The Maximum-Flow Problem-Stable marriage Problem-Backtracking - n-Queens problem - Hamiltonian Circuit Problem--Subset Sum Problem Graph Coloring Problem.

SUGGESTED ACTIVITIES:

- External Learning- Maximum-Flow Problem
- External Learning- Backtracking Algorithms like N Queens Problem and Hamiltonian Circuit Problem
- Practical : Implementation of subset sum problem
- Practical : Implementation of Hamiltonian Circuit Problems

SUGGESTED EVALUATION METHODS:

- Tutorials on Hamiltonian Circuit Problem
- Quizzes on Backtracking algorithms

UNIT - V P, NP CLASSES AND BRANCH AND BOUND 9

Lower - Bound Arguments P, NP NP- Complete and NP Hard Problems-Branch and Bound - LIFO Search and FIFO search Assignment problem Knapsack

Problem - Travelling Salesman Problem-- Approximation Algorithms for NP-Hard Problems Travelling Salesman problem Knapsack problem.

SUGGESTED ACTIVITIES:

- External Learning- NP Completeness
- External Learning- Branch and Bound Algorithms like Knapsack Problem
- Practical : Implementation of Travelling Salesman Problem using Branch and Bound
- External Learning- Approximation Algorithms for NP-Hard Problems
- Practical : Implementation of Travelling Salesman Problem using ApproximationAlgorithms.

SUGGESTED EVALUATION METHODS:

- Tutorials on NP-Hard Problems
- Assignments on NP Completeness
- Quizzes on Knapsack Problems
- Assignments on Travelling Salesman Problem.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Understand different algorithmic design strategies

2 Articulate the process of problem solving and writing algorithms.

3 Design and implementing the problems using algorithmic design paradigms (divide- and-conquer, greedy method, dynamic-programming and Backtracking, Branch and Bound) and apply when an algorithmic design situation calls for it.

4 Analyze the correctness of algorithms using inductive proofs and invariants

5 Describe the classes P, NP,NP-Hard, NP Complete and appraise to prove that a certain problem is P,NP,BP-Hard, NP-Complete.

6 Designing their theoretical knowledge in practice

TEXT BOOKS:

1 Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.

2 S.Sridhar, DESIGN AND ANALYSIS OF ALGORITHMS, First Edition, Oxford Edition, 2014.

3 AnanyLevitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.

REFERENCES:

1 Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Computer Algorithms/ C++,Second Edition, Universities Press, 2007.

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, 2015.

21CS1401	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts and the applications of database systems.
- To know the basics of SQL and construct queries using SQL.
- To learn the relational database design principles.
- To understand the basic issues of transaction processing and concurrency control.
- To Familiar with database storage structures and access techniques

UNIT - I DATABASE FUNDAMENTALS **9**

Introduction: Database System Applications, Purpose of Database Systems, View of Data, components and structure, Database Users and Administrator, History of Database Systems. Data models: ER model, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Enhanced E-RModel.

SUGGESTED ACTIVITIES:

- Developing ER diagrams for Banking application
- Translating requirements into models
- Comparing various data models and views

SUGGESTED EVALUATION METHODS:

- Quizzes on History of Database
- Assignments on architecture of Database
- Assignments on ER model

UNIT - II RELATIONAL DATABASE **9**

Relational Data Model Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators, SQL Introduction, data definition in SQL, table, key and foreign key definitions, update behaviours. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL.

SUGGESTED ACTIVITIES:

- Simple SQL queries
- Writing PL-SQL programs

SUGGESTED EVALUATION METHODS:

- Quizzes on SQL commands
- . Assignments on SQL functions

- Quizzes on control flow and functions

UNIT - III DATABASE DESIGN **9**

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Properties of Decompositions. Normalization: First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form – Multivalued Dependencies –Fourth Normal Form – Join Dependencies – Fifth Normal Form.

SUGGESTED ACTIVITIES:

- Writing Armstrong's Axioms
- Developing Normal Forms for a requirement
- Applying Decomposition and Functional Dependency

SUGGESTED EVALUATION METHODS:

- Quizzes on Normalization theory.
- Assignments on Normal Forms
- Case study

UNIT - IV TRANSACTION MANAGEMENT **9**

Transactions, Transaction Concept, ACID properties, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Concurrency Control: Lock-Based Protocols, Multiple Granularity, Timestamp-Based Protocols,Validation- Based Protocols, Multiversion Schemes.Recovery System-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm.

SUGGESTED ACTIVITIES:

- Writing Transaction rules for a database
- Comparing the efficiency of protocols
- Understanding the importance of Recovery

SUGGESTED EVALUATION METHODS:

- Quizzes on Transaction Management
- Assignments on Protocols
- Quizzes on Recovery

UNIT - V IMPLEMENTATION TECHNIQUES AND NON- RELATIONAL MODEL **9**

Data on External Storage – RAID- File Organizations – Indexing and Hashing - Trees – B+ tree and B- Tree index files. Hashing: Static – Dynamic. Query Processing and Query Optimization - Introduction to No SQL & Mongo DB: Advantages, Architecture, Data Models Mongo DB Data types and CRUD Operations

SUGGESTED ACTIVITIES:

- Applying RAID models
- Writing queries for index
- Comparing efficiency of Tree methods
- Writing No-SQL Queries

SUGGESTED EVALUATION METHODS:

- Quizzes on Tree concepts.
- Assignments on Indexing
- Quizzes on Query Optimization.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Remember the Structure of a Database
2 Understand an Entity Relational Model for a database.
3 Apply Relational and Non-Relational database concepts to design a database.
4 Analyze the importance of normalization and functional dependencies in database design
5 Evaluate the working principles of indexing and hashing.
Create a database design using both Relational and Non- Relational models

TEXT BOOKS:

1 Database System Concepts, A. Silberschatz, Henry. F. Korth, S. Sudarshan, McGraw Hill India Private Limited, 7th edition.
Mongo DB Complete Guide by Manu Sharma, BPB Publications, ISBN:9789389898866, July 2021.

REFERENCES:

1 Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGrawHillEducation (India) Private Limited, 3rd Edition

21CS1303	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and AnalysisModelling.
- To understand the various software design methodologies, software testing, softwareprocess models
- To learn various testing and maintenance measures
- To understand the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects

UNIT - I SOFTWARE PROCESS MODELS 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Waterfall model – Spiral Model – V shaped model – RAD model – Iterative Model –Prototype model.

SUGGESTED ACTIVITIES:

- Analyze which process model is suitable for a particular project
- Analyze Agile compare with traditional process models
- Estimate activity durations and resources required for a particular project

SUGGESTED EVALUATION METHODS:

- Incremental model compares with Waterfall model
- Assignments on different process models
- Evaluate the software process model is suitable for software concerns in the present scenario.

UNIT - II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

SUGGESTED ACTIVITIES:

- Gathering the requirements of the client – functional and non functional requirements
- Prepare the Software Requirements Specification (SRS) of a particular project (e.g Railway reservation system, Airlines etc)
- Identify customer's needs of a particular project
- Evaluate the system for feasibility (both technically and financially feasible)

SUGGESTED EVALUATION METHODS:

- Establish schedule and constraints for a particular project
- Create system definitions
- Perform economic and technical analysis

UNIT - III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model- Design Heuristic – Architectural Design Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design – Component level Design: Designing Class basedcomponents, traditional Components.

SUGGESTED ACTIVITIES:

- Implementing architectural design of a particular software project
- Implementing Interface design of a particular software project
- Implementing Component design of a particular software project
- Implementing Database design of a particular software project.

SUGGESTED EVALUATION METHODS:

- Evaluate Questionnaire method for software design
- Assignments on Heuristic evaluation methods applied in design of the software.
- Tabulate the tools used in software design.

UNIT - IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing basispath testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –SoftwareImplementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering – Software Configuration Management.

SUGGESTED ACTIVITIES:

- Develop test cases for any software project
- Enumerate the tools available for software testing
- Enumerate the principles of software testing
- List out the principles of BPR

SUGGESTED EVALUATION METHODS:

- Assignments on test suite.
- Assignments on Black box testing for any software product.
- Assignments on Testing artifacts of a software project

UNIT - V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS-Introduction to Agility: Extreme programming, Scrum, DevOps.

SUGGESTED ACTIVITIES:

- How to estimate the size of the software product using LOC or other traditional methods
- Enumerate Earned Value Analysis for a particular project
- Draft the time frame of a particular project using Gantt chart
- Compare traditional process models with agile methods

SUGGESTED EVALUATION METHODS:

- How to fix the size of the software and evaluate the cost of the software project
- Determine the cost of the software project using COCOMO I & II Model
- How to predict the risk of a particular project
- Evaluate how the agile software process model is suitable for software concerns in the present scenario.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Identify the key activities in managing a software project.
2 Compare different process models.
3 Concepts of requirements engineering and Analysis Modelling.
4 Apply systematic procedure for software design and deployment.
5 Compare and contrast the various testing and maintenance.
6 Manage project schedule, estimate project cost and effort required.

TEXT BOOKS:

1 Roger S. Pressman, Bruce R.Maxim¯Software Engineering – A Practitioner's Approach,Eight Edition, McGraw-Hill International Edition, 2015.
2 IanSommerville, ¯Software Engineering, 9th Edition, Pearson Education Asia, 2011.
Gene Kim, Jez Humble, Patrick Debois, and John Willis, The DevOps Handbook- How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press,2nd Edition,2016.

REFERENCES:

1 Rajib Mall, ¯Fundamentals of Software Engineering, Third Edition, PHI LearningPrivateLimited,2009.

2 PankajJalote, ―Software Engineering, A Precise Approach‖, Wiley India, 2010.
3 Kelkar S.A., ―Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.
4 Stephen R.Schach, Software Engineering, Tata McGraw-Hill Publishing CompanyLimited,2007.

21CB1202	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To learn the basic structure and operations of a computer.
- To learn various addressing modes, instruction formats and program control statements
- To understand parallelism and multi-core processors.
- To learn about different memory and various ways of communication with I/O devices.

UNIT - I DIGITAL FUNDAMENTALS 9

Digital Systems – Binary Numbers – Octal and Hexadecimal Conversions – Signed Binary Numbers Complements of numbers-Boolean Algebra and Logic Gates – K-Maps – Standard Forms – NANDand NOR Implementation.

SUGGESTED ACTIVITIES:

- In-class activity Number systems, problems in number conversion and complements.
- Proofs and simplification of basic theorems and properties of Boolean algebra in Class
- Assignments on simplification of Boolean functions using 3 and 4 variable K-Map
- Study of various Logic gates with truth table.

SUGGESTED EVALUATION METHODS:

- Verifying the correctness of the activity
- Checking the understanding of properties of Boolean algebra and K-Map
- Quiz on logic gates.

UNIT - II COMBINATIONAL AND SEQUENTIAL CIRCUITS 9 9

Combinational circuits – Binary Adder – Subtractor – ALU Design – Decoders – Encoders – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers and Counters.

SUGGESTED ACTIVITIES:

- Applications of combinational circuits - activity in class. For example: Identifying the role of the combinational circuits in designing circuits like digital boards
- Study of Binary adder, subtractor, Decoders, Encoders and Multiplexers
- Assignments on analysis of different sequential circuits.

SUGGESTED EVALUATION METHODS:

- Group discussion on applications of combinational circuits.
- Quiz on Binary adder, subtractor, Decoders, Encoders and Multiplexers.
- Verifying the correctness of the analysis of the given circuits.

UNIT - III BASIC STRUCTURE OF A COMPUTER 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of the Computer Hardware, Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

SUGGESTED ACTIVITIES:

- In-class activity on performance evaluation
- Flipped classroom – Evolution and types of computer systems, identification of benchmarks.
- Analyze the ISA supported by the architectural simulator by running simple programs on the simulator
- Mapping and correlating a C code with its machine code.

SUGGESTED EVALUATION METHODS:

- Mock test on problems for computer performance.
- Group discussion on activity four with assembly instruction, identifying the instruction type and encoding used in machine code.
- Quizzes on ISA

UNIT - IV PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control,Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

SUGGESTED ACTIVITIES:

- Flipped Classroom for analyzing data path in atleast two processors.
- Practical – Analyzing the data path on the standard simulator.
- Practical – Study of the pipelined implementation and analysis of various hazards.

SUGGESTED EVALUATION METHODS:

- Assignment on data path design.
- Group discussion on pipeline depth and stages.
- Quiz on class or automatic quizzes on the flipped classroom content.

UNIT - V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O –

Accessing I/O: Parallel And Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

SUGGESTED ACTIVITIES:

- Flipped classroom on memory hierarchy in atleast two processors.
- Study hit/miss rates for various access patterns. Experiment with different replacement policies.
- Study of different types of cache mapping.

SUGGESTED EVALUATION METHODS:

- Mock test for problems on cache memory mapping, replacement policies.
- Quizzes on memory management in atleast two processors

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Evaluate and simplify logic functions using Boolean Algebra and K-map
2 Design and Analyze Combinational and Sequential Circuits
3 Recognize and explain the functional units of computers
4 Categorize various addressing modes , instruction formats and program control statements
5 Discuss the implementation of processors and hazards
6 Analyze memory, I/O devices and cache structure for processors.

TEXT BOOKS:

1 M. Morris Mano, Michael D. Ciletti, “Digital Design”, Fifth Edition, Pearson Education, 2013. (Unit 1,2)
2 David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Fifth Ed (Unit 3,4,5).

REFERENCES:

1 John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012
2 Carl
3 William
4 M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2008.

WEB REFERENCES:

1 https://www.brainkart.com/subject/Digital-Principles-and-System-Design_100
2 http://scitechpublications.com/shop/computer-information/digital-principles-and-systemdesign-2/
3 http://www.sasurieengg.com/e-course-material/I-year-E-course-material-IIsem/7.CS6201%20- DPSD.pdf

ONLINE COURSES / RESOURCES:

1 https://onlinecourses.nptel.ac.in/noc21_ee39/preview
2 http://www.cs.iit.edu/~virgil/cs470/Book/
3 http://www.svecw.edu.in/Docs%5CITIIBTechIISemLecCOA.pdf
4 https://onlinecourses.nptel.ac.in/noc21_ee39/preview

21CS1411	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Learn to create and use a database.
- Be familiarized with a query language.
- Have hands on experience on DDL Commands.
- Have a good understanding of DML Commands and DCL Commands.
- Familiarize advanced SQL queries.

LIST OF EXPERIMENTS

1 Creation of tables for Salesman and Customer Relation with following structure: Salesman Relation:

salesman_id	name	city	commission

Customer Relation:

customer_id	cust_name	city	grade	salesman_id

2 Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing recordsbased on conditions.

3 Creation of Views, Synonyms, Sequence, Indexes, Save point.

4 Set various constraints like Not Null, Primary Key, Foreign Key and Check constraints.

5 Creating relationship between the databases and retrieve records using joins for thebelow relations:

Salesman Relation:

salesman_id	name	city	commission
5001	James Hoog	New York	0.15
5002	Nail Knite	Paris	0.13
5005	Pit Alex	London	0.11
5006	Mc Lyon	Paris	0.14
5007	Paul Adam	Rome	0.13
5003	Lauson Hen	San Jose	0.12

Customer Relation:

customer_id	cust_name	city	grade	salesman_id
3002	Nick Rimando	New York	100	5001
3007	Brad Davis	New York	200	5001
3005	Graham Zusi	London	300	5002
3004	Fabian	Paris	300	5006
3009	Geoff Cameron	Rome	100	5007
3003	Jozy	San Jose	300	5003

6 Execute the different types of Joins to find the output for the below:

7 From the following tables write a SQL query to find the salesperson and customer who reside in the same city. Return Salesman, cust_name and city

8 From the following tables write a SQL query to find those orders where the order amount exists between 500 and 2000. Return ord_no, purch_amt, cust_name, city.

9 From the following tables write a SQL query to find the salesperson(s) and the customer(s) he represents. Return Customer Name, city, Salesman, commission

10 From the following tables write a SQL query to find salespeople who received commissions of more than 12 percent from the company. Return Customer Name, customer city, Salesman, commission

11 Write a SQL statement to join the tables salesman, customer and orders so that the same column of each table appears once and only the relational rows are returned

12 Write a PL/SQL block to satisfy some conditions by accepting input from the user.

13 Write a PL/SQL block that handles all types of exceptions.

14 Creation of Procedures.

15 Creation of database triggers and functions

16 Database Connectivity with Front End Tools (Java/Python)

17
a. Mini project
b. Inventory Control System.
c. Material Requirement Processing.
d. Hospital Management System.R
e. ailway Reservation System.
f. Personal Information System.
g. Timetable Management System.
h. Hotel Management System

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Understand the Syntax of SQL commands

Remember queries to retrieve records

2 Apply referential integrity constraints

Analyze the database design using constraints

3 Evaluate PL/SQL programs to implement triggers, functions, procedures andexceptions

4 Create front end tools to manipulate information from backend

21CC1411	DIGITAL SYSTEM DESIGNLABORATORY	L	T	P	C
		0	0	4	2

- To understand the various basic logic gates
- To design and implement the various combinational circuits
- To understand the concepts of flip flops, registers and counters
- To design and implement sequential circuits

LIST OF EXPERIMENTS

1 Study of Logic Gates
2 Verification of Boolean Theorems
3 Implementation of Combinational Circuits and using HDL
4 Design and Implementation of Code Converter and using HDL
5 Implementation of Adder & Subtractor and using HDL
6 Parity Generator & Checker
7 Implementation of Multiplexer and using HDL
8 Implementation of Demultiplexer and using HDL
9 Design and Implementation of 3 Bit Synchronous Counters
10 Design and Implementation of Shift Register and using HDL
11 Develop a mini project for any application using synchronous/Asynchronous circuits

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Upon Completion of the course, the students will be able to:
2 Learn the basics of gates.
3 Construct basic combinational circuits and verify their functionalities
4 Apply the design procedures to design basic sequential circuits
5 Design of counters and shift registers
6 To understand the basic digital circuits and to verify their operation

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1 Digital trainer kits - 30
2 Digital ICs required for the experiments in sufficient numbers

Web References

1 http://ece.sliet.ac.in/digital-system-design-laboratory/://www.skit.ac.in/ece-
2 https://www.lbrce.ac.in/Digital%20System%20Design%20LAB.pdf
3 https://www.azdocuments.in/2020/01/digital-system-design-
4 https://www.iare.ac.in/sites/default/files/lab1/DSDLABMANUAL%20R-

5 https://www.skit.ac.in/ece-academics/ec-course-outcomes-and-
6 https://jecassam.ac.in/wp-content/uploads/2018/10/5Digital-Signal-Logic-

SEMESTER V

21MA1501	ALGEBRA AND NUMBER THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the basic notions of rings, fields which will then be used to solve relatedproblems.
- To introduce and apply the concepts of rings, finite fields and polynomials.
- To understand the basic concepts in number theory .
- To examine the key questions in the Theory of Numbers.
- To give an integrated approach to number theory and abstract algebra, and provide a firmbasis for further reading and study in the subject.

