SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

B.TECH.

COMPUTER AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS 2023
(R-2023)

CURRICULUM AND SYLLABI

25 years of ACADEMIC EXCELLENCE

VISION AND MISSION OF THE INSTITUTE

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1 - Quality Education	To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.
M2 -Research and Innovation	To foster value based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.
M3 - Employability and Entrepreneurship	To inculcate the employability and entrepreneurial skills through value and skill based training
M4:- Ethical values	To instill deep sense of human values by blending societal righteousness with academic professionalism for growth of society

VISION AND MISSION OF THE DEPARTMENT

Vision

To promote students with latest technology and research in the field of Computer and Communication Engineering to meet global socio-economic needs

Mission

M1- Technical Knowledge:	To provide academic excellence in the field of computer and Communication engineering to meet the needs of the Society.
M2 - Innovation and Exposure:	To conduct recognized research analytically in multi-disciplinary Research areas of the framework at National and International levels
M3 - Employability and Entrepreneurship:	To provide complementary technical, inter and intrapersonal skills for employability and entrepreneurship
M4 - Ethics:	To instruct integrity, ethical principles and interactive skills among the students to form a better nation

PROGRAM OUTCOMES

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 problems 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 EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Technical Knowledge	To satisfy the requirements of industry, Research and Development organizations by employing technological knowledge in Computer and Communication Engineering.
PEO2: Leadership Skill	To lead, contribute and innovate new technologies and systems in the key domains of Computer and Communication Engineering
PEO3: Research and Development	To get exposed to collaborative work that can be implemented for society's well-being through advanceresearch expertise
PEO4: Professional Behavior	Gains code of conduct, etiquettes to establish boundaries in environment.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1 - Basic Knowledge in CCE	Use the latest tools and technologies to apply the fundamental concepts of computer and communication engineering principles to software development, mobile communication and computing
PSO2 - Network Design and Security	Design and Interpret computer networks, Internet of Things with efficient data analytics and security.
PSO3 - Algorithmic Thinking and Programming Skill	Develop efficient algorithms to solve real time problems through powerful programming and problem solving skills

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences including Management courses (HS)	15
2	Basic Science Courses (BS)	20
3	Engineering Science including workshop, drawing, basics of electrical / mechanical / computer etc. (ES)	29
4	Professional Core Courses (PC)	65
5	Professional Electives Courses (PE)	18
6	Open Electives Courses (OE)	9
7	Project Work and Internship (PA)	13
8	Ability Enhancement Courses (AEC*)	
9	Mandatory Courses (MC*)	-
Total		**169**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	AICTE Suggested Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science (HS)	5	3	1	1	2			3	15
2	Basic Sciences(BS)	4	7	5	4					20
3	Engineering Sciences (ES)	12	13		4					29
4	Professional Core (PC)			16	11	12	15	11		65
5	Professional Electives (PE)				3	3	3	3	6	18
6	Open Electives (OE)				-	3	3	3		9
7	Project Work (PA)					1	1	2	8	12
8	Internship (PA)							1		**1**
9	Ability Enhancement Courses (AEC*)	-	-	-	-	-	-	-	-	**-**
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	**-**
Total		**22**	**21**	**23**	**22**	**23**	**21**	**22**	**20**	**169**

**** AEC and MC are not included for CGPA calculation***

HONOURS DEGREE PROGRAMME:

The student is permitted to opt for earning an Honours degree in the same discipline of engineering in addition to the degree in his/her own discipline. To earn an Honours degree the student is required to earn an additional 18 - 20 credits (over and above the total 170 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0. The prescribed courses offered for Honours degree are given in **Annexure -V**

SEMESTER-I										
Sl.No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics – I	BS	3	1	0	4	25	75	100
2	U23HSTC01	Universal Human Values- II	HS	2	0	0	2	25	75	100
3	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
4	U23CSTC02	Problem Solving Approach	ES	3	0	0	3	25	75	100
5	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23ENBC01	Communicative English - I	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC01	Basics of Electrical and Electronics Engineering Laboratory	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23CCC1XX	Certification Course – I**	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23CCM101	Induction Program	MC	2 Weeks			-	-	-	-
							21	425	575	1000

***** Certification Courses are to be selected from the list given in Annexure III***

SEMESTER – II										
Sl.No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics -II	BS	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
4	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
5	U23CCT201	Digital Electronics	PC	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										
7	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23CCP201	Digital Electronics Laboratory	PC	0	0	2	1	50	50	100
10	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CCC2XX	Certification Course - II**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CCM202	Sports Yoga and NSS	MC	0	0	2	-	100	-	100
							23	575	625	1200

***** Certification Courses are to be selected from the list given in Annexure III***

SEMESTER – III										
Sl.No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23CCT302	Principles of Computer Organization	PC	3	0	0	3	25	75	100
3	U23CCT303	Analog Electronics	PC	3	0	0	3	25	75	100
4	U23CCT304	Principles of Communication Engineering	PC	3	0	0	3	25	75	100
5	U23CCT305	Software Engineering Principles and Testing Techniques	PC	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CSBC01	Design and Analysis of Algorithms	PC	2	0	2	3	50	50	100
Practical										
7	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
8	U23ENPC01	General Proficiency-I	HS	0	0	2	1	50	50	100
9	U23CCP302	Principles of Communication Engineering Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23CCS301	Skill Enhancement Course-I*	AEC	0	0	4	-	100	-	100
11	U23CCC3XX	Certification Course -III**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CCM303	Climate Change	MC	0	0	2	-	100	-	100
							22	625	575	1200