UNIT - I RINGS AND INTEGRAL DOMAIN 9+3

Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT - II FINITE FIELDS AND POLYNOMIALS 9+3

Rings- Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomialsover finite fields.

UNIT - III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 9+3

Division algorithm -Base-b representations -Number patterns – Prime and composite numbers – GCD

– Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT - IV DIOPHANTINE EQUATIONS AND CONGRUENCES 9+3

Linear Diophantine equations – Congruences – Linear Congruences - Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.

UNIT - V CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS 9+3

Wilson‘s theorem – Fermat‘s little theorem – Euler‘s theorem – Euler‘s Phi functions – Tau andSigma functions.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 **Apply** the basic concepts of rings to solve problems.
2 **Understand** the basic notions of fields.
3 **Explain** the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
4 **Demonstrate** accurate and efficient use of advanced algebraic techniques.

5	**Demonstrate** their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
6	**Apply** integrated approach to number theory and abstract algebra and provide a firm basis for further reading and study in the subject.

TEXT BOOKS:

1	Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", PearsonEducation, 5th Edition, New Delhi, 2007.
2	Koshy, T., ¯Elementary Number Theory with Applications‖, Elsevier Publications, NewDelhi, 2002.

REFERENCES:

1	Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition,2006.
2	Niven, I., Zuckerman.H.S., and Montgomery, H.L., ¯An Introduction to Theory ofNumbers‖, John Wiley and Sons , Singapore, 2004.
3	San Ling and Chaoping Xing, ¯Coding Theory – A first Course, Cambridge Publications, Cambridge, 2004.

21CS1403	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

UNIT - I INTRODUCTION AND PHYSICAL LAYER **9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model Physical Layer: Performance – Transmission media – Switching.

SUGGESTED ACTIVITIES:

- Designing Network Topology
- Problems on Performance metrics

SUGGESTED EVALUATION METHODS:

- Quizzes on Performance metrics
-

UNIT - II DATA-LINK LAYER & MEDIA ACCESS 9

Introduction – Link-Layer Addressing – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs: IEEE 802.11, Bluetooth, Zig bee.

SUGGESTED ACTIVITIES:

- Problems on Error correction and detection

SUGGESTED EVALUATION METHODS:

- Assignment HDLC
- Quizzes

UNIT - III NETWORK LAYER 9

Introduction – Network Layer Protocols: IPV4 , ICMP, IPV6 – Unicast Routing Algorithms – Multicasting Basics

SUGGESTED ACTIVITIES:

- :Problems on IP Addressing- In class
- In Class - Problems in Distance Vector Routing , Link State Routing using simulator

SUGGESTED EVALUATION METHODS:

- Assignments on IP Addressing and Routing Protocols

UNIT - IV TRANSPORT LAYER **9**

Introduction – Transport Layer Protocols – User Datagram Protocol – TransmissionControl Protocol – SCTP.

SUGGESTED ACTIVITIES:

- Socket Programming on UDP
- Implementation of DNS using UDP

SUGGESTED EVALUATION METHODS:

- Quiz on UDP and TCP applications

UNIT - V APPLICATION LAYER **9**

WWW and HTTP – FTP – Email -Telnet -SSH – DNS – SNMP

SUGGESTED ACTIVITIES:

- Seminar topic WWW and HTTP

SUGGESTED EVALUATION METHODS:

- Implementation of HTTP using Socket Programming.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Understand the basic layers and its functions in computer networks.
2 Evaluate the performance of a network.
3 Understand the basics of how data flows from one node to another.
4 Analyze and design routing algorithms.
5 Design protocols for various functions in the network.
6 Understand the working of various application layer protocols.

TEXT BOOKS:

1 Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013. Edition, Morgan Kaufmann Publishers Inc., 2012.

REFERENCES:

1 William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
2 Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3 Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

4 James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

NPTEL COURSES

1 https://nptel.ac.in › noc › noc22 › SEM1 › noc22-cs1

ONLINE COURSES / RESOURCES:

1 Computer Network Tutorial - javatpoint https://www.javatpoint.com › computer-network-tutorial https://www.geeksforgeeks.org/computer-network-tutorials/

2 TCP/IP Tutorial and Technical Overview, (IBM Redbook) - Download From http://www.redbooks.ibm.com/abstracts/gg243376.html

3 TCP/IP Guide, Charles M. Kozierok, Available Online - http://www.tcpipguide.com/

4 Request for Comments (RFC) - IETF - http://www.ietf.org/rfc.html

21EC1503	MICROCONTROLLERS AND COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the Architecture of 8051 microcontroller.
- To design a 8051 microcontroller based system.
- To understand about PIC microcontroller architecture
- To design a PIC microcontroller based system.
- To understand the concept of various memories and interfacing.
- To study the parallel processing technique of advanced processor.

UNIT - I 8051 MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) --I/O Pins Ports and Circuits - Instruction set Addressing modes Assembly language programming.

UNIT - II INTERFACING WITH 8051 MICROCONTROLLER 9

Programming 8051 Timers Serial Port Programming Interrupts Programming – LCD & Keyboard Interfacing ADC, DAC & Sensor Interfacing External Memory Interface- Stepper Motor and Waveform generation.

UNIT - III PIC MICROCONTROLLER 9

Introduction to PIC microcontrollers, architecture and memory organization, registers, I/O ports, interrupts, timer, instruction sets, PIC programming in assembly and C, Sensor interfacing, motor control.

UNIT - IV MEMORY AND I/O ORGANIZATION 9

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

UNIT - V ADVANCED COMPUTER ARCHITECTURE 9

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 **CO1:** Design and implement 8051 microcontroller based systems.
2 **CO2:** Interface various devices with 8051

3 **CO3:** Design and implement PIC microcontroller based systems.

4 **CO4:** Interface various devices with PIC microcontroller.

5 **CO5:** Explain the concept of various memories, interfacing and organization of multiprocessors.

6 **CO6:** Gain knowledge in parallel processing technique and unconventional architectures.

TEXT BOOKS:

1 Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition, Pearson education, 2011. (UNIT I &2).

2 Muhammod Ali Mazidi, Rolin D. Mckinlay & Danny Sansey, "PIC Microcontroller and Embeded System SPI, UART using Assembly & C for PICI8," Pearson International Edition, 2008. (UNIT3)

3 Miles J. Murdocca and Vincent P. Heuring, ―Computer Architecture and Organization: AnIntegrated approach, Second edition, Wiley India Pvt Ltd, 2015 (UNIT 4 & 5).

REFERENCES:

1 Doughlas V.Hall, ―Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012

2 A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3 rd edition, Tata McGrawHill, 2012.

3 John .B.Peatman , "Design with PIC Microcontroller", Prentice Hall, 1997.

4 David A. Patterson and John L. Hennessey, ―Computer Organization and Design, Fifth edition, Morgan Kauffman / Elsevier, 2014.

21CS1501	OBJECT ORIENTED ANALYSIS AND DESIGN (Lab Integrated) (Common to CSE & CCE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of object modelling
- To understand and differentiate Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification.

UNIT - I UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with OO Basics Unified Process – UML diagrams – Use Case –Case study – The Next Gen POS System - Inception-- Use case Modelling – Relating Use cases – Include, Extend And Generalization – When to use Use cases - Requirements Capture and Modelling --Object Analysis classification Use case Realization.

SUGGESTED ACTIVITIES:

- Analyse the OO basic concepts
- Use case modeling for any problem Statement.
- Identify the use case relationship in any problem Statement

SUGGESTED EVALUATION METHODS:

- Assignments on Unified Process applied to Next Gen POS System, any problem Statement.
- Quiz in Use case Modeling

UNIT - II STATIC UML DIAGRAMS 9

Class Diagram – Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition Relationship between sequence diagrams and use cases – When to use Class Diagrams-CRC cards-Assembling and Analysing Class diagrams.

SUGGESTED ACTIVITIES:

- Identify the Conceptual Classes in any Problem Statement.
- Create domain Model for any Problem Statement
- Create Class Diagram for any Problem Statement
- Create CRC cards for any requirement(user story, business rule, or system use case)

SUGGESTED EVALUATION METHODS:

- Assignments on Identifying the Conceptual Classes in Library Information System, Hospital Management System etc.
- Assignments on Creating Domain Model for Library Information System, Hospital Management System etc.
- Quiz in CRC cards.

UNIT - III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9

Dynamic Diagrams – UML interaction diagrams System sequence diagram – Collaboration diagram – When to use Communication Diagrams State machine diagram and Modelling –When to use State Diagrams Activity diagram – When to use activity diagrams –Implementation Diagrams UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment Diagrams- Model consistency.

SUGGESTED ACTIVITIES:

- Design Dynamic UML diagrams for the Problem Statement
- Design Implementation UML diagrams for the Problem Statement

SUGGESTED EVALUATION METHODS:

- Assignments on modeling the system with Dynamic UML diagrams
- Assignments on modeling the system with all UML diagrams.
- Quiz in UML diagram

UNIT - IV DESIGN PATTERNS 9

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – ControllerDesign Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design tocode.

SUGGESTED ACTIVITIES:

- Apply Grasp Patterns to Library Information System , Hospital Management System etc.
- Apply GoF patterns to Library Information System , Hospital Management System etc.
- Apply Forward Engineering (Mapping Design to code.) in Library Information System, Hospital Management System etc.

SUGGESTED EVALUATION METHODS:

- Assignments on Applying GRASP patterns
- Assignments on Applying GoF patterns.
- Quiz in Mapping design to code

UNIT - V TESTING OBJECT-ORIENTED SOFTWARE 9

Issues in Testing Object-Oriented Software -An Orthogonal Approach to Test - Intraclass Testing - Testing with State Machine Models - Interclass Testing - Structural Testing of Classes - Oracles for Classes -Polymorphism and Dynamic Binding – Inheritance- Genericity – Exceptions.

SUGGESTED ACTIVITIES:

- Develop the test cases for testing with State Machine Models, Interclass Testing , Intraclass Testing
- Apply OO testing techniques to OO Projects.

SUGGESTED EVALUATION METHODS:

- Assignments on testing with State Machine Models, Interclass Testing , Intraclass Testing
- Assignments on Structural Testing of Classes.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

Draw standard UML diagrams using an UML modeling tool for a given case study and map designto code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagramfrom that.
5. Using the identified scenarios, find the interaction between objects and represent them usingUML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriatedesign patterns.
10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR MINI-PROJECT

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system

   Online course reservation system

6 Airline/Railway reservation system
7 Software personnel management system
8 Credit card processing
9 e-book management system
10 Recruitment system
11 Foreign trading system
12 Conference management system
13 BPO management system
14 Library management system
15 Student information system

TOTAL : 75 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to:

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns

TEXT BOOKS

1 Craig Larman, ¯Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development‖, Third Edition, Pearson Education, 2005.

2 Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition – 1999.

REFERENCES:

1 Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, ¯Design patterns: Elements of Reusable Object-Oriented Software‖, Addison-Wesley, 1995.

2 Martin Fowler, ¯UML Distilled: A Brief Guide to the Standard Object Modeling Language,Third edition, Addison Wesley, 2003.

3 Software Testing and Analysis: Process, Principles, and Techniques , Mauro Pezze

21EC1501	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize with various Amplitude Modulation Schemes
- To understandAngle Modulation Techniques
- To acquaint the fundamentals of Source coding Techniques
- To understand the importance of Channel coding
- To impart knowledge invarious waveform coding
- To introduce the various band pass signaling schemes

UNIT - I AMPLITUDE MODULATION 9

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB Modulation index, Spectra, Power relations and Bandwidth – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, comparison of different AM techniques, Super heterodyne Receiver, Noise performance analysis in AM

UNIT - II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth FM modulation –Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator - PLL as FM Demodulator. Noise performance analysis in FM

UNIT - III INFORMATION THEORY & ERROR CONTROL CODING 9

Discrete Memoryless source, Information, Entropy, Source coding theorem – Shannon-Fano codes and Huffman codes.Channel coding theorem - Linear Block codes - Convolutional codes - Viterbi Decoder.

UNIT - IV WAVEFORM CODING 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization --- Uniform and non-uniform quantization - quantization noise-- Logarithmic Companding, PCM, DPCM, ADPCM --Delta Modulation and ADM principles-Linear Predictive Coding

UNIT - V DIGITAL MODULATION SCHEME 9

Geometric Representation of signals Generation, detection, PSD & BER of Coherent BPSK, BFSK and QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers – Principle of DPSK.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Compare and contrast various amplitude modulation techniques
2 Analyze and understand Angle Modulation schemes and its noise performance
3 Apply the concepts of Source Coding to improve coding efficiency
4 Construct feasible solutions for error control using Channel Coding Methods
5 Understand the concepts of sampling and quantization, Waveform Encoding schemes
6 Discuss the importance of Digital modulation techniques

TEXT BOOKS:

1 Simon Haykins," Communication Systems", Wiley, 5th Edition, 2009.
2 B.P.Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford UniversityPress, 2011.

REFERENCES:

1 WaynerTomasi, Electronic Communication System, 5th Edition, Pearson Education,2008.
D.Roody, J.Coolen, Electronic Communications, 4th edition PHI 2006
2 A.Papoulis, "Probability, Random variables and Stochastic Processes",
3 McGraw Hill, 3rd edition, 1991.
4 B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition Pearson Education 2007
H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006

21CS1602	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (COMMON TO CSE & CCE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various characteristics of intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To know about the various applications of AI
- To understand the need for machine learning and various algorithms in machine learning.

UNIT - I INTRODUCTION **9**

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems- Search Strategies- Uninformed – Informed-BFS-Greedy best first search-A* search

SUGGESTED ACTIVITIES:

- Developing PEAS description for agents
- Comparing Future of AI
- Different Approach in AI to Real Time Problems

SUGGESTED EVALUATION METHODS:

- Quiz on History of AI
- Learners to write a letter to self-keeping the future in context
- Assignment on Problem Solving Approach

UNIT - II PROBLEM SOLVING METHODS **9**

Problem solving Methods – Heuristics Iterative Deepening A*- RBFS – Memory Bounded A* – Local Search Algorithms and Optimization Problems Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing –Min Max- Optimal Decisions in Games – Alpha Beta Pruning – Stochastic Games

SUGGESTED ACTIVITIES:

- Participating in Game based activity
- Basic Structure of Decision Tree to students
- Searching Techniques for Problem Solving

SUGGESTED EVALUATION METHODS:

- Designing a decision tree based on the data given
- Quiz on Searching Techniques
- Students are divided into groups to find different solution for a particular problem.

UNIT - III KNOWLEDGE REPRESENTATION AND AI APPLICATIONS 9

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining- Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering- AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot.

SUGGESTED ACTIVITIES:

- Installing Prolog.
- Game based activity for AI applications.
- Flowchart for Knowledge Representation.

SUGGESTED EVALUATION METHODS:

- Mystery Animal Game (based on Natural Language Processing).
- Assignment on Retrieval and Extraction techniques.
- Quiz on Simple Prolog Programming.

UNIT - IV MACHINE LEARNING AND SUPERVISED LEARNING ALGORITHMS 9

Introduction to Machine Learning (ML) - Essential concepts of ML –Learning a Class from Examples- Linear, Non-linear-Multi-class and Multi-label classification- Decision Trees- ID3-Classification and Regression Trees (CART)- Regression- Linear Regression- Multiple Linear Regression- Logistic Regression- Bayesian Classifier- Bayesian Network.

SUGGESTED ACTIVITIES:

- Developing a framework for real life activities such as decision tree.
- Developing algorithms for basic mathematical expressions using regression tree.
- Simple program on SVM classification

SUGGESTED EVALUATION METHODS:

- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT - V UNSUPERVISED LEARNING AND MACHINE LEARNING APPLICATIONS 9

Introduction to clustering, clustering algorithms - Self-Organizing Map - Expectation Maximization - Gaussian Mixture Models – Principal Component Analysis (PCA) - MACHINE LEARNING APPLICATIONS - Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection- Medical Diagnosis.

SUGGESTED ACTIVITIES:

- Developing a framework for real life activities such as clustering techniques.
- Application of clustering algorithms to datasets (UCI/Kaggle/Corel 10k).

SUGGESTED EVALUATION METHODS:

- Quizzes on clustering concepts.
- Assignments on Machine learning applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to:

1	Understand concepts of Artificial Intelligence and different types of intelligentagents and their architecture.
2	Formulate problems as state space search problem and efficiently solve them.
3	Understand the working of various informed and uninformed searching algorithmsand different heuristics.
4	the conc pt of knowledge r pr se tation.
5	Understand supervised and unsupervised learning algorithms.
6	Apply Machine learning algorithms for real world problems.

TEXT BOOKS

1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach, Prentice Hall,Fourth Edition, 2020 (Unit 1, 2, 3)
2. Tom M. Mitchell, “Machine Learning”, Indian Edition, McGraw-Hill, 2017.

REFERENCES:

1. Munesh Chandra Trivedi, “A Classical Approach to Artificial Intelligence”, KhannaBook Publishing, 2019.
2. Vinod Chandra S.S, AnandHareendran S, “Artificial Intelligence and MachineLearning”, PHI Learning, 2014.
3. David L. Poole and Alan K. Mackworth, ¯Artificial Intelligence: Foundations ofComputational Agents, Cambridge University Press, 2010.
4. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC Press,2014.
5. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2 nd Edition,CRC Press, 2015.

CS1412	NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
4. Echo client and echo server
5. Chat
6. File Transfer
7. Simulation of DNS using UDP sockets.
8. Write a code simulating ARP /RARP protocols.
9. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
10. Study of TCP/UDP performance using Simulation tool.
11. Simulation of Distance Vector/ Link State Routing algorithm.
12. Performance evaluation of Routing protocols using Simulation tool.
13. Simulation of error correction code (like CRC).

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Implement various protocols using TCP and UDP.
2. Compare the performance of different transport layer protocols.
3. Use simulation tools to analyze the performance of various network protocols.
4. Analyze various routing algorithms.Implement error correction codes.

21EC1511	MICROCONTROLLERS AND INTERFACING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Understand architecture and advanced features of microcontrollers.
- Understand PIC/ARM processor registers, instruction pipeline, interrupts and architecture.
- Learn about instructions, addressing modes, conditional instructions
- Programming of advanced microcontrollers.
- Able to write a assembly language program for microcontroller.
- Able to write a program for interfacing of external devices with microcontroller.

LIST OF EXPERIMENTS

Assembly language programming experiments using 8051 and PIC:

1. Addition/Subtraction/multiplication/division of 8/16 bit data.
2. Data transfer/exchange between specified memory locations.
3. Largest/smallest from a series.
4. Sorting (Ascending/Descending) of data.
5. Square/cube/square root of 8-bit data
6. Code conversion-(Hex to Decimal / ASCII to Decimal and vice versa.

Interfacing experiments using 8051 and PIC

7. Display (LED/Seven segment/LCD) and keyboard interface
8. ADC interface.
9. DAC interface with wave form generation.
10. Stepper motor and DC motor interface
11. Interfacing Temperature sensor.
12. Mini Projects using anyone microcontroller.

TOTAL: 60 PERIODS

OUTCOME:

On successful completion of the course student will be able to:

1. **CO1:**Write assembly language Program for 8051 microcontrollers
2. **CO2:** Write assembly language Program for PIC microcontrollers
3. **CO3:** Interface various peripheral devices 8051 microcontroller
4. **CO4:** Interface various peripheral devices PIC microcontroller
5. **CO5:** Function effectively as an individual and in a team to accomplish the given task.

SEMESTER VI

21CS1502	INTERNET PROGRAMMING (COMMON TO CSE &CCE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand client-side programming.
- To understand server-side programming.
- To be familiarize on PHP programming.
- To understand XML Essentials.
- To learn web service architecture.

UNIT - I CLIENT-SIDE PROGRAMMING 9

Introduction to Web: Server - Client - Communication Protocol (HTTP) --- Introduction to Typescript-IDEs- IntelliJ IDEA- Class Decorator --Classes. Configuration and Compilation of all files in Typescript Bootstrap: Introduction to Bootstrap - Structure of the Page – Typography Forms and Buttons.

SUGGESTED ACTIVITIES:

- Designing a web page using IDEs-IntelliJ IDEA.
- Design a letter form using Typography.

SUGGESTED EVALUATION METHODS:

- Assignment on Forms and Buttons.
- Assignment on Communication Protocol HTTP.

UNIT - II SERVER-SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- Database Connectivity: JDBC perspectives, JDBC program example JSP: Understanding Java Server Pages JSP Standard Tag Library (JSTL) Creating HTML forms by embedding JSP code.

SUGGESTED ACTIVITIES:

- Create Database Connectivity.
- Develop a JSP Standard Tag Library.

SUGGESTED EVALUATION METHODS:

- Assignment on Database Connectivity for a client server communication.
- Quiz on HTML forms by embedding JSP code.

UNIT - III PHP 9

An introduction to PHP – PHP - Using PHP – Variables Program control Built-in functions- Form Validation - Regular Expressions - File handling Cookies Connecting to Database.

SUGGESTED ACTIVITIES:

- Program control in PHP
- Validate the form using Form Validation in PHP

SUGGESTED EVALUATION METHODS:

- Assignment on built in functions using PHP
- Assignment on File handling

UNIT - IV XML 9

XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS andATOM)

SUGGESTED ACTIVITIES:

- Analyse XML Data using XML Parsers and Validation
- Present a web page using Schema DOM and Presenting XML

SUGGESTED EVALUATION METHODS:

- Assignment on XSL and XSLT Transformation
- Seminar on News Feed (RSS and ATOM).

UNIT - V INTRODUCTION TO AJAX and WEB SERVICES 9

AJAX: 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 (WSDL) --Consuming a web service, Database Driven webservice from an application – SOAP.

SUGGESTED ACTIVITIES:

- Update a Webpage using AJAX.
- Creating, Publishing, Testing and Describing a Web services (WSDL).

SUGGESTED EVALUATION METHODS:

- Assignment on Web Services and Basics.
- Seminar on SOAP.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to:

Build dynamic web pages with validation using Typescript Objects and by

- applying different classes and methods.
- Develop server-side programs using Servlets and JSP.
- Develop an application using JDBC.
- Construct simple web pages in PHP.

- Represent data in XML format.
- Use AJAX and web services to develop interactive web applications.

TEXT BOOKS

1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 5th Edition, 2011.
2. Boris Cherny, "Programming Typescript" 2021.

REFERENCES:

1. Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition, 1999.
2. Chris Bates. Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5. Josh Goldberg , "Learning Typescript",2021.

21EC1502	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Discrete Fourier Transform(DFT), properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the characteristics of digital filters, design digital FIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To understand the effects of finite precision representation on digital filters.
- To understand the fundamental concepts of multi rate signal processing and its applications.
- To introduce the concepts of adaptive filters and its application to Communication engineering

UNIT - I DISCRETE FOURIER TRANSFORM 9

Analysis & synthesis equations for Discrete Fourier transform (DFT) - Properties of DFT - periodicity, symmetry, circular convolution, Linear filtering using DFT, Filtering long data sequences - overlap save and overlap add method, Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT), Linear filtering using FFT.

UNIT - II INFINITE IMPULSE RESPONSE FILTERS 9

Characteristics of practical frequency selective filters, characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters, Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Impulse invariance method, Bilinear transformation, Frequency transformation in the analog domain, Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT - III FINITE IMPULSE RESPONSE FILTERS 9

Introduction of FIR filters - Design of linear phase FIR filters using windows - Rectangular, Hamming and Hanning window, Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.

UNIT - IV **FINITE WORD LENGTH EFFECTS** **9**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT - V **DSP ARCHITECTURE AND APPLICATIONS** **9**

DSP Fixed-Point Architecture- Blocks of DSP Processor-Addressing modes, Multirate signal processing - Decimation, Interpolation, Sampling rate conversion by a rational factor, Adaptive Filters – Introduction - Applications of adaptive filter - Equalization.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Apply DFT for the analysis of digital signals and systems
2. Design IIR filters
3. Design FIR Filters.
4. Characterize the effects of finite precision representation on digital filter.
5. Design multirate filters with fixed point DSP Processor.
6. Apply adaptive filters appropriately in communication systems

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolaxis, ―Discrete-Time Signal Processing‖, 4th Edition, Pearson, 2007.
2. Emmanuel C. Ifeachor& Barrie. W. Jervis, ―Digital Signal Processing‖, Second Edition, Pearson Education / Prentice Hall, 2002.
3. A. V. Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time Signal Processing‖, 8th Indian Reprint, Pearson, 2004.

REFERENCES:

1. P. Ramesh Babu, “Digital Signal Processing”, Scitech Publications in 2011.
2. B.P.Lathi,“Principles of Linear Systems and Signals”, Second Edition,Oxford,2009.
3. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”,Tata Mc Graw Hill, 2007.
4. Andreas Antoniou,”Digital Signal Processing”, Tata Mc Graw Hill, 2006.

WEB REFERENCES:

1. https://www.digimat.in/nptel/courses/video/108105055/L01.html
2. http://www.nitttrc.edu.in/nptel/courses/video/117102060/L01.html

ONLINE COURSES / RESOURCES:

1. https://www.arm.com/resources/education/online-courses/digital-signal-processing
2. https://in.coursera.org/learn/dsp1

21EC1601	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the importance of Channel coding.
- To understand the design of a cellular system.
- To study the various digital signaling techniques.
- To study the multipath mitigation techniques.
- To understand the concepts of multiple antenna techniques.

UNIT - I WIRELESS CHANNEL CODING TECHNIQUES 9

Channel coding theorem Linear Block codes –Cyclic Codes- Convolutional codes Viterbi Decoder.

UNIT - II CELLULAR ARCHITECTURE 9

Multiple Access techniques FDMA, TDMA, CDMA – Capacity calculations-Cellular concept- Frequency reuse channel assignment- hand off- interference & system capacity trunking & grade of service – Coverage and capacity improvement

UNIT - III DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, π/4-DQPSK,Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT - IV MULTIPATH MITIGATION TECHNIQUES 9

ISI, Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Rake receiver.

UNIT - V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Analyze problems &arrive at feasible solutions for error control using Channel Coding Methods
2. Design a cellular system based on resource availability and traffic demands
3. Identify suitable signaling techniques for the wireless channel and system under consideration.
4. Identify suitable multipath mitigation techniques for the wireless channel and system under consideration.
5. Understand The concepts of multiple antenna techniques

TEXT BOOKS:

1. Rappaport,T.S., “Wireless communications”, Pearson Education, Second Edition, 2010
2. Andreas.F. Molisch, “Wireless Communications”, John Wiley - India, 2006

REFERENCES:

1. Andrea Goldsmith ,“Wireless Communication”, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad,“OFDM for wireless multimedia communications”, Artech House, 2000
3. David Tse and PramodViswanath,,”Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009.

21CS1511	INTERNET PROGRAMMING LABORATORY (COMMON TO CSE &CCE)	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To be exposed to creation of user interfaces using Typescript and Bootstrap.
- To learn to create dynamic web pages using server-side scripting.
- To learn to write Client Server applications.
- To be familiar with PHP programming.
- To be familiar with XML programming
- To be exposed to creating applications with AJAX

LIST OF EXPERIMENTS

1. To create a simple web page using bootstrap.
2. Implementation of Typescript classes and functions.
3. Implementation of Bootstrap Typography.
4. Validate the Registration, user login, user profile and payment by credit card pages using Typescript.
5. Write programs in Java using Servlets:
6. To invoke servlets from HTML forms
7. Session tracking using hidden form fields and Session tracking for a hit count
8. Write programs in Java to create three-tier applications using servlets for conducting online examinations for displaying student mark lists. Assume that student information is available in a database which has been stored in a database server.
9. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.
10. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.
11. PHP-Validate the form using PHP regular expressions.
12. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document
13. Write a web service for finding what people think by asking 500 people's opinions for any consumer product.

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Build dynamic web pages with validation using Typescript objects and by applying different bootstrap mechanisms.

2 Develop dynamic web pages using server side scripting.

3 To create client server applications.

4 Use PHP programming to develop web applications.

5 Use XML programming to develop Web Applications

6 Construct web applications using AJAX and web services.

21EC1512	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

To implement generation of sequences.

To realize Linear Convolution, Circular Convolution and Correlation.

To analyze Frequency spectrum analysis (DFT).

To design and realize IIR filters.

To design and realize FIR filters.

To implement signal processing algorithms using digital signal processor.

LIST OF EXPERIMENTS

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations.

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Bandstop filtering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass,High pass, Band pass and Band stop filtering
6. Implement an Up-sampling and Down-sampling operation in DSP Processor.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Generation of basic signal sequences.
2. Design and implement the basic signal processing operations like convolution and correlation helps to resolve real time applications.
3. Frequency domain analysis using DFT.

4	Design of IIR Filters for performing filtering operations over real-time signals.
5	Design of FIR Filters for performing filtering operations over real-time signals.
	Implentation of signal processing algorithms using digital signal processor.

TEXT BOOKS

1 John G. Proakis, Dimitris G. Manolaxis, ¯Discrete-Time Signal Processing‖, 4thEdition, Pearson, 2007.

REFERENCE BOOKS

1 P. Ramesh Babu, ¯Digital Signal Processing‖, Scitech Publications in 2011.

2 Sanjit K. Mitra, ¯Digital Signal Processing – A Computer Based Approach, Tata Mc Graw Hill, 2007.

SEMESTER VII

21CS1701	CRYPTOGRAPHY AND NETWORK SECURITY (Common to CSE,IT,CCE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems
- To understand necessary Approaches and Techniques.
- To learn to build protection mechanisms in order to secure computer networks.
- To learn the various Authentication schemes.
- To understand various Security practices and System security standards

UNIT - I INTRODUCTION 9

Security trends Legal, Ethical and Professional Aspects of Security, Need for Securityat Multiple levels, Security Policies Model Of Network Security – Security attacks-- Services And Mechanisms – OSI Security Architecture – Classical Encryption Techniques : Substitution techniques, Transposition techniques --- Steganography --Foundations of Modern Cryptography: Perfect Security – Information Theory – Product Cryptosystem – Cryptanalysis.

SUGGESTED ACTIVITIES:

- Implementation of steganography concept.
- Comparing substitution techniques and transposition techniques
- Different Approaches in cryptanalysis in Real Time Problems

SUGGESTED EVALUATION METHODS:

- Quiz on Security and attacks.
- Assignments on substitution techniques, transposition technique problems.
- Quiz on simple Classical encryption techniques.

UNIT - II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics of Symmetric Key Cryptography: Algebraic Structures Modular Arithmetic-Euclid'S Algorithm- Congruence And Matrices – Groups- Symmetric Key Ciphers: SDES – Block Cipher Principles of DES – Strength of DES- Differential And Linear Cryptanalysis Block Cipher Design Principles – Block Cipher Mode of Operation – Evaluation Criteria for AES – Advanced Encryption Standard Triple Des-Blowfish- RC4 -RC5 algorithm key distribution.

SUGGESTED ACTIVITIES:

- Problem Solving on Algebraic structures.
- Implementation of Symmetric key ciphers and RC4 Algorithm.

SUGGESTED EVALUATION METHODS:

- Quiz on SDES and mode of operation.
- Assignments on AES and DES algorithms.

UNIT - III PUBLIC KEY CRYPTOGRAPHY 9

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem– Elliptic curve cryptography.

SUGGESTED ACTIVITIES:

- Problem solving on Prime numbers and Factorization.
- Solving Puzzles on Chinese Remainder Theorem.

SUGGESTED EVALUATION METHODS:

- Quiz on Primes.
- Assignment on Asymmetric key ciphers
- Quiz on Key distribution

UNIT - IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC - MD5 - SHA-- HMAC – CMAC – Digital signature and authentication protocols – DSA -- Entity Authentication: Biometrics, Passwords,Challenge Response protocols- Authentication applications - Kerberos, X.509.

SUGGESTED ACTIVITIES:

- Comparing different authentication Algorithms
- Implementing MD5 algorithm
  /

SUGGESTED EVALUATION METHODS:

- Assignment on Authentication applications
- Assignment on Digital signature
- Quiz on different Kerberos versions.

UNIT - V SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security – PGP, S/MIME – IP security – Web Security: SET - OWASP- XSS-SQL Injection- SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

SUGGESTED ACTIVITIES:

- Set up a Honeypot and monitor the honeypot on network (KF Sensor).
- Demonstrate intrusion detection system (IDS) using any tool (snort or any other s/w)
- Installation of rootkits and study about the variety of options.

SUGGESTED EVALUATION METHODS:

- Assignment on SQL Injection
- Quiz on Viruses and Firewalls.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to:

1	Understand the fundamentals of network security, security architecture,
2	Apply the different cryptographic operations of symmetric cryptographic algorithms.
3	Apply the different cryptographic operations of public key cryptography.
4	Apply the various Authentication schemes to simulate different applications.
5	Understand various Security practices and System security standards. Analyze various threats and vulnerabilities in systems.

TEXT BOOKS

1 William Stallings, Cryptography and Network Security: Principles and Practice, PHI 8th Edition, 2020. BehrouzA. Ferouzan, "Cryptography & Network Security",Tata McGraw Hill,2nd edition 2015.

REFERENCES:

1 Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", PrenticeHall of India,3rd Edition-2020.

2 C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and NetworkSecurity, Wiley India Pvt.Ltd.

3 Charles Pfleeger, "Security in Computing", 5th Edition, Prentice Hall of India, 2015

4 Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATECommunication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

5 Douglas R Simson "Cryptography-Theory and practice", Third Edition, CRC Press,2006.

21EC1703	OPTICAL COMMUNICATION AND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study about the various optical fiber modes, configuration and fabricationtechniques
- To understand the transmission characteristics of optical fibers
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks.

UNIT - I INTRODUCTION TO OPTICAL FIBERS 9

Introduction-general optical fiber communication system- basic optical laws and definitions- optical modes and configurations mode analysis for optical propagation through fibers- modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables- classification of optical fiber-single mode fiber-graded index fiber.

UNIT - II TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER 9

Attenuation-absorption scattering losses-bending losses-core and cladding losses-signal dispersion –inter symbol interference and bandwidth-intra model dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion- dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profile- cutoff wave length-dispersion calculation-mode field diameter.

UNIT - III OPTICAL SOURCES AND DETECTORS 9

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures- surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects- comparisons of photo detectors.

UNIT - IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit. Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements-Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing- Optical Fiber connectors.

UNIT - V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 9

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM –Passive and Active DWDM Components-Elements of optical networks-SONET/SDH- Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration- Optical ETHERNET- Soliton.

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TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1 Realize basic elements in optical fibers, different modes and configurations.

2 Analyse the transmission characteristics associated with dispersion and polarization techniques.

3 Explain optical sources and detectors with their use in optical communication system.

4 Discuss fiber optic receiver systems and measurement techniques.

5 Understand fiber joints and coupling.

6 Analyze optical communication systems and its networks.

TEXT BOOKS:

1 P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India)Private Limited, 2016 (UNIT I, II, III).

2 GredKeiser,"Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.(UNIT I, IV, V).

REFERENCES:

1 John M. Senior , “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.

2 Rajiv Ramaswami, ¯Optical Networks ¯ , Second Edition, Elsevier , 2004.

3 J.Gower, ¯Optical Communication System‖, Prentice Hall of India, 2001.

Govind P. Agrawal, ¯Fiber-optic communication systems‖, third edition, John Wiley & sons, 2004.
4

WEB REFERENCES:

1 online at http://www.mhhe.com/engcs/electrical/keiser/

ONLINE COURSES / RESOURCES:

1 Optical Engineering by Prof. Shanti Bhattacharya, IIT Madras -NPTEL SWAYAM.

2 Optical Wireless Communications for Beyond 5G Networks and IoT by Prof.AnandSrivastava, IIIT Delhi-NPTEL SWAYAM.

21EC1701	EMBEDDED SYSTEMS AND ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Embedded and Robotics system.
- To study the Architecture of ARM Processor.
- To understand interfacing concepts of ARM.
- To select appropriate hardware and microcontrollers based on need of application.
- To illustrate about robotic vision
- To apply robot based concepts in AI

UNIT - I INTRODUCTION TO EMBEDDED AND ROBOTICS 9

Introduction Embedded systems, Definition, Examples and components of embedded Systems, Embedded System Design Process, Various Embedded core controllers. Robotics -Definition and origin of robotics – degrees of freedom – Robot classifications and specifications – Asimov's laws of robotics.

UNIT - II ARM PROCESSOR 9

ARM design philosophy, data flow model and core architecture, registers, program status register, instruction pipeline, interrupts and vector table, operating modes and ARM processor families.

UNIT - III INTERFACING WITH ARM 9

Addressing modes, Instruction Sets: Data processing instructions, branch, load, store instructions, PSR instructions, and conditional instructions. Interfacings- LED blinking, simple I/O Switch, ADC, DAC, Stepper Motor and Sensor Interfacing.

UNIT - IV ROBOTIC VISION 9

Industrial application of vision controlled robotic system-process of imaging-architecture of robotics vision system-image acquisition-description of other components of vision systems-image representation - image processing.

UNIT - V AI ROBOTICS 9

Intelligent systems- elements of artificial intelligence- system architecture-applicationsof advanced robot-fuzzy logic control-advanced concept and procedures-future development-impact on employment.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Gain knowledge of theory and practice related to Embedded and Robotic System.
2. Provide depth knowledge about ARM architecture and its interfacing.
3. Identify, formulate and solve engineering problems by using Embedded Systems.
4. Understand the vision controlled robotic system.
5. Realize the description of components of vision system.
6. Understand the applications of robotics in AI.

TEXT BOOKS:

1. K.V.K.K.Prasad, “Embedded Real Time Systems: Concepts, Design and Programming” 1st Edition, Dreamtech Publication,2014.
2. Rajkamal, “Embedded System: Architecture, Programming and Design”, TMH3.
3. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
4. James G. Keramas , Robot Technology Fundamendals India Edition.

REFERENCES:

1. Muhammad Ali Mazidi Shujen Chen, Sepehr Naimi Sarmad Naimi “Embedded Programming Using C Language”, 1st Edition, Freescale ARM Cortex-M.
2. Jonathan W Valvano,Embedded Microprocessor System:Real Time Interfacing, 3rd Edition, Thomson Engineering,2012.
3. John M. Holland, "Designing Autonomous Mobile Robots-Inside the mind of an Intelligent Machine", Newnes Publication, 2004.
4. Groover, M.P., Weiss, M., Nagel, R.N., & Odrey, N.G. Industrial robotics - technology, programming, and applications.
5. Shibu K.V, “Introduction to Embedded Systems”, McGraw Hill. 2014.

21EC1712	ADVANCED COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Understand the working principle of optical sources, detector, fibers
- Develop understanding of simple optical communication link
- Understand the measurement of BER, Pulse broadening
- Understand the characteristics of Microwave Devices
- Measure Various Microwave parameters
- Understand the characteristics of Microwave IC Filter

LIST OF OPTICAL EXPERIMENTS

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

LIST OF MICROWAVE EXPERIMENTS

1. VSWR and Impedance Measurement and Impedance Matching
2. Characterization of Directional Couplers, Isolators, Circulators
3. Gunn Diode Characteristics
4. Microwave IC – Filter Characteristics

TOTAL: 60 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Analyze the performance of simple optical link by measurement of losses and analyzing the mode characteristics of fiber.
2. Develop simple Optical communication Link.
3. Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER.
4. Understand the intricacies in Microwave System design.
5. Measure the various Microwave parameters.
6. Analyze the characteristics of Microwave IC Filter.

21CS1712	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY (Common to CSE,IT,CCE)	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To learn different cipher techniques
- To implement the algorithms DES, RSA,SHA-1
- To understand the usage of security tools

LIST OF EXPERIMENTS

1	Perform encryption, decryption using the following substitution techniques
2	Ceaser cipher, (ii) Playfair cipher iii) Hill cipher iv) Vigenere cipher
3	Perform encryption and decryption using following transposition techniques i) Rail Fence ii) Row & Column Transformation
	Implementation DES algorithm.
5	Implementation AES algorithm.
6	Implement RSA Algorithm using HTML and JavaScript
7	Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
8	Calculate the message digest of a text using the SHA-1 algorithm.
9	Implement the SIGNATURE SCHEME - DSA.
10	Demonstrate intrusion detection system (IDS) using any tool eg. Snort.
11	Automated Attack and Penetration Tools Exploring N-Stalker, a VulnerabilityAssessment Tool
12	Implementation of XSS and SQL injection,

MINI PROJECTS:

1	Keylogger projects.
2	Antivirus.
3	Analysis and Assessment of different Cyber-Attacks
4	Network Monitoring and Anomalies Discovery.
5	Bug Bounties.

TOTAL: 60 PERIODS

COURSE OUTCOMES

At the end of the course, the student will able to

1	Develop code for classical Encryption Techniques to solve the problems.
2	Build cryptosystems by applying symmetric key encryption algorithms
3	Develop public key encryption algorithms.
4	Construct code for authentication algorithms.
5	Develop a signature scheme using Digital signature standard.
6	Demonstrate the system security using open-source tools.

PROFESSIONAL ELECTIVES

VERTICAL I: DATA SCIENCE

21AD1901	EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT - I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT - II EDA USING PYTHON 9

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations..

UNIT - III UNIVARIATE ANALYSIS 9

Introduction to Single variable: Distribution Variables Numerical Summaries of Level and Spread Scaling and Standardizing – Inequality.

UNIT -IV BIVARIATE ANALYSIS 9

Relationships between Two Variables - Percentage Tables -- Analysing Contingency Tables - Handling Several Batches Scatterplots and Resistant Lines.

UNIT -V MULTIVARIATE AND TIME SERIES ANALYSIS 9

Introducing a Third Variable Causal Explanations Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the fundamentals of exploratory data analysis.
2. Implement the data visualization using Matplotlib.
3. Perform univariate data exploration and analysis.
4. Apply bivariate data exploration and analysis.
5. Use Data exploration techniques for multivariate and time series data.
6. Use Data visualization techniques for multivariate and time series data.

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, ―Hands-On Exploratory Data Analysis with Python‖, Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017.
3. Catherine Marsh, Jane Elliott, ―Exploring Data: An Introduction to Data Analysis for Social Scientists‖, Wiley Publications, 2nd Edition, 2008.

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, ―Fundamentals of Data Visualization‖, O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, ―Interactive Data Visualization: Foundations, Techniques, and Applications‖, 2nd Edition, CRC press, 2015.

21AD1902	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT - I INTRODUCTION **9**

Introduction and basic taxonomy of recommender systems Traditional and non-personalized Recommender Systems --Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

UNIT - II CONTENT-BASED RECOMMENDATION SYSTEMS **9**

High-level architecture of content-based systems Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT - III COLLABORATIVE FILTERING **9**

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

UNIT -IV ATTACK-RESISTANT RECOMMENDER SYSTEMS **9**

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design Robust recommendation algorithms.

UNIT -V EVALUATING RECOMMENDER SYSTEMS **9**

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
4. Design and implement a simple recommender system.

5. Learn about advanced topics of recommender systems.
6. Learn about advanced topics of recommender systems applications

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.

21AD1918	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

UNIT - I INTRODUCTION 9

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT - II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 9

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT - III THIRD-GENERATION NEURAL NETWORKS 9

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-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 DEEP FEEDFORWARD 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 -V RECURRENT NEURAL NETWORKS 9

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders, LSTM networks.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning
5. Use the key computations to build and train deepneural networks for various tasks.
6. Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ¯Deep Learning‖, MIT Press, 2016.
2. Francois Chollet, ¯Deep Learning with Python‖, Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, ¯Hands-On Machine Learning with Scikit-Learn and TensorFlow‖, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, ¯Deep Learning: A Practitioner‘s Approach‖, O‘Reilly Media, 2017.
3. Charu C. Aggarwal, ¯Neural Networks and Deep Learning: A Textbook‖, Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, ¯Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications‖, PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, ¯Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003.

21AD1919	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT - I NATURAL LANGUAGE BASICS 9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT - II TEXT CLASSIFICATION 9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT - III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems evaluating dialogue systems

UNIT -IV TEXT-TO-SPEECH SYNTHESIS 9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

UNIT -V AUTOMATIC SPEECH RECOGNITION 9

Speech recognition: Acoustic modelling – Feature Extraction --HMM, HMM-DNN systems

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Explain existing and emerging deep learning architectures for text and speech processing
2. Apply deep learning techniques for NLP tasks, language modelling and machine translation

3. Explain coreference and coherence for text processing
4. Build question-answering systems, chatbots and dialogue systems
5. Apply deep learning models for building speech recognition
6. Apply deep learning models for building text-to-speech systems

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, ¯Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition‖, Third Edition, 2022.

REFERENCES:

1. Dipanjan Sarkar, ¯Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data‖, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, ¯Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, ¯Fundamentals of Speech Recognition‖ 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, ¯Natural language processing with Python‖, O'REILLY.

21AD1920	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

UNIT - I INTRODUCTION TO BUSINESS ANALYTICS 9

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNIT - II BUSINESS INTELLIGENCE 9

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process Decision Support Systems – Business Intelligence – OLAP – Analytic functions

UNIT - III BUSINESS FORECASTING 9

Introduction to Business Forecasting and Predictive analytics --- Logic and Data Driven Models –Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNIT -IV HR & SUPPLY CHAIN ANALYTICS 9

Human Resources – Planning and Recruitment – Training and Development - Supply chain network Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT -V MARKETING & SALES ANALYTICS 9

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales predictive analytics for customers' behaviour in marketing and sales.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Explain the real world business problems and model with analytical solutions.
2. Explain the real world business problems and model with analytical solutions.
3. Identify the business processes for extracting Business Intelligence

4. Apply predictive analytics for business fore-casting
5. Apply predictive analytics for business fore-casting
6. Use analytics for marketing and sales.

TEXT BOOKS:

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017.
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016.

REFERENCES:

1. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
2. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
3. Mahadevan B, ¯Operations Management -Theory and Practice‖,3rd Edition, Pearson Education,2018.

IMAGE AND VIDEO ANALYTICS

L	T	P	C
3	0	0	3

21AD1906

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

UNIT - I INTRODUCTION 9

Computer Vision – Image representation and image analysis tasks Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation Traditional and Hierarchical image data structures- T-pyramid of an image- the quad tree representation of an image using the homogeneity criterion of equal intensity

UNIT - II IMAGE PRE-PROCESSING 9

Local pre-processing - Image smoothing - Edge detectors --Zero-crossings of the second derivative - Scale in image processing - Canny edge detection-- Parametric edge models - Edges in multi- speralct images-- Local pre-processing in the frequency domain - Line detection by local pre- processing operators -- Image restoration – Geometric transformations Case study of MNIST.

UNIT - III OBJECT DETECTION USING MACHINE LEARNING 9

Object detection- Object detection methods – Deep Learning framework for Object detection- bounding box approach-Intersection over Union (IoU) -Deep Learning Architectures-R-CNN-Faster R- CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures motion analysis using moving edges Case study: Geospatial objet detection.

UNIT -IV FACE RECOGNITION AND GESTURE RECOGNITION 9

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition-Implementation using FaceNet- Gesture Recognition – Implementation of Facial Detection and Recognition static hand gesture.

UNIT -V VIDEO ANALYTICS 9

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem- RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture- Improvement in Inception v2-Video analytics-RestNet and Inception v3. Case study: Airport Projects event detection in video surveillance system.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the basics of image processing techniques for computer vision.
2. Understand the basics of image processing techniques for video analysis.
3. Explain the techniques used for image pre-processing.
4. Develop various object detection techniques.
5. Understand the various face recognition mechanisms.
6. Elaborate on deep learning-based video analytics.

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, ¯Image Processing, Analysis, and Machine Vision‖, 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021

REFERENCES:

1. Richard Szeliski, ¯Computer Vision: Algorithms and Applications‖, Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, ¯Video Analytics for Business Intelligence‖, Springer, 2012.
3. D. A. Forsyth, J. Ponce, ¯Computer Vision: A Modern Approach‖, Pearson Education, 2003.
4. E. R. Davies, (2012), ¯Computer & Machine Vision‖, Fourth Edition, Academic Press.

21AD1921	COMPUTER VISION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

UNIT - I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT - II FEATURE DETECTION, MATCHING AND SEGMENTATION 9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT - III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration – Triangulation - Two-frame structure from motion Factorization Bundle adjustment - Constrained structure and motion Translational alignment Parametric motion - Spline-based motion Optical flow Layered motion.

UNIT -IV 3D RECONSTRUCTION 9

Shape from X - Active range finding - Surface representations Point-based representations- Volumetric representations - Model-based reconstruction --- Recovering texture maps and albedosos.

UNIT -V IMAGE-BASED RENDERING AND RECOGNITION 9

View interpolation Layered depth images - Light fields and Lumigraphs -- Environment mattes - Video-based rendering-Object detection - Face recognition Instance recognition - Category recognition-- Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To understand basic knowledge, theories and methods in image processing and computer vision.
2. To implement basic image processing techniques in OpenCV.

3. To implement some advanced image processing techniques in OpenCV.
4. To apply 2D feature-based image alignment, segmentation and motion estimations.
5. To apply 3D image reconstruction techniques
6. To design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard Eugene Woods,‖ Digital Image Processing‖, Pearson,2018.
2. Richard Szeliski, ¯Computer Vision: Algorithms and Applications‖, Springer-Texts in Computer Science, Second Edition, 2022.
3. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

21AD1922	DATA VISUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the fundamental concepts related to visualization data
- To learn foundations for visualization
- To learn foundations for visualization
- To learn interaction concepts and techniques
- To use visualization techniques for research

UNIT - I INTRODUCTION AND DATA FOUNDATION 9

Basics - Relationship between Visualization and Other Fields---The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation -- Types of Data - Structure within and between Records Data Preprocessing Data Sets

UNIT - II FOUNDATIONS FOR VISUALIZATION 9

Visualization stages - Semiology of Graphical Symbols The Eight Visual Variables Historical Perspective - Taxonomies Experimental Semiotics based on Perception Gibson_s Affordance theory – A Model of Perceptual Processing.

UNIT - III VISUALIZATION TECHNIQUES 9

Spatial Data: One-Dimensional Data Two-Dimensional Data – Three Dimensional Data - Dynamic Data Combining Techniques. Geospatial Data : Visualizing Spatial Data - Visualization of Point Data Visualization of Line Data Visualization of Area Data Other Issues in Geospatial Data Visualization Multivariate Data : Point-Based Techniques - LineBased Techniques - Region-Based Techniques --Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT -IV INTERACTION CONCEPTS AND TECHNIQUES 9

Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations --Document Collection Visualizations -Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces-- A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space --Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations Interaction Control.

UNIT -V RESEARCH DIRECTIONS IN VISUALIZATIONS 9

Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation , Hardware and Applications

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the fundamental concepts related to visualization data
2. Learn foundations for visualization and become familiar with visualization techniques
3. Visualize the objects in different dimensions
4. Design and process the data for Visualization.
5. Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences
6. Apply the virtualization techniques for research projects.

REFERENCES:

1. Matthew Ward, Georges Grinstein and Daniel Keim, ¯Interactive Data Visualization Foundations, Techniques, Applications‖, 2010
2. Colin Ware, ¯Information Visualization Perception for Design‖, 2nd edition, Margon Kaufmann Publishers, 2004.
3. Robert Spence ¯Information visualization – Design for interaction‖, Pearson Education, 2 nd Edition, 2007.
4. Alexandru C. Telea, ¯Data Visualization: Principles and Practice,‖ A. K. Peters Ltd, 2008.

VERTICAL II: FULL STACK DEVELOPMENT

21IT1901	OPEN SOURCE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Understand the difference between open-source software and commercial software.
- Understand the policies, licensing procedures and ethics of FOSS.
- Understand open-source philosophy, methodology and ecosystem.
- Awareness with Open-Source Technologies
- Knowledge to start, manage open-source projects

UNIT - I INTRODUCTION 9

Introduction to Open-Source: Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

UNIT - II OPEN-SOURCE PRINCIPLES AND METHODOLOGY 9

Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization Licensing: What is a License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - III OPEN SOURCE PROJECT 9

Starting and maintaining own Open-Source Project, Open-Source Hardware, Open-Source Design, Open-source Teaching, Open-source media.Collaboration: Community and Communication, Contributing to OpenSource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student‘s choice

UNIT -IV UNDERSTANDING OPEN-SOURCE ECOSYSTEM 9

Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies.

UNIT -V OPEN SOURCE ETHICS & CASE STUDIES 9

Open Source Ethics – Open Vs Closed Source – Government – Ethics – Impact of Open source Technology – Shared Software – Shared Source.

Example Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, wordpress, GCC, GDB, github, Free BSD, Open Solaris, Open Office. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies.

Study: Understanding the developmental models, licensing, mode of funding, commercial/non- commercial use.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Differentiate between Open Source and Proprietary software and Licensing.
2. Understand the policies, licensing procedures and ethics of FOSS
3. Build and modify one or more Free and Open Source Software packages.
4. Recognize the applications, benefits and features of Open-Source Technologies
5. Contribute software to and interact with Free and Open Source Software development projects.
6. Gain knowledge to start, manage open-source projects.

TEXT BOOKS:

1. Kailash Vadera, Bhavyesh Gandhi, ¯Open Source Technology‖, Laxmi Publications Pvt Ltd 2012, 1st Edition.
2. Open Source Software, P.Rizwan Ahmed, Margham Publication, Chennai, 2015

REFERENCES:

1. Fadi P. Deek and James A. M. McHugh, ¯Open Source: Technology and Policy‖, Cambridge Universities Press 2009.
2. ¯Open-Source Technology‖, Kailash Vadera&Bhavyesh Gandhi, University Science Press, Laxmi Publications, 2009
3. Unix Concepts and Applications by Sumitabha Das, Tata McGraw Hill Education, 2006
4. The official Ubuntu Book, 8th Edition

5. ¯Perspectives on Free and Open-Source Software‖, Clay Shirky and Michael Cusumano, MIT press.
6. ¯Understanding Open Source and Free Software Licensing‖, Andrew M. St. Laurent, O'Reilly Media.
7. ¯Open Source for the Enterprise‖, Dan Woods, GautamGuliani, O'Reilly Media

8. Linux kernel Home: http://kernel.org4
9. Open-Source Initiative: https://opensource.org/5
10. The Linux Foundation: http://www.linuxfoundation.org/
11. The Linux Documentation Project: http://www.tldp.org/2
12. Docker Project Home: http://www.docker.com3.
13. Linux Documentation Project: http://www.tldp.org/6
14. Wikipedia: https://en.wikipedia.org/7.https://en.wikipedia.org/wiki/Wikipedia:Contributing_to_Wikipedia8
15. GitHub: https://help.github.com/9
16. The Linux Foundation: http://www.linuxfoundation.org/

21IT1902	APP DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT - I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 9

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design,

UNIT - II NATIVE APP DEVELOPMENT USING JAVA 9

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props

UNIT - III HYBRID APP DEVELOPMENT 9

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova,

UNIT -IV CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE 9

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT -V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Develop Native applications with GUI Components.
2. Develop hybrid applications with basic event handling.
3. Implement cross-platform applications with location and data storage capabilities.

4. Implement cross platform applications with basic GUI and event handling.
5. Develop web applications with cloud database access.
6. To gain in-depth Knowledge of Popular Frameworks, Server, APIs

TEXT BOOKS:

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, November 2021
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing, 2019.

REFERENCES:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition, 2018.
2. Native Mobile Development by Shaun Lewis, Mike Dunn, November 2019
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras, 2015
4. Apache Cordova 4 Programming, John M Wargo, 2015
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition, 2019

21CS1903	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT - II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT - III CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT -IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT -V CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand Cloud Service Management terminology, definition & concepts
2. Compare and contrast cloud service management with traditional IT service management
3. Build and automate business solutions using cloud technologies.
4. Identify strategies to reduce risk and eliminate issues associated with adoption of Cloud services
5. Select appropriate structures for designing, deploying and running cloud-based services In business environment
6. Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

TEXT BOOKS:

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications,2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad ,2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour,2017.

REFERENCES:

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

21IT1903	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT - I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking Brainstorming and Game storming Observational Empathy

UNIT - II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns Interaction Behaviors and Principles – Branding Style Guides

UNIT - III FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research User Needs and its Goals Know about Business Goals

UNIT -IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests Other Evaluative User Research Methods - Synthesizing Test Findings Prototype Iteration

UNIT -V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories -- Creating Scenarios - Flow Diagrams Flow Mapping Information Architecture

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the various Research Methods used in Design
2. Build UI for user Applications
3. Evaluate UX design of any product or application
4. Demonstrate UX Skills in product development
5. Implement Sketching principles

6. Create Wireframe and Prototype

TEXT BOOKS:

1. Joel Marsh, ¯UX for Beginners‖, O'Reilly , 2022
2. Jon Yablonski, ¯Laws of UX using Psychology to Design Better Product & Services‖ O'Reilly 2021

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, ¯Designing Interface‖ 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan ¯Refactoring UI‖, 2018
3. Steve Krug, ¯Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile‖, Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

21IT1904	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT - I FOUNDATIONS OF SOFTWARE TESTING 9

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT - II TEST PLANNING 9

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT - III TEST DESIGN AND EXECUTION 9

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT -IV ADVANCED TESTING CONCEPTS 9

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT -V TEST AUTOMATION AND TOOLS 9

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the basic concepts of software testing and the need for software testing
2. Design Test planning and different activities involved in test planning
3. Design effective test cases that can uncover critical defects in the application
4. Focus on wide aspects of testing
5. Understand multiple facets of testing
6. Automate the software testing using Selenium and TestNG

TEXT BOOKS:

1. Yogesh Singh, ¯Software Testing‖, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

REFERENCES:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman‘s Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing

21IT1905	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT - I FUNDAMENTALS OF WEB APPLICATION SECURITY 9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT - II SECURE DEVELOPMENT AND DEPLOYMENT 9

Web Applications Security Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT - III SECURE API DEVELOPMENT 9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT -IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT -V HACKING TECHNIQUES AND TOOLS 9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understanding the basic concepts of web application security and the need for it
2. Be acquainted with the process for secure development and deployment of web applications
3. Acquire the skill to design and develop Secure Web Applications that use Secure APIs
4. Be able to get the importance of carrying out vulnerability assessment and penetration testing
5. Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.
6. Using the acquired knowledge into practice for testing the vulnerabilities and identifying threats.

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw- Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES:

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

21IT1906	DEVOPS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT - I INTRODUCTION TO DEVOPS 9

Devops Essentials - Introduction to AWS, GCP, Azure Version control systems: Git and Github Gerrit Code review.

UNIT - II COMPILE AND BUILD USING MAVEN , GRADLE & ANT 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle – Introduction to ANT- Installation of ANT – Understand and Build using ANT.

UNIT - III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT -IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT -V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file Testing and Monitoring Selenium, Jira, ELK

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand different actions performed through Version control tools like Git.

2. Understand the various installation procedure of SDK
3. Ability to Perform Automated Continuous Deployment
4. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
5. Ability to do configuration management using Ansible
6. Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS:

1. Roberto Vormittag, ―A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises‖, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, ―Linux for Beginners: An Introduction to the Linux Operating System and Command Line‖, Kindle Edition, 2014

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, ―Ansible for DevOps: Server and configuration management for humans‖, First Edition, 2015
3. David Johnson, ―Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps‖, Second Edition, 2016.
4. Mariot Tsitoara, ―Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer‖, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

21IT1907	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT - I SYNTAX AND SEMANTICS 9

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing

UNIT - II DATA, DATA TYPES, AND BASIC STATEMENTS 9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control structures – selection – iterations – branching – guarded statements

UNIT - III SUBPROGRAMS AND IMPLEMENTATIONS 9

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping

UNIT -IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING 9

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling

UNIT -V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES 9

Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Describe syntax and semantics of programming languages
2. Explain data, data types, and basic statements of programming languages
3. Design and implement subprogram constructs
4. Apply object-oriented, concurrency, and event handling programming constructs and Develop programs in Scheme, ML, and Prolog
5. Understand and adopt new programming languages
6. Applying the programming Languages in creating various applications

TEXT BOOKS:

1. Robert W. Sebesta, ¯Concepts of Programming Languages‖, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, ¯Programming Language Pragmatics‖, Fourth Edition, Elsevier, 2018.
3. R. Kent Dybvig, ¯The Scheme programming language‖, Fourth Edition, Prentice Hall, 2011.
4. Jeffrey D. Ullman, ¯Elements of ML programming‖, Second Edition, Pearson, 1997.
5. W. F. Clocksin and C. S. Mellish, ¯Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.

VERTICAL III: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

21CS1901	CLOUD TOOLS AND TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To develop the cloud application using various programming model of Hadoop and Aneka

UNIT - I CLOUD PLATFORM ARCHITECTURE 9

Cloud Computing: Definition, Characteristics Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Architectural Design Challenges

UNIT - II VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE 9

Basics of Virtual Machines Taxonomy of Virtual Machines Virtualization – Management Virtualization – Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization Implementation levels of virtualization – Virtualization structure – Virtualization of CPU, Memory and I/O devices – Virtual clusters and Resource Management – Virtualization for data center automation

UNIT - III PAAS CLOUD PLATFORM 9

Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services- REST API- Blops

UNIT -IV AWS CLOUD PLATFORM – IAAS 9

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console Setting up AWS Storage - Stretching out with Elastic Compute Cloud Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager.

UNIT -V PROGRAMMING MODEL 9

Introduction to Hadoop Framework --Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Developing Map Reduce Applications Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Employ the concepts of virtualization in the cloud computing
2. Identify the architecture, infrastructure and delivery models of cloud computing
3. Deploy practical virtualization solution
4. Develop the Cloud Application in AWS platform
5. Apply concepts to design Cloud Applications
6. Develop services using various Cloud computing programming models.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, ―Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, ―The Docker Book‖, O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, ―Cloud security. A Comprehensive Guide to Secure Cloud Computing‖, Wiley Publishing, 2010.

REFERENCES:

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019 3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010
4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.

5. Danielle Ruest, Nelson Ruest, ¯Virtualization: A Beginner‟s Guide‖, McGraw - Hill Osborne Media, 2009. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
6. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010
7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
8. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

21CS1902 **VIRTUALIZATION**

L	T	P	C
3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT - I INTRODUCTION TO VIRTUALIZATION **9**

Virtualization and cloud computing-- Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization partial virtualization Paravirtualization-Types of Hypervisors

UNIT - II SERVER AND DESKTOP VIRTUALIZATION **9**

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform- Desktop Virtualization-Types of Desktop Virtualization

UNIT - III NETWORK VIRTUALIZATION **9**

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization- VLAN-WAN Architecture-WAN Virtualization

UNIT -IV STORAGE VIRTUALIZATION **9**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT -V VIRTUALIZATION TOOLS **9**

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box --IBM PowerVM-Google Virtualization- Case study.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

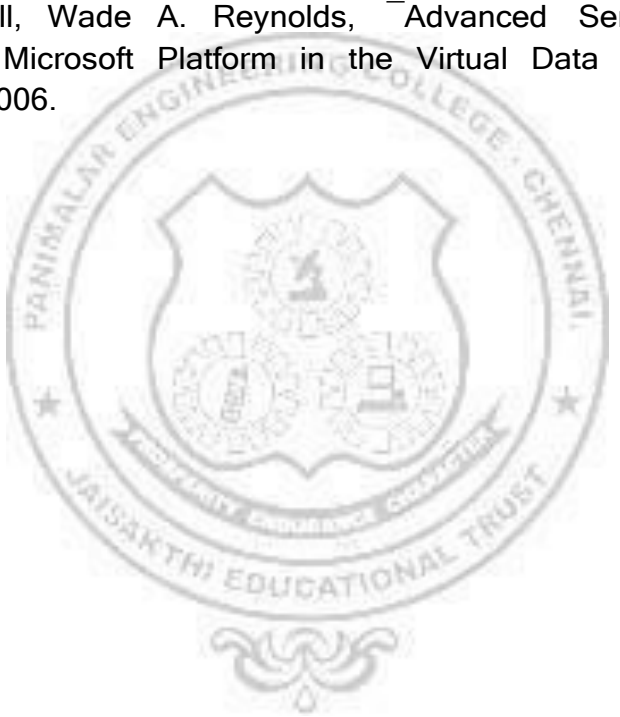
1. Understand the basics and types of Virtualization
2. Understand the Hypervisors and its types
3. Analyze the virtualization concepts for server and Desktop
4. Apply the Virtualization for real-world applications
5. Install & Configure the different VM platforms
6. Experiment with the VM with various software

TEXT BOOKS:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Dave McCrory , Advanced Server Virtualization: VMware and MicrosoftPlatform in the Virtual Data Center, Auerbach,2006
4. Chris Wolf, Erick M. Halter, ¯Virtualization: From the Desktop to the Enterprise‖, APress, 2005.

REFERENCES:

1. James E. Smith, Ravi Nair, ¯Virtual Machines: Versatile Platforms for Systems and Processes‖, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, ¯Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center‖, Auerbach Publications, 2006.



21CS1903	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT - II CLOUD SERVICES STRATEGY 9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT - III CLOUD SERVICE MANAGEMENT 9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT -IV CLOUD SERVICE ECONOMICS 9

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT -V CLOUD SERVICE GOVERNANCE & VALUE 9

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand Cloud Service Management terminology, definition & concepts
2. Compare and contrast cloud service management with traditional IT service management
3. Build and automate business solutions using cloud technologies.
4. Identify strategies to reduce risk and eliminate issues associated with adoption of Cloud services
5. Select appropriate structures for designing, deploying and running cloud-based services In business environment
6. Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

TEXT BOOKS:

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications,2020.
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad ,2013.
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour,2017.

REFERENCES:

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi

21CS1904	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT - I STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT - II INTELLIGENT STORAGE SYSTEMS AND RAID 9

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale- out storage Architecture- Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage.

UNIT - III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

FibreChannel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol,connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT -IV BACKUP, ARCHIVE AND REPLICATION 9

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).

UNIT -V SECURING STORAGE INFRASTRUCTURE 9

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
2. Illustrate the usage of advanced intelligent storage systems and RAID
3. Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
4. Examine the different role in providing disaster recovery and remote replication technologies
5. Discuss the different backup and recovery strategies
6. Infer the security needs and security measures to be employed in information storage management

TEXT BOOKS:

1. EMC Corporation, Information Storage and Management, Wiley, India,2012.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017.
3. Ulf Troppens,Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, Storage Networks Explained, Second Edition, Wiley, 2009

21CS1905	SITE RELIABILITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the organizational impact of introducing SRE
- To gain knowledge of how to develop service-level objectives from business objectives.
- To gain familiarity with incident and problem analysis.
- To explore the knowledge in the production system towards the monitoring of services.
- To gain insights into building incident management and scaling processes for better reliability and performance

UNIT - I INTRODUCTION **9**

Introduction to Site Reliability Engineering (SRE) - Tenets of SRE -- Production Environment – Hardware - Software Infrastructure- Development Environment - Sample Service - SRE and DevOps - Technology to support SRE -- Google SRE model

UNIT - II PRINCIPLES OF SRE **9**

Embracing Risk - Service Level Objectives - Monitoring Distributed Systems - Release Engineering – Simplicity Minimal APIs

UNIT - III EFFECTIVE SRE MANAGEMENT AND PRACTICES **9**

Practical Alerting from Time-Series Data Being On-Call Effective Troubleshooting - Emergency Response - Learn from the Past - Managing Incidents-- Postmortem Culture: Learning from Failure - Tracking Outages - Testing for Reliability Software Engineering in SRE

UNIT -IV LOAD BALANCING AND CRITICAL STATE MANAGEMENT **9**

Load Balancing at the Frontend - Load Balancing in the Datacenter -- Handling Overload - Addressing Cascading Failures-- Managing Critical State: Distributed Consensus for Reliability - Distributed Periodic Scheduling with Cron -- Data Processing Pipelines and Data Integrity

UNIT -V MANAGEMENT OF SRE **9**

Accelerating SREs to On-Call and Beyond – Interrupts handling Embedding an SRE to Recover from Operational Overload Communication and Collaboration in SRE - Evolving SRE Engagement Model - Availability Table Collection of Best Practices for Production Services - Example Incident State Document-- Example Postmortem Example Production Meeting Minutes

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the organizational impact of introducing SRE
2. Gain knowledge of how to develop service-level objectives from business objectives
3. Differentiate between service level agreement of user with organizational service level agreement
4. Become familiar with incident and problem analysis.
5. Become familiar with incident and problem analysis.
6. Confirm the scaling processes for better reliability and performance.

TEXT BOOKS:

1. Betsy Beyer, Chris Jones, Niall Richard Murphy, Jennifer Petoff, ―Site Reliability Engir
2. Heather Adkin Ana Oprea, Piotr Lewandowski, Reliable Systems‖, 2020
3. Betsy Beyer, N Kent Kawahara and Stephen Thorne

REFERENCES:

1. Enterprise R - Site Reliability Googleuserconte tic/pdf/enterprise-roadmap-to-sre.
2. Anatomy of an I ring - https://static.goo com/media/sre.g gineers.pdf
3. Incident M - Site Reliability Engineering - https://static. googleusercontent.com/media/sre.google/en//static/pdf/IncidentMeticsInSre.pdf

21CS1906	STREAM PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT - I FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT - II REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT - III DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT -IV EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API.

UNIT -V REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand data Processing terminology, definition & concepts
2. Understand the applicability and utility of different streaming algorithms.
3. Describe and apply current research trends in data-stream processing.
4. Analyze the suitability of stream mining algorithms for data stream systems.
5. Program and build stream processing systems, services and applications.
6. Solve problems in real-world applications that process data streams.

TEXT BOOKS:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication,2018
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media,2017
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing,2017

REFERENCES:

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

21IT1906	DEVOPS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT - I INTRODUCTION TO DEVOPS 9

Devops Essentials - Introduction to AWS, GCP, Azure Version control systems: Git and Github Gerrit Code review.

UNIT - II COMPILE AND BUILD USING MAVEN , GRADLE & ANT 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle – Introduction to ANT- Installation of ANT – Understand and Build using ANT.

UNIT - III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT -IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT -V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file Testing and Monitoring Selenium, Jira, ELK

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand different actions performed through Version control tools like Git.

2. Understand the various installation procedure of SDK
3. Ability to Perform Automated Continuous Deployment
4. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
5. Ability to do configuration management using Ansible
6. Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS:

1. Roberto Vormittag, ¯A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises‖, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, ¯Linux for Beginners: An Introduction to the Linux Operating System and Command Line‖, Kindle Edition, 2014

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, ¯Ansible for DevOps: Server and configuration management for humans‖, First Edition, 2015
3. David Johnson, ¯Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps‖, Second Edition, 2016.
4. Mariot Tsitoara, ¯Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer‖, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

21CS1907	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT - I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control Basic of cryptography Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT - II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing Comprehensive data protection End-to-end access control Common attack vectors and threats Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT - III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification --- Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options --OS Hardening and minimization Verified and measured boot Intruder Detection and prevention

UNIT -IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT -V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges Events and alerts Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the cloud concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Define cloud policy and Identity and Access Management.
4. Design cloud security patterns
5. Understand various risks and audit and monitoring mechanisms in the cloud.
6. Define the various architectural and design considerations for security in the cloud.

TEXT BOOKS:

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, ¯Cloud Computing:‖, Wiley 2013
2. Dave shackleford, ¯Virtualization Security‖, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, ¯Cloud Security and Privacy‖, OREILLY 2011

REFERENCES:

1. Mark C. Chu-Carroll ¯Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi,2013

VERTICAL IV: CYBER SECURITY AND DATA PRIVACY

		L	T	P	C
21IT1908	**ETHICAL HACKING**	**3**	**0**	**0**	**3**

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods
- To understand hacking options available in Web and wireless applications
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT - I INTRODUCTION **9**

Ethical Hacking Overview - Role of Security and Penetration Testers -- Penetration-Testing Methodologies- Laws of the Land Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing--- Network and Computer Attacks - Malware ProtectingAgainst Malware Attacks.- Intruder Attacks Addressing Physical Security

UNIT - II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS **9**

Footprinting Concepts-- Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence --- Footprinting through Social Engineering - Footprinting Tools-- Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques Scanning Beyond IDS and Firewall

UNIT - III ENUMERATION AND VULNERABILITY ANALYSIS **9**

Enumeration Concepts NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities-- Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT - IV SYSTEM HACKING **9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks Components of a Wireless Network – Wardriving- Wireless Hacking Tools of the Trade

UNIT - V NETWORK PROTECTION SYSTEMS **9**

Access Control Lists -- Cisco Adaptive Security Appliance Firewall Configuration and Risk Analysis Tools for Firewalls and Routers Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering Security Incident Response Teams – Honeypots.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To express knowledge on basics of computer based vulnerabilities
2. To gain understanding on different foot printing, reconnaissance and scanning methods.
3. To demonstrate the enumeration and vulnerability analysis methods
4. To gain knowledge on hacking options available in Web and wireless applications
5. To acquire knowledge on the options for network protection.
6. To use tools to perform ethical hacking to expose the vulnerabilities

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker‘s Handbook: Finding and Exploiting Security Flaws, DafyddStuttard and Marcus Pinto, 2011.

REFERENCES:

1. 1.Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

21IT1909	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices
- To understand and use forensics tools for Android devices.

UNIT - I INTRODUCTION TO DIGITAL FORENSICS 9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT - II DIGITAL CRIME AND INVESTIGATION 9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methodsfor Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT - III DIGITAL FORENSIC READINESS 9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT - IV iOS FORENSICS 9

Mobile Hardware and Operating Systems--iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT - V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools–Oxygen Forensics – MobilEdit – Android App Decompiling.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Have knowledge on digital forensics.
2. Know about digital crime and investigations.
3. Be forensic ready.
4. Investigate, identify and extract digital evidence from iOS devices.
5. Investigate, identify and extract digital evidence from Android devices.
6. Exploration of digital evidence using various OS

TEXT BOOKS:

1. Andre Arnes, ¯Digital Forensics‖, Wiley, 2018.
2. Chuck Easttom, ¯An In-depth Guide to Mobile Device Forensics‖, First Edition, CRCPress, 2022.

REFERENCES:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, CharlesRiver Media, 2005, ISBN: 1-58450-389.

21IT1910	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT - I FUNDAMENTALS OF SOCIAL NETWORKING 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, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT - II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT - III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 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, Big data and Privacy

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, What is Neo4j, Nodes, Relationships, Properties.

UNIT - V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Develop semantic web related simple applications
2. Address Privacy and Security issues in Social Networking
3. Explain the data extraction and mining of social networks
4. Explain the access control policies and identities for network services
5. Discuss the prediction of human behavior in social communities
6. Describe the applications of social networks

TEXT BOOKS:

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing, 2017
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, ¯Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling‖, IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer, 2009.

21IT1911	MODERN CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block ciphers and messageauthentication codes.

UNIT - I INTRODUCTION **9**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations

UNIT - II FORMAL NOTIONS OF ATTACKS **9**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM- CPA and NM- CCA2, Inter-relations among the attack model

UNIT - III RANDOM ORACLES **9**

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF)

UNIT - IV BUILDING A PSEUDORANDOM PERMUTATION **9**

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT - V MESSAGE AUTHENTICATION CODES **9**

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes:One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. FormallyAnalyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authenticatio
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Express the use of Message Authentication Codes.
6. Identify the modern cryptographic methods in implementing a closed network with authentication

TEXT BOOKS:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications,Springer Verlag, 2002.
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low PricedEdition), 2016.
3. Introduction to Modern Cryptography: Principles and Protocols (Chapman & Hall/CRCCryptography and Network Security Series), 2007

REFERENCES:

1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available athttp://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced EditionAvailable),Part 1 and Part 23, 2009.
3. William Stallings, ¯Cryptography and Network Security: Principles and Practice‖, PHI 3rdEdition, 2006

21IT1912	ENGINEERING SECURE SOFTWARE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

UNIT-I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS **9**

Software Assurance and Software Security - Threats to software security Sources of software insecurity - Benefits of Detecting Software Security--- Properties of Secure Software – Memory- Based Attacks: Low-Level Attacks Against Heap and Stack Defense Against Memory-Based Attacks

UNIT-II SECURE SOFTWARE DESIGN **9**

Requirements Engineering for secure software -- SQUARE process Model Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection Session Hijacking. Secure Design Threat Modeling and Security Design Principles.

UNIT-III SECURITY RISK MANAGEMENT **9**

Risk Management Life Cycle - Risk Profiling - Risk Exposure Factors - Risk Evaluation and Mitigation - Risk Assessment Techniques - Threat and Vulnerability Management.

UNIT-IV SECURITY TESTING **9**

Traditional Software Testing – Comparison Secure Software Development Life Cycle Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping Enumeration – Remote Exploitation – Web Application Exploitation Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection Tools for Penetration Testing.

UNIT-V SECURE PROJECT MANAGEMENT **9**

Governance and security - Adopting an enterprise software security framework Security and project management Maturity of Practice

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Identify various vulnerabilities related to memory attacks.
2. Apply security principles in software development.
3. Evaluate the extent of risks.
4. Involve selection of testing techniques related to software security in the

testingphase of software development.

5. Use tools for securing software.
6. Justify the adopted security testing in the created application

TEXTBOOKS:

1. Julia H. Allen, ¯Software Security Engineering‖, Pearson Education, 2008
2. Evan Wheeler, ¯Security Risk Management: Building an Information Security Risk Management Program from the Ground Up‖, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, ¯The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)‖, Addison-Wesley Professional,2006

REFERENCES:

1. Robert C. Seacord, ¯Secure Coding in C and C++ (SEI Series in Software Engineering)‖, Addison-Wesley Professional, 2005.
2. Jon Erickson, ¯Hacking: The Art of Exploitation‖, 2nd Edition, No Starch Press, 2008.
3. Mike Shema, ¯Hacking Web Apps: Detecting and Preventing Web Application Security Problems‖, First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, ¯Web Application Security, A Beginner's Guide‖, Kindle Edition, McGraw Hill, 2012
5. Lee Allen, ¯Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)‖, Kindle Edition, Packt Publishing,2012
6. Jason Grembi, Secure Software Development: A Security Programmer's Guide, 2008.

21IT1913	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT-I INTRODUCTION TO BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT-II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT-III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopolyproblem- Proof of Stake- Proof of Burn - Proof of Elapsed Time -- Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT-IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT-V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practicein the crypto currency domain.
3. Understand the function of Blockchain as a method of securingdistributed ledgers, howconsensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Apply security features in blockchain technologies.

6. Be familiar with existing and potential applications of blockchain technology

TEXTBOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography,Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, ¯Mastering Bitcoin: Unlocking Digital Cryptocurrencies‖,O'Reilly, 2014.

REFERENCES:

1. Daniel Drescher, ¯Blockchain Basics‖, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton UniversityPress, 2016.
3. Melanie Swan, ¯Blockchain: Blueprint for a New Economy‖, O'Reilly, 2015
4. Ritesh Modi, ¯Solidity Programming Essentials: A Beginner's Guide to Build Smart Contractsfor Ethereum and Blockchain‖, Packt Publishing, 2018.
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

21IT1914	CYBER PHYSICAL SYSTEMS SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn about design of cyber-physical systems.
- To know about MATLAB usage.
- To learn about analysis of cyber-physical systems.
- How to implement safety assurance in these systems.
- To do the software analysis
- To know basic security measures to take in Cyber-Physical Systems

UNIT-I INTRODUCTION TO CYBER-PHYSICAL SYSTEMS 9

Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, Industry 4.0, AutoSAR, IIOT implications, Building Automation, Medical CPS.

UNIT-II CPS - PLATFORM COMPONENTS 9

CPS Platform components: CPS HW platforms Processors, Sensors, Actuators, CPS Network WirelessHart, CAN, Automotive Ethernet, CPS Sw stack – RTOS, Scheduling Real Time control tasks Principles of Automated Control Design: Dynamical Systems and Stability Controller Design Techniques, Stability Analysis: CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise.

UNIT-III USING MATLAB 9

Matlab toolboxes Simulink, Stateflow CPS implementation: From features to software components, Mapping software components to ECUs, CPS Performance Analysis effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion

UNIT-IV CPS SAFETY ASSURANCE AND SOFTWARE ANALYSIS 9

Formal Methods for Safety Assurance of Cyber-Physical Systems: Advanced Automata based modeling and analysis, Basic introduction, and examples, Timed and Hybrid Automata, Definition of trajectories, Formal Analysis: Flow pipe construction, reachability analysis Analysis of CPS Software: Weakest Pre-conditions, Bounded Model checking, CPS SW Verification: Frama-C, CBMC Secure Deployment of CPS: Attack models, Secure Task mapping and Partitioning, State estimation for attack detection Automotive Case study: Vehicle ABS hacking Power Distribution Case study: Attacks on Smart Grids

UNIT-V CPS SECURITY 9

CPS vulnerabilities, threats, attacks & failures, CPS security threats, CPS vulnerabilities, Cyberphysical system attacks, CPS failures, Evaluating risks, Securing CPS, CPS security challenges, CPS security solutions, CPS forensics, Limitations, CPS protection recommendations

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the core principles behind CPS.
2. Identify safety specifications and critical properties.
3. Understand abstraction in system designs.
4. Express pre and post conditions and invariants for CPS models.
5. Identify CPS security threats and do the software analysis.
6. Justify the basic security measures in Cyber-Physical Systems ensuring security technologies

TEXTBOOKS:

1. Raj Rajkumar, Dionisio De Niz , and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2017.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.

REFERENCES:

1. André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex Dynamics., Springer, 2010. 426 pages,ISBN 978-3-642-14508-7.
2. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, The publisher, Paul Temme, 2011.
3. Jean-Paul A. Yaacoub, Ola Salman, Hassan N. Noura, NesrineKaaniche, Ali Chehab, Mohamad Malli, "Cyber-physical systems security: Limitations, issues and future trends", Microprocessors and Microsystems, Vol 77, 2020, ISSN 0141-9331 (Unit 5)
4. Sajal Das, Krishna Kant, and Nan Zhang, ¯Handbook on Securing Cyber-Physical CriticalInfrastructure - Foundations & Challenges‖, Morgan Kaufmann, 2012.
5. Awad, A.I., Furnell, S., Paprzycki, M., Sharma, S.K., Security in Cyber-Physical Systems Foundations and Applications, Springer International Publishing, 2021

21CS1907	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT-I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of cryptography --- Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT-II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats -- Network and Storage - Secure Isolation Strategies Virtualization strategies Inter-tenant network segmentation strategies-- Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT-III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification ---- Authentication and Authorization - Roles-based Access Control Multi-factor authentication - Single Sign-on, Identity Federation -- Identity providers and service consumers - Storage and network access control options-- OS Hardening and minimization Verified and measured boot Intruder Detection and prevention

UNIT-IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT-V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges Events and alerts Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

TOTAL:45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the cloud concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Define cloud policy and Identity and Access Management.
4. Design cloud security patterns

5. Understand various risks and audit and monitoring mechanisms in the cloud.
6. Define the various architectural and design considerations for security in the cloud.

TEXTBOOKS:

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, ¯Cloud Computing:‖, Wiley 2013
2. Dave shackleford, ¯Virtualization Security, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, ¯Cloud Security and Privacy‖, OREILLY 2011

REFERENCES:

1. Mark C. Chu-Carroll ¯Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya,Christian Vechhiola, S. ThamaraiSelvi,2013

VERTICAL V : CREATIVE MEDIA TECHNOLOGIES

21CS1908	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in thedevelopment of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT - I INTRODUCTION 9

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT - II VR MODELING 9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT - III VR PROGRAMMING 9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT -IV APPLICATIONS 9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT -V **AUGMENTED REALITY** **9**

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation- Navigation-Wearable devices

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basic concepts of AR and VR
2. Understand the tools and technologies related to AR/VR
3. Understand the graphical processing units and their architectures.
4. Know the working principle of AR/VR related Sensor devices
5. Design of various models using modeling techniques
6. Develop AR/VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, ¯Virtual Reality Blueprints: Create compelling VR experiences for mobile‖, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, ¯Augmented Reality: Principles & Practice‖, Addison Wesley, 2016

REFERENCES:

1. John Vince, ¯Introduction to Virtual Reality‖, Springer-Verlag, 2004.
2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design‖, Morgan Kaufmann, 2003.

21CS1909	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT - I INTRODUCTION TO MULTIMEDIA 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT - II MULTIMEDIA FILE FORMATS AND STANDARDS 9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT - III MULTIMEDIA AUTHORING 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools,Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools,audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning,simulations.

UNIT -IV ANIMATION 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT -V MULTIMEDIA APPLICATIONS 9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

TOTAL: 45 PERIODS

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

1. Get the bigger picture of the context of Multimedia and its applications

2. Use the different types of media elements of different formats on content pages
3. Author 2D and 3D creative and interactive presentations for different target multimedia applications.
4. Use different standard animation techniques for 2D, 21/2 D, 3D applications for the mobile UI
5. Explore different popular applications of multimedia
6. Understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia‖, Third Edition, Springer Texts in Computer Science, 2021.

REFERENCES:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, ¯Multimedia Computing‖, Cambridge University Press, 2018.
3. Prabhat K.Andleigh, Kiran Thakrar, ¯Multimedia System Design‖, Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, ¯Multimedia Cloud Computing Systems‖, Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, ¯3D Graphics and Animation‖, Second Edition, New Riders, 2002.
6. Rogers David, ¯Animation: Master – A Complete Guide (Graphics Series)‖, Charles River Media, 2006.
7. Rick parent, ¯Computer Animation: Algorithms and Techniques‖, Morgan Kauffman, 3rd Edition, 2012.
8. Emilio Rodriguez Martinez, Mireia Alegre Ruiz, ¯UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native‖, Packt Publishing, 2022.

21CS1910	VIDEO CREATION AND EDITING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording.
- To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT - I FUNDAMENTALS 9

Evolution of filmmaking - linear editing - non-linear digital video--- Economy of Expression risks associated with altering reality through editing.

UNIT - II STORYTELLING 9

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files media management.

UNIT - III USING AUDIO AND VIDEO 9

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT -IV WORKING WITH FINAL CUT PRO 9

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects --Advanced Editing and Training Techniques - Working with Audio Using Media Tools Viewing and Setting Preferences.

UNIT -V WORKING WITH AVID XPRESS DV 4 9

Starting Projects and Working with Project Window Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode Working with Audio Output Options.

TOTAL: 45 PERIODS

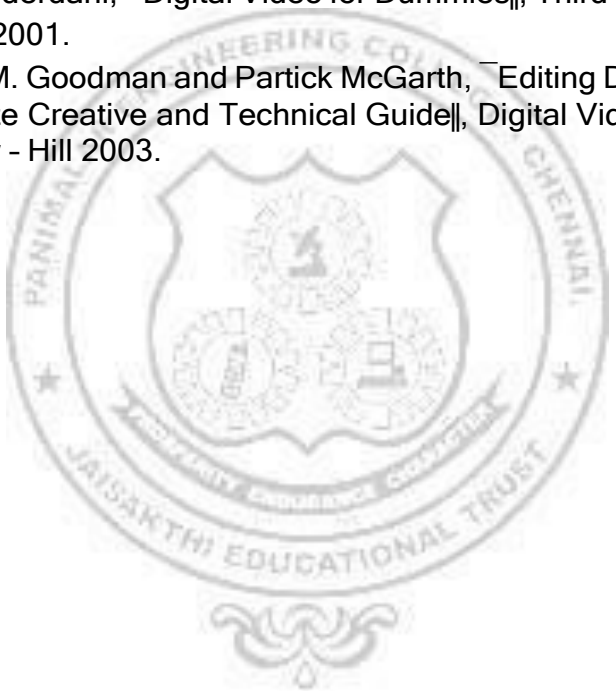
OUTCOMES:

On completion of the course, the students will be able to:

1. Compare the strengths and limitations of Nonlinear editing.
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Apply different media tools.
5. Address the core issues of advanced editing and training techniques.
6. Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS:

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, ¯Digital Video for Dummies‖, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, ¯Editing Digital Video: The Complete Creative and Technical Guide‖, Digital Video and Audio, McGraw – Hill 2003.



21IT1903	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT - I FOUNDATIONS OF DESIGN 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking Brainstorming and Game storming Observational Empathy

UNIT - II FOUNDATIONS OF UI DESIGN 9

Visual and UI Principles - UI Elements and Patterns Interaction Behaviors and Principles – Branding Style Guides

UNIT - III FOUNDATIONS OF UX DESIGN 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research User Needs and its Goals Know about Business Goals

UNIT -IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes Responsive Design – Wireframing Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools

- Interaction Patterns - Conducting Usability Tests-- Other Evaluative User Research Methods Synthesizing Test Findings Prototype Iteration

UNIT -V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories -- Creating Scenarios - Flow Diagrams Flow Mapping Information Architecture

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:

1. Understand the various Research Methods used in Design
2. Build UI for user Applications
3. Evaluate UX design of any product or application
4. Demonstrate UX Skills in product development
5. Implement Sketching principles

6. Create Wireframe and Prototype

TEXT BOOKS:

1. Joel Marsh, ¯UX for Beginners‖, O'Reilly , 2022
2. Jon Yablonski, ¯Laws of UX using Psychology to Design Better Product & Services‖ O'Reilly 2021

REFERENCES:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, ¯Designing Interface‖ 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan ¯Refactoring UI‖, 2018
3. Steve Krug, ¯Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile‖, Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

21CS1911	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To examine and explore the role and importance ofdigital marketing in today's rapidly changing business environment.
- Focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT - I INTRODUCTION TO ONLINE MARKET 9

Online Market space- Digital Marketing Strategy- Components-- Opportunities for building Brand Website Planning and Creation Content Marketing.

UNIT - II SEARCH ENGINE OPTIMISATION 9

Search Engine optimisation - Keyword Strategy- SEO Strategy --SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising----Display Advertisement

UNIT - III E- MAIL MARKETING 9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT -IV SOCIAL MEDIA MARKETING 9

Social Media Marketing Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers Influencer Marketing.

UNIT -V DIGITAL TRANSFORMATION 9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

1. Examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
2. To know the key elements of a digital marketing strategy.
3. Focuses on how digital marketing can be utilized by organizations

4. Study how the effectiveness of a digital marketing campaign can be measured
5. Undertand social media marketing
6. Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition , 2017;ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press, 2015, ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition, 2017; ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Ryan, D.,2014, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited,2014.
5. Barker, Barker, Bormann and Neher, Social Media Marketing: A Strategic Approach,2E South-Western ,Cengage Learning,2017.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education,2015.

21CS1912	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the art vfx techniques
- To become familiar with popular compositing techniques

UNIT - I ANIMATION BASICS 9

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT - II CGI, COLOR, LIGHT 9

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT - III SPECIAL EFFECTS 9

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNIT -IV VISUAL EFFECTS TECHNIQUES 9

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT -V COMPOSITING 9

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the student will be able to:

1. Implement animation in 2D / 3D following the principles and techniques
2. Use CGI, color and light elements in VFX applications
3. Create special effects using any of the state of the art tools
4. Apply popular visual effects techniques using advanced tools
5. Use compositing tools for creating VFX for a variety of applications

6. Understand the state of the art vfx techniques

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCES:

1. Jon Gress, ―Digital Visual Effects and Compositing‖, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics‖, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, ―Introduction to Visual Effects A Computational Approach‖, Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, ―Lighting for Animation: The art of visual storytelling
, Routledge, 1st Edition, 2016.
5. Eran Dinur, ―The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, ― The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures‖, Third Edition, 2020.and Games‖, Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

21CS1913 **GAME DEVELOPMENT**

L	T	P	C
3	0	0	3

OBJECTIVES : To impart Knowledge on the following topics:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT - I **3D GRAPHICS FOR GAME DESIGN** **9**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT - II **GAME DESIGN PRINCIPLES** **9**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT - III **GAME ENGINE DESIGN** **9**

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT -IV **OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS** **9**

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT -V **GAME DEVELOPMENT USING PYGAME** **9**

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:

1. Explain the concepts of 2D and 3d Graphics
2. Understand the stages of game development
3. Design game design documents.
4. Implementation of gaming engines.
5. Survey gaming environments and frameworks.
6. Implement a simple game in Pygame.

TEXT BOOKS:

1. Sanjay Madhav, ―Game Programming Algorithms and Techniques: A Platform Agnostic Approach‖, Addison Wesley,2013.
2. David H. Eberly, ―3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, CRC Press,2006.
3. Will McGugan, ―Beginning Game Development with Python and Pygame: From Novice to Professional‖, Apress,2007.

REFERENCES:

1. Paul Craven, ―Python Arcade games‖, Apress Publishers,2016.
2. Jung Hyun Han, ―3D Graphics for Game Programming‖, Chapman and Hall/CRC, 2011.

21CS1914	MULTIMEDIA DATA COMPRESSION AND STORAGE	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of compression techniques
- To understand the categories of compression for text, image and video
- To explore the modalities of text, image and video compression algorithms
- To know about basics of consistency of data availability in storage devices
- To understand the concepts of data streaming services

UNIT - I BASICS OF DATA COMPRESSION 9

Introduction – Lossless and Lossy Compression- Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications

UNIT - II IMAGE COMPRESSION 9

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications Facsimile encoding

UNIT - III VIDEO COMPRESSION 9

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.

UNIT -IV DATA PLACEMENT ON DISKS 9

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system

UNIT -V DISK SCHEDULING METHODS 9

Scheduling methods for disk requests – Feasibility conditions of concurrent streams- Scheduling methods for request streams

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able to:

1. Understand the basics of text, Image and Video compression
2. Understand the categories of compression for text, image and video
3. Understand the various compression algorithms for multimedia content
4. Explore the applications of various compression techniques
5. Explore knowledge on multimedia storage on disks
6. Understand scheduling methods for request streams

TEXT BOOKS:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCES:

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition, 2009

VERTICAL VI: EMERGING TECHNOLOGIES

21CS1908	AUGMENTED REALITY/VIRTUAL REALITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT - I INTRODUCTION 9

Introduction to Virtual Reality and Augmented Reality - Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality - Components of VR System – Introduction to AR-AR Technologies-Input Devices - 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT - II VR MODELING 9

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT - III VR PROGRAMMING 9

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT -IV APPLICATIONS 9

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT -V AUGMENTED REALITY 9

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation- Navigation-Wearable devices

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the basic concepts of AR and VR
2. Understand the tools and technologies related to AR/VR
3. Understand the graphical processing units and their architectures.
4. Know the working principle of AR/VR related Sensor devices
5. Design of various models using modeling techniques
6. Develop AR/VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, ¯Virtual Reality Blueprints: Create compelling VR experiences for mobile‖, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, ¯Augmented Reality: Principles & Practice‖, Addison Wesley, 2016

REFERENCES:

1. John Vince, ¯Introduction to Virtual Reality‖, Springer-Verlag, 2004.
2. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design‖, Morgan Kaufmann, 2003.

21CS1915	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT - I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation Benefits of RPA Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT - II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT - III APP INTEGRATION, RECORDING AND SCRAPING 9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT -IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT -V DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors Open Source RPA, Future of RPA

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course, the students will be able to

1. Understand the basic concepts of Robotic Process Automation.
2. Enunciate the key distinctions between RPA and existing automation techniques and platforms.
3. Use UiPath to design control flows and work flows for the target process
4. Implement recording, web scraping andprocess mining by automation
5. Use UIPath Studio to detect, and handle exceptions in automation processes
6. Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , ¯The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems‖, Apress publications, 2020.

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, ¯Robotic Process Automation Rpa A Complete Guide ¯, 2020

21AD1918	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

UNIT - I INTRODUCTION 9

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT - II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 9

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT - III THIRD-GENERATION NEURAL NETWORKS 9

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-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 DEEP FEEDFORWARD 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 -V RECURRENT NEURAL NETWORKS 9

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders, LSTM networks.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning
5. Use the key computations to build and train deepneural networks for various tasks.
6. Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ¯Deep Learning‖, MIT Press, 2016.
2. Francois Chollet, ¯Deep Learning with Python‖, Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, ¯Hands-On Machine Learning with Scikit-Learn and TensorFlow‖, Oreilly, 2018.
2. Josh Patterson, Adam Gibson, ¯Deep Learning: A Practitioner‘s Approach‖, O‘Reilly Media, 2017.
3. Charu C. Aggarwal, ¯Neural Networks and Deep Learning: A Textbook‖, Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, ¯Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications‖, PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, ¯Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003.

21IT1915	CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To learn cybercrime and cyber law.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack.

UNIT - I INTRODUCTION 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT - II ATTACKS AND COUNTERMEASURES 9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT - III RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT -IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT -V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL: 45 PERIODS

OUTCOMES: On successful completion of this course, the student will be able to

1. Explain the basics of cyber security, cyber crime and cyber law
2. Classify various types of attacks and learn the tools to launch the attacks
3. Apply various tools to perform information gathering
4. Apply intrusion techniques to detect intrusion
5. Apply intrusion prevention techniques to prevent intrusion
6. Design and explore the firewalls to defined networks

TEXT BOOKS:

1. Anand Shinde, ―Introduction to Cyber Security Guide to the World of Cyber Security‖, Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, ―Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives‖, Wiley Publishers, 2011
3. https://owasp.org/www-project-top-ten/

REFERENCES:

1. David Kim, Michael G. Solomon, ―Fundamentals of Information Systems Security‖, Jones & Bartlett Learning Publishers, 2013
2. Kimberly Graves, ―CEH Official Certified Ethical hacker Review Guide‖, Wiley Publishers, 2007
3. Kimberly Graves, ―CEH Official Certified Ethical hacker Review Guide‖, Wiley Publishers, 2007
4. William Stallings, Lawrie Brown, ―Computer Security Principles and Practice‖, Third Edition, Pearson Education, 2015
5. Georgia Weidman, ―Penetration Testing: A Hands-On Introduction to Hacking‖, No Starch Press, 2014 (Lab)

21CS1916	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT - I QUANTUM COMPUTING BASIC CONCEPTS 9

Complex Numbers - Linear Algebra - Matrices and Operators --Global Perspectives Postulates of Quantum Mechanics – Quantum Bits Representations of Qubits – Superpositions

UNIT - II QUANTUM GATES AND CIRCUITS 9

Universal logic gates - Basic single qubit gates - Multiple qubit gates -- Circuit development Quantum error correction

UNIT - III QUANTUM ALGORITHMS 9

Quantum parallelism - Deutsch's algorithm - The Deutsch-Jozsa algorithm -- Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

UNIT -IV QUANTUM INFORMATION THEORY 9

Data compression - Shannon's noiseless channel coding theorem Schumacher's quantum noiseless channel coding theorem --Classical information over noisy quantum channels

UNIT -V QUANTUM CRYPTOGRAPHY 9

Classical cryptography basic concepts - Private key cryptography Shor's Factoring Algorithm - Quantum Key Distribution - BB84 Ekart 91

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to

1. Understand the background of classical computing and quantum computing.
2. Gain knowledge about the basic hardware and mathematical models of quantumcomputation.
3. Understand the background of Quantum Mechanics.
4. Analyze the computation models
5. Model the circuits using quantum computation,environments and frameworks.

6. Understand the quantum operations such as noise and error-correction.

TEXT BOOKS:

1. Parag K Lala, Mc Graw Hill Education, ¯Quantum Computing, A Beginners Introduction‖, First edition, 2020.
2. Michael A. Nielsen, Issac L. Chuang, ¯Quantum Computation and Quantum Information‖, Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition, 2020, ¯Quantum Computingfor Everyone‖.

REFERENCES:

1. Scott Aaronson, ¯Quantum Computing Since Democritus‖, Cambridge University Press, 2013.
2. N. David Mermin, ¯Quantum Computer Science: An Introduction‖, Cambridge University Press, 2007.

21IT1913	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT - I INTRODUCTION TO BLOCKCHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT - II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT - III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT -IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT -V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:

1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Understand the function of Blockchain as a method of securingdistributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

5. Apply security features in blockchain technologies.
6. Be familiar with existing and potential applications of blockchain technology

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. 2.Andreas Antonopoulos, ¯Mastering Bitcoin: Unlocking Digital Cryptocurrencies‖, O'Reilly, 2014.

REFERENCES:

1. Daniel Drescher, ¯Blockchain Basics‖, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, ¯Blockchain: Blueprint for a New Economy‖, O'Reilly, 2015
4. Ritesh Modi, ¯Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain‖, Packt Publishing, 2018.
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

21CS1913	GAME DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES : To impart Knowledge on the following topics:

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

UNIT - I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT - II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT - III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT -IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT -V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL: 45 PERIODS

OUTCOMES: On completion of the course, the students will be able to:

1. Explain the concepts of 2D and 3d Graphics
2. Understand the stages of game development
3. Design game design documents.
4. Implementation of gaming engines.
5. Survey gaming environments and frameworks.

6. Implement a simple game in Pygame.

TEXT BOOKS:

1. Sanjay Madhav, ―Game Programming Algorithms and Techniques: A Platform Agnostic Approach‖, Addison Wesley,2013.
2. David H. Eberly, ―3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, CRC Press,2006.
3. Will McGugan, ―Beginning Game Development with Python and Pygame: From Novice to Professional‖, Apress,2007.

REFERENCES:

1. Paul Craven, ―Python Arcade games‖, Apress Publishers,2016.
2. Jung Hyun Han, ―3D Graphics for Game Programming‖, Chapman and Hall/CRC, 2011.

21CS1917	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: To impart Knowledge on the following topics:

- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

UNIT - I INTRODUCTION 9

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

UNIT - II 3D PRINTING PRINCIPLES 9

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection Processes, applications, limitations;

UNIT - III INKJET TECHNOLOGY 9

Printer Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet; Powder based fabrication – Colourjet.

UNIT -IV LASER TECHNOLOGY 9

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures;

UNIT -V INDUSTRIAL APPLICATIONS 9

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

TOTAL: 45 PERIODS

OUTCOMES: At the end of this course, the students will be able to:

1. Outline and examine the basic concepts of 3D printing technology
2. Explain the principles of 3D printing technique
3. Outline 3D printing workflow
4. Explain and categorize the concepts and working principles of 3D printing using inkjet technique
5. Explain and categorize the working principles of 3D printing using laser technique

6. Explain various method for designing and modeling for industrial applications

TEXT BOOKS:

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014

VERTICAL V WIRELESS NETWORKS AND IOT

		L	T	P	C
21EC1929	**WIRELESS NETWORKS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To understand the concept about Wireless networks, protocol stack and standards.
- To understand and analyze the network layer solutions for Wireless networks.
- To study about fundamentals of 3G Services, its protocols and applications.
- To have in depth knowledge on internetworking of WLAN and WWAN.
- To learn about evolution of 4G Networks, its architecture and applications.

UNIT - I WIRELESS LAN 9

Introduction-WLAN technologies: IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, Wireless HART.

UNIT - II MOBILE NETWORK LAYER 9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP.

UNIT - III 3G OVERVIEW 9

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

UNIT - IV INTERNETWORKING BETWEEN WLANS AND WWANS 9

Internetworking objectives: and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

UNIT - V 4G & BEYOND 9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the key concepts of wireless networks, standards, technologies and their basic operations.
2. Analyze the network layer solutions for wireless networks.
3. Familiarize with the fundamentals of 3G Services, its protocols and applications.
4. Acquainted with in depth knowledge on internetworking of WLAN and WWAN.
5. Learn about evolution of 4G Networks, its architecture and applications.
6. Implement different type of applications for smart phones and mobile devices with latest network strategies.

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communication", Second Edition, Pearson Education 2012.
2. Vijay Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.

REFERENCES:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband‖, Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin, Michael Moher, David Koilpillai, ¯Modern Wireless Communications‖, First Edition, Pearson Education 2013.

21EC1930	AD-HOC AND WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Ad hoc network and Sensor Network fundamentals.
- To understand the different routing protocols.
- To have an in-depth knowledge on sensor network architecture and design issues.
- To understand the transport layer and security issues possible in Ad hoc networks.
- To understand the transport layer and security issues possible in Sensor networks.
- To have an exposure to mote programming platforms and tools.

UNIT - I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS 9

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols Destination Sequenced Distance Vector (DSDV), On-Demand Routing protocols –Ad hoc On-Demand Distance Vector Routing (AODV).

UNIT - II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES 9

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture-- Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT - III WSN NETWORKING CONCEPTS AND PROTOCOLS 9

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols - LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT - IV SENSOR NETWORK SECURITY 9

Network Security Requirements, Issues and 6r Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack, Key Distribution and Management, Secure Routing SPINS, reliability requirements in sensor networks.

UNIT - V SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Know the basics of Ad hoc networks and Wireless Sensor Networks.
2. Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement.
3. Apply the knowledge to identify appropriate physical and MAC layer protocols
4. Understand the transport layer and security issues possible in Ad hoc and sensor networks.
5. Be familiar with the OS used in Wireless Sensor Networks.
6. Gain knowledge to build basic modules.

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004.
2. HolgerKarl , Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006.

REFERENCES:

1. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Elsevier publication, 2004.
2. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, “Wireless sensor networks: a survey”, computer networks, Elsevier, 2002, 394 - 422.

21EC1931	COOPERATIVE COMMUNICATIONS AND NETWORKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the key concepts of Cooperative communications protocols.
- To learn about the concepts of multi node Cooperative communications.
- To understand the concepts of differential modulations for various cooperative communications.
- To bring out the concepts of cooperative networks.
- To present the application of cooperative networks in broadband communication.

UNIT - I COOPERATIVE COMMUNICATIONS WITH SINGLE RELAY 9

Cooperative communications, Cooperation protocols, System model, SER analysis for DF protocol, SER analysis for AF protocol, Comparison of DF and AF cooperation gains, Trans-modulation in relay communications

UNIT - II MULTI-NODE COOPERATIVE COMMUNICATIONS 9

Multi-node decode-and-forward protocol, Multi-node amplify-and-forward protocol, Distributed space-time coding (DSTC), Distributed space-frequency coding (DSFC)

UNIT - III DIFFERENTIAL MODULATION FOR COOPERATIVE COMMUNICATIONS 9

Differential modulation, Differential modulations for DF cooperative communications, Differential modulation for AF cooperative communications

UNIT - IV COOPERATIVE NETWORKING 9

Cognitive multiple access via cooperation - System model, CCMA protocols, Stability analysis, Throughput region, Delay analysis; Content-aware cooperative multiple access - System model, protocol, Dynamic state model, Performance analysis.

UNIT - V BROADBAND COOPERATIVE COMMUNICATIONS AND COVERAGE EXPANSION 9

System model, Cooperative protocol and relay-assignment scheme, Performance analysis, Performance lower bound and Optimum relay location.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the key concepts of Cooperative communications.
2. Learn about the concepts of multi node Cooperative communications.
3. Understand the concepts of differential modulations for cooperative communications.
4. Understand about cooperative networks.
5. Apply the Cooperative communication and networking concepts to broadband communications.
6. Able to develop various networks to expand coverage area.

TEXT BOOKS:

1. K.j.Ray liu, Ahmed k.Sadek, weifeng Su and Andres kwasinski “Cooperative Communications and Networking” Cambridge University Press, 2009.

REFERENCES:

1. Y.-W. Peter Hong , Wan-Jen Huang , C.-C. Jay Kuo., “Cooperative Communications and Networking: Technologies and System Design”,Kindle Edition, 2010.
2. Gerhard kramer, Ivana maric and Roy D, “Cooperative Communications (Foundations and Trends in Networking)” , Ebook PDF, Kindle Edition, in 2006.

21EC1932	IOT AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the fundamentals of IoT.
- To bring the IoT perspective in thinking and building solutions using Arduino and Raspberry pi.
- To provide overview of applications of IoT and relevant technologies.
- To explore various components of the Internet of things such as Sensors, internetworking and cyber space.
- To be able to design and implement IoT circuits and solutions.

UNIT - I INTRODUCTION TO IOT SYSTEMS 9

Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

UNIT - II M2M FOR IOT 9

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.

UNIT - III M2M VS IOT AN ARCHITECTURAL OVERVIEW 9

Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

UNIT - IV IOT REFERENCE ARCHITECTURE 9

Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world-Introduction, Technical design Constraints.

UNIT - V DOMAIN SPECIFIC APPLICATIONS OF IoT 9

Home automation, Industry applications, Surveillance applications, Other IoT applications. Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Articulate IoT sensing and actuation methods and physical design of IoT systems.
2. Interpret the M2M architecture for IoT.
3. Relate architecture overview of IoT systems.
4. Infer knowledge on IoT reference architecture.
5. Memorize various application of domain specific IoT system.
6. Able to develop various projects related to IoT.

TEXT BOOKS:

1. 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", 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.

REFERENCES:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
2. Cuno Pfister, "Getting Started with the Internet of Things", O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

21EC1933	IoT BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Smart Objects and IoT Architectures.
- To learn about various IOT-related protocols.
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT.
- To develop IoT infrastructure for popular applications.

UNIT - I FUNDAMENTALS OF IoT 9

Evolution of Internet of Things - Enabling Technologies - IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models - Simplified IoT Architecture and Core IoT Functional Stack -Fog, Edge and Cloud in IoT - Functional blocks of an IoT ecosystem - Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT - II IoT PROTOCOLS 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN - Network Layer: IP versions, Constrained Nodes and Constrained Networks - Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks - Application Transport Methods: Supervisory Control and Data Acquisition - Application Layer Protocols: CoAP and MQTT

UNIT - III DESIGN AND DEVELOPMENT 9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT - IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest - Role of Machine Learning - No SQL Databases - Hadoop Ecosystem - Apache Kafka, Apache Spark - Edge Streaming Analytics and Network Analytics - Xively Cloud for IoT, Python Web Application Framework - Django - AWS for IoT - System Management with NETCONF-YANG.

UNIT - V CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IoT system - IBM Watson IoT platform - Manufacturing - Converged Plantwide Ethernet Model (CPwE) - Power Utility Industry - GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

TOTAL: 45PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Gain the Knowledge of IoT devices.
2. Analyze various protocols for IoT.
3. Design a PoC of an IoT system using Rasperry Pi/Arduino.
4. Apply data analytics and use cloud offerings related to IoT.
5. Analyze applications of IoT in real time scenario.
6. Gain knowledge to build basic smart devices.

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
2. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
3. Rajkamal, “Internet of Things: Architecture, Design Principles And Applications”, McGraw Hill Higher Education, 2016

REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
4. Michael Margolis,” Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects”, 2nd Edition, O'Reilly Media, 2011.

21EC1934	INDUSTRIAL IOT 4.0	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn and understand the Importance of IIoT in industrial applications.
- To uunderstand the architecture and protocols of IIOT.
- To apply the IIoT concepts in building solutions to Industrial problems.
- To uunderstand the need of Industry 4.0.
- To learn and understand the Industry 4.0 real-world applications.
- To design and develop various industrial projects.

UNIT - I INTRODUCTION ON INDUSTRIAL IOT (IIOT) 9

Introduction on IIoT, History of IIoT, IIoT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, sensors and interfacing: Introduction to sensors, Transducers, Classification, Roles of sensors in IIoT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIoT sensors, Role of actuators, types of actuators.

UNIT - II IIOT ARCHITECTURE AND PROTOCOLS 9

Industrial Internet of things Reference Architecture,complete architecture of IIOT with interfacing, Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, BACnet, BLE, Modbus, SPI, I2C, IIoT protocols COAP, MQTT, 6LoWPAN, LWM2M, AMPQ IIoT cloud platforms: Overview of COTS cloud platforms, Predix, PTC Thing Worx, Microsoft Azure etc. Data analytics, cloud services, Business models: SaaS, PaaS, IaaS.

UNIT - III IIOT DATA MONITORING & CONTROL 9

IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

UNIT - IV INDUSTRY 4.0 9

The revolution on Industry 4.o, Sustainability assessment of Manufacturing Industries, Lean Production system, Smart factories, Cyber-physical systems, Collaboration platform and Product lifecycle management, Role of Industry 4.0 in Artificial Intelligence, Big Data and Advanced Technologies.

UNIT - V CASE STUDIES ON IIOT AND INDUSTRY 4.0 9

IIOT Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management, Milk Processing and Packaging Industries, Food Industry.

OUTCOMES:

On successful completion of the course student will be able to:

1. Apply M2M protocols for development of IIoT Applications.
2. Understand the elements of IIoT to build a total control plane in an Industrial application.
3. Learn and understand the concept of IIOT architecture and protocols.
4. Build smart factory based on the concepts.
5. Build Industrial Applications.
6. Able to develop various industrial projects.

TEXT BOOKS:

1. Sudip Misra, Chandana Roy, Anandarup Mukherjee, " Introduction to Industrial Internet of Things and Industry 4.0", 1st edition, CRC Publisher, December 2020.
2. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: Apress, 2016.

REFERENCES:

1. HakimaChaouchi, " The Internet of Things Connecting Objects to the Web",Willy Publications, 2010.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", ,2ndEdition, Willy Publications, 2010
3. Inside the Internet of Things (IoT), Deloitte University Press, 2016.
4. Ovidiu, Peter, " Internet of Things-From Research and Innovation to Market Deployment" River Publishers Series, 2014.

21EC1935	WIRELESS SENSOR NETWORK DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of wireless sensor network
- To gain knowledge on the MAC and Routing Protocols of WSN
- To get exposed to 6LOWPAN technology
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN
- To gain knowledge about operating system related to WSN and 6LOWPAN

UNIT - I INTRODUCTION 9

Principle of Wireless Sensor Network Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT - II MAC AND ROUTING PROTOCOLS 9

MAC protocols fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC,TRAMA, Routing protocols - Requirements, Classification -SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT - III 6LOWPAN 9

6LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers Addressing, Routing – Mesh - Under - Route-Over, Header Compression Stateless header compression - Context- based header compression, Fragmentation and Reassembly, Mobility types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO - Routing MANET, ROLL, Border routing.

UNIT - IV APPLICATIONS 9

Design Issues, Protocol Paradigms end-to-end, Real time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols -Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP),Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry- Specific protocols.

UNIT - V TOOLS 9

TinyOS Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki Structure, Communication Stack, Simulation environment Cooja simulator, Programming.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Design solutions for WSNs applications.
2. Develop efficient MAC and Routing Protocols.
3. Design solutions for 6LOWPAN applications.
4. Develop efficient layered protocols in 6LOWPAN.
5. Use Tiny OS and Contiki OS in WSNs applications.
6. Use 6LOWPAN applications.

REFERENCES:

1. Holger Karl , Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley Publication, 2006.
2. Anna Forster, “Introduction to Wireless Sensor Networks”, Wiley, 2017.
3. Zach Shelby Sensinode and Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet” John Wiley and Sons, Ltd, Publication, 2009.
4. Philip Levis, “TinyOS Programming”, 2006 -www.tinyos.net.
5. The Contiki Operating System.http://www.sics.se/contiki.

VERTICAL VII RADIO COMMUNICATION AND BROADBAND NETWORKS

21EC1943	BROADBAND ACCESS TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various Access Technologies.
- To understand the functions of Digital Subscriber Lines.
- To comprehend operation of Cable Modem.
- To explore various Fiber Access Technologies.
- To comprehend the concepts of Broad Band Access.

UNIT - I REVIEW OF ACCESS TECHNOLOGIES 9

Phone-Line modem, cable-access, ISDN, Emerging Broad band Technologies, Cable DSL, Fiber and Wireless.

UNIT - II DIGITAL SUBSCRIBER LINES 9

Asymmetric Digital subscriber lines (ADSL) – Rate Adaptive subscriber line(RADSL)- ISDN Digital subscriber line (IDSL) ----------High bit rate DSL (HDSL)-Single line DSL (SDSL)- very high bit rate DSL (VDSL)- Standards for XDSL & Comparison.

UNIT - III CABLE MODEM 9

Cable Modem, DOCSIS – Physical Cabling, Dual Modem Operation, Hub Restriction, Upstream Operation – Downstream operation – Access control – framing Security sub layer – Data link layer – LLC & Higher layers – ATM centric VS IP – centric cable modem.

UNIT - IV FIBER ACCESS TECHNOLOGIES 9

Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison.

UNIT - V BROAD BAND WIRELESS 9

Fixed Wireless, Direct Broadcast Satellite (DBS), Multi-channel multi point distribution services (MMDS), Local multi point distribution services (LMDS), and Wideband integrated Digital Interactive Services (WIDIS), Mobile Wireless 3G – IMT 2000.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Describe the various Access Technologies.
2. Identify the functions of Digital Subscriber Lines.
3. Apply operation of Cable Modem.
4. Analyze various Fiber Access Technologies.
5. Explain the concepts of Broad Band Access.

TEXT BOOKS:

1. Niel Ransom and Albert A. Azzam, “Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS”, McGraw Hill 1999.
2. Gilbert Held, “Next Generation Modems: A Professional Guide to DSL and cable modems”, John Wiley & sons.

REFERENCES:

1. Walter J Woralski, “ADSL and DSL Technologies”, McGraw Hill computer Communication series, 1998.
2. William Webb, “Introduction to Wireless Local Loop broadband and narrow band system”, Artech House, 2000.
3. Martin P. Clarke, “Wireless Access Network: Fixed Wireless Access and WLL network Design and operation”, John Wiley & Sons 2000.

21EC1944	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need for SDN and its data plane operations.
- To understand the functions of control plane.
- To comprehend the migration of networking functions to SDN environment.
- To explore various techniques of network function virtualization.
- To comprehend the concepts behind network virtualization.

UNIT - I SDN: BACKGROUND AND DATA PLANE 9

Evolving Network Requirements – The SDN Approach – SDN and NFV-Related Standards – SDN Data Plane – Open Flow Logical Network Device – Open Flow Protocol.

UNIT - II SDN CONTROL PLANE 9

SDN Control Plane Architecture: Southbound Interface, Northbound Interface – Control Plane Functions – ITU-T Model – Open Daylight – REST – Cooperation and Coordination among Controllers.

UNIT - III SDN APPLICATION PLANE 9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking -- Mobility and Wireless – Information-centric Networking.

UNIT - IV NETWORK FUNCTION VIRTUALIZATION 9

NFV Concepts – Benefits and Requirements – Reference Architecture – NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV.

UNIT - V NETWORK VIRTUALIZATION 9

Virtual LANs – Open Flow VLAN Support – Virtual Private Networks – Network Virtualization – Open Daylight's Virtual Tenant Network – Co Software-Defined Infrastructure.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Describe the motivation behind SDN and its data plane (K2).
2. Identify the functions of control plane (K3).
3. Apply SDN to networking applications (K3).
4. Apply various operations of network function virtualization.
5. Explain various use cases of SDN.

TEXT BOOKS:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.

REFERENCES:

1. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
2. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
3. Oswald Coker, SiamakAzodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

21EC1945	COGNITIVE RADIO NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of cognitive radio.
- To familiarize with Architecture of Cognitive Radio.
- To learn spectrum sensing and dynamic spectrum access.
- To acquaint the fundamentals of MAC & Network Layer Design in Cognitive Radio.
- To introduce the Advancement in Cognitive Radio.

UNIT - I **INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO** **9**

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT - II **COGNITIVE RADIO ARCHITECTURE** **9**

Cognitive Radio – functions, components and design rules, Cognition cycle – orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT - III **SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS** **9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection , Bayesian Approach, Neyman Pearson fusion rule for spectrum sensing, Optimum spectrum sensing – Kullback Leibler Divergence and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

UNIT - IV **MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO** **9**

MAC for cognitive radios – Multichannel MAC-- slotted ALOHA – CSMA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT - V **ADVANCED TOPICS IN COGNITIVE RADIO** **9**

Cognitive radio for Internet of Things Features and applications – Enabling technologies and protocols – M2M technologies Data storage and analysis techniques--Requirement and challenges of IoT – Energy efficiency– MIMO Cognitive Radio – Power allocation algorithms.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand the concepts of cognitive radio.
2. Familiarize with Architecture of Cognitive Radio.
3. Learn spectrum sensing and dynamic spectrum access.
4. Compare MAC and network layer design for cognitive radio.
5. Discuss cognitive radio for Internet of Things and M2M technologies.

TEXT BOOKS:

1. Alexander M. Wyglinski, MaziarNekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press, Elsevier, 2010.
2. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006.

REFERENCES:

1. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", John Wiley and Sons, 2009.
2. HuseyinArslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007.
3. S.Shanmugavel, M.A.Bhagyaveni, R.Kalidoss, "Cognitive Radio-An Enabler for Internet of things", River Publishers, 2017.

21EC1946	WIRELESS BROAD BAND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various network layer and transport layer protocols for wireless networks.
- To study the architecture and interference mitigation techniques in 3G standards.
- To learn about 4G technologies and LTE-A in mobile cellular networks.
- To learn about the layer level functionalities in interconnecting networks.
- To study the emerging techniques in 5G network

UNIT - I WIRELESS PROTOCOLS 9

Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing DHCP, Mobile transport layer-Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements- Indirect TCP, snooping TCP, Mobile TCP.

UNIT - II 3G EVOLUTION 9

IMT-2000 - W-CDMA, CDMA 2000 radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA, HSUPA.

UNIT - III 4G EVOLUTION 9

Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E- UTRAN architecture mobility management, resource management, services, channel logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT - IV BROAD BAND LAYER-LEVEL FUNCTIONS 9

Characteristics of wireless channels downlink physical layer, uplink physical layer, MAC scheme -frame structure, resource structure, mapping, synchronization, reference signals and channel estimation, SC-FDMA, interference cancellation – CoMP, Carrier aggregation, Services multimedia broadcast/multicast, location-based services.

UNIT - V **5G EVOLUTION** **9**

5G Roadmap - Pillars of 5G - 5G Architecture, The 5G internet - IoT and context awareness - Networking reconfiguration and virtualization support - Mobility QoS control - emerging approach for resource over provisioning, Small cells for 5G mobile networks- capacity limits and achievable gains with densification - Mobile data demand, Demand Vs Capacity, Small cell challenges, conclusion and future directions.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Design and implement the various protocols in wireless networks.
2. Analyze the architecture of 3G network standards.
3. Analyze the difference of LTE-A network design from 4G standard.
4. Design the interconnecting network functionalities by layer level functions.
5. Explore the current generation (5G) network architecture.

TEXT BOOKS:

1. Kaveh Pahlavan, “Principles of wireless networks”, Prentice-Hall of India, 2008.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", John Wiley, 2015.

REFERENCES:

1. Vijay K.Garg, “Wireless Network Evolution - 2G & 3G”. Prentice Hall, 2008.
2. Clint Smith,P.E, Dannel Collins, “3G Wireless Networks” Tata McGraw- Hill, 2nd Edition, 2011.
3. SassanAhmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, 2014.

21EC1947	MASSIVE MIMO NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge about massive MIMO networks.
- To understand the massive MIMO propagation channels.
- To learn about channel estimation in single cell massive MIMO systems.
- To comprehend the channel estimation in and multicell massive MIMO systems.
- To comprehend the concepts of massive MIMO deployment in the context of single cell and multicell deployment.

UNIT - I MASSIVE MIMO NETWORKS 9

Definition of Massive MIMO, Correlated Rayleigh Fading, System Model for Uplink and Downlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favourable Propagation, Local Scattering Spatial Correlation Model.

UNIT - II MASSIVE MIMO PROPAGATION CHANNEL 9

Favorable Propagation and Deterministic Channels-Capacity Upper Bound-Distance from Favorable Propagation-Favorable Propagation and Linear Processing-Singular Values and Favorable Propagation, Favorable Propagation and Random Channels-Independent Rayleigh Fading-Uniformly Random Line-of-Sight (UR-LoS)-Independent Rayleigh Fading versus UR-LoS Finite-Dimensional Channels.

UNIT - III SINGLE-CELL SYSTEMS 9

Uplink Pilots and Channel Estimation Orthogonal Pilots- De-Spreading of the Received Pilot Signal-MMSE Channel Estimation, Uplink Data Transmission Zero-Forcing -Maximum-Ratio, Downlink Data Transmission-Linear Precoding-Zero-Forcing-Maximum-Ratio, Discussion-Interpretation of the Effective SINR Expressions-Implications for Power Control-Scaling Laws and Upper Bounds on the SINR - Near-Optimality of Linear Processing when M >> K Net Spectral Efficiency
Limiting Factors: Number of Antennas and Mobility.

UNIT - IV MULTI-CELL SYSTEMS 9

Uplink Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing Maximum-Ratio, Downlink Data Transmission -Zero-Forcing -- Maximum-Ratio, Discussion -Asymptotic Limits with Infinite Numbers of Base Station Antennas The Effects of Pilot Contamination Non-Synchronous Pilot Interference.

UNIT - V **CELL DEPLOYMENT IN MIMO** **9**

Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: Preliminaries and Algorithms, Multi-Cell Deployment Examples: Mobile Access - Dense Urban.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Understand and explain massive MIMO networks.
2. Analyze massive MIMO propagation channels and their capacity bounds.
3. Examine channel estimation techniques for single cell system.
4. Analyze channel estimation techniques for multi cell system.
5. Explain the concepts underlying the deployment of single and multicell massive MIMO systems.

TEXT BOOKS:

1. Thomas L. Marzetta, Erik G. Larsson, Hong Yang, Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press 2016.
2. Emil Björnson, Jakob Hoydis and Luca Sanguinetti (2017), "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency", Foundations and Trends, Now, 2017.

REFERENCES:

1. Long Zhao, Hui Zhao, Kan Zheng, "Wei Xiang Massive MIMO in 5G Networks: Selected Applications", Springer 2018.
2. Leibo Liu, Guiqiang Peng, Shaojun Wei, "Massive MIMO Detection Algorithm and VLSI Architecture", Springer 2019.
3. Shahid Mumtaz, Jonathan Rodriguez, Linglong Dai, "mmWave Massive MIMO A Paradigm for 5G", Elsevier, 2017.

21EC1948	5G AND BEYOND COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get acquainted with the fundamentals of 5G networks.
- To study the processes associated with 5G architecture.
- To study spectrum sharing and spectrum trading.
- To learn the security features in 5G networks.
- To study the introduction of 6G system.

UNIT - I 5G CONCEPTS AND CHALLENGES 9

Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNIT - II NETWORK ARCHITECTURE 9

5G architecture and core, network slicing, multi access edge computing(MEC)visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, and edge computing. 5G protocols: 5G NAS,NGAP, GTP-U, IPSec and GRE.

UNIT - III DYNAMIC SPECTRUM MANAGEMENT 9

Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves.

UNIT - IV SECURITY IN 5G NETWORKS 9

Security features in 5G networks, network domain security, user domain security, flow based QoS framework, mitigating the threats in 5G.

UNIT - V 6G WIRELESS NETWORKS 9

6G Vision, Usage Scenarios, and Requirements, Architecture --Large-Dimensional and Autonomous 6G Networks, AI-Enabled Innovative Wireless Network Design, Promising Technologies for 6G Networks.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. Explore the concepts of 5G networks.
2. Comprehend the 5G architecture and protocols.
3. Understand dynamic spectrum management.
4. Familiarize the security aspects in 5G networks.
5. Understand the concepts of 6G networks.

TEXT BOOKS:

1. Stephen Rommer, “5G Core networks: Powering Digitalization”, Academic Press, 2019.
2. SaroVelrajan, “An Introduction to 5G Wireless Networks : Technology, Concepts and Use cases”, First Edition, 2020.

REFERENCES:

1. Jyrki.Penttinen,“5G Simplified: ABCs of Advanced Mobile Communications”, Copyrighted Material.
2. Wan Lee Anthony,” 5G system Design: An end to end Perspective”, Springer Publications, 2019.
3. Z. Zhang, Y. Xiao, Z. Ma, M. Xiao, Z. Ding, X. Lei, G. K. Karagiannidis, and P. Fan, “6G wireless networks: Vision, requirements, architecture, and key technologies,” IEEE Vehicular Technology Magazine, vol. 14, pp. 28–41, March 2019.

21EC1949	PHOTONIC NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the relevance of Photonic Networks to the existing technology.
- To enable the student to understand the importance of the infrastructure in photonic networks.
- To familiarize with the architectures and the protocol stack.
- To expose the student to the advances in networking and switching domains.
- To enable the student to understand the network design and management.

UNIT - I PHOTONIC SYSTEM COMPONENTS 9

Light Propagation in optical fibers – Loss & bandwidth, System limitations, NonLinear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT - II PHOTONIC NETWORK ARCHITECTURE 9

Introduction to Optical Networks; SONET / SDH, Metropoliton Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

UNIT - III WAVELENGTH ROUTING NETWORKS 9

The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

UNIT - IV PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

UNIT - V NETWORK DESIGN AND MANAGEMENT 9

Transmission System Engineering – System model, Power penalty transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of the course student will be able to:

1. To comprehend and appreciate the significance and role of Photonic Networks in the present contemporary world.
2. To use the backbone infrastructure of photonic networks for our present and future communication needs.
3. Discuss the architectures and the protocol stack in use.
4. Describe the advances and recent trends in the networking and switching approaches.
5. Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods, Network management and protection methods in vogue.

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar N. Sivarajan,"Optical Networks: A Practical Perspective", Harcourt Asia Pvt Ltd., 3rd Edition, 2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002.

REFERENCES:

1. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
   Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.
2. Martin P. Clarke, "Wireless Access Network: Fixed Wireless Access and WLL network Design and operation", John Wiley & Sons 2000.