SEMESTER – IV										
Sl.No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC05	Discrete Mathematics and Graph theory	BS	3	1	0	4	25	75	100
2	U23ITTC02	Programming in Java	ES	3	0	0	3	25	75	100
3	U23CSTC04	Database Management Systems	PC	3	0	0	3	25	75	100
4	U23CCT406	Computer and Communication Networks	PC	3	0	0	3	25	75	100
5	U23CCE4XX	Professional Elective - I#	PE	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CCB401	Operating Systems Principles and Practices	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U23ITPC02	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
9	U23CSPC03	Database Management Systems Laboratory	PC	0	0	2	1	50	50	100
10	U23CCP403	Computer and Communication Networks Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CCS402	Skill Enhancement Course-II*	AEC	0	0	4	-	100	-	100
12	U23CCC4XX	Certification Course -IV**	AEC	0	0	4	-	100	-	100
Mandatory Course										
13	U23CCM404	Right to Information and Good Governance	MC	0	0	2	-	100	-	100
							23	675	625	1300

#Professional Electives are to be selected from the list given in Annexure I

***** Certification Courses are to be selected from the list given in Annexure III***

**** Skill Development Courses (1 and 2) are to be selected from the list given in Annexure IV***

SEMESTER – V										
Sl.No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23CSTC06	Artificial Intelligence	PC	3	0	0	3	25	75	100
3	U23CCT507	Signal Processing	PC	3	0	0	3	25	75	100
4	U23CCT508	Cyber Physical System Design	PC	3	0	0	3	25	75	100
5	U23CCE5XX	Professional Elective - II#	PE	3	0	0	3	25	75	100
6	U23XXOC0X	Open Elective-I$	OE	3	0	0	3	25	75	100
Practical										
7	U23CSPC05	Artificial Intelligence Laboratory	PC	0	0	2	1	50	50	100
8	U23CCP504	Signal Processing Laboratory	PC	0	0	2	1	50	50	100
9	U23CCP505	Cyber Physical System Design Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23CCW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23CCC5XX	Certification Course - V**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CCM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	600	600	1200

SEMESTER – VI										
Sl.No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ITTC03	Machine Learning	PC	3	0	0	3	25	75	100
2	U23CCT609	Microprocessor and Embedded Systems	PC	3	0	0	3	25	75	100
3	U23CCT610	Internet and Web Programming	PC	3	0	0	3	25	75	100
4	U23CCE6XX	Professional Elective - III#	PE	3	0	0	3	25	75	100
5	U23XXOC0X	Open Elective-II$	OE	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CCB602	Data Science for Networking	PC	2	0	2	3	50	50	100
Practical										
7	U23ITPC03	Machine Learning Laboratory	PC	0	0	2	1	50	50	100
8	U23CCP606	Microprocessor and Embedded Systems Laboratory	PC	0	0	2	1	50	50	100
9	U23CCP607	Internet and Web Programming Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23CCW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23CCC6XX	Certification Course - VI**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CCM606	Gender Equality	MC	2	0	0	-	100	-	100
							22	575	625	1200

#Professional Electives are to be selected from the list given in Annexure I

$ Open Electives are to be selected from the list given in Annexure II

***** Certification Courses are to be selected from the list given in Annexure III***

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECTC01	Internet of Things	PC	3	0	0	3	25	75	100
2	U23CCT711	Cloud Computing and Distributed Systems	PC	3	0	0	3	25	75	100
3	U23CCT712	Blockchain Technology and Application	PC	3	0	0	3	25	75	100
4	U23CCE7XX	Professional Elective - IV#	PE	3	0	0	3	25	75	100
5	U23XXOC0X	Open Elective -III$	OE	3	0	0	3	25	75	100
Practical										
6	U23ECPC01	Internet of Things Laboratory	PC	0	0	2	1	50	50	100
7	U23CCP708	Cloud Computing and Distributed Systems Laboratory	PC	0	0	2	1	50	50	100
Project Work										
8	U23CCW703	Project Phase - I	PA	0	0	4	2	50	50	100
9	U23CCW704	Internship / Inplant Training	PA	0	0	2	1	100	-	100
							20	475	525	1000

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC03	Entrepreneurship and Business Management	HS	3	0	0	3	25	75	100
2	U23CCE8XX	Professional Elective - V#	PE	3	0	0	3	25	75	100
3	U23CCE8XX	Professional Elective - VI#	PE	3	0	0	3	25	75	100
Project Work										
5	U23CCW805	Project phase - II	PA	0	0	16	8	50	100	150
							17	125	325	450

#***Professional Electives are to be selected from the list given in Annexure I***

Annexure – I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE401	Mobile Communication and Networks
2	U23CCE402	Network Analysis and Management
3	U23CCE403	Information and Image coding Theory
4	U23CCE404	Compiler Design
5	U23CCE405	Azure Development and Operations
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE506	Wireless Adhoc and Sensor Networks
2	U23CCE507	Data Mining and Information Warehousing
3	U23CCE508	Multimedia Graphics Design
4	U23CCE509	Theory of Computation
5	U23ITEC01	Software Defined Networks
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE610	Advanced Communication Techniques
2	U23ECEC01	Digital Image Processing
3	U23CCE611	Computational Intelligence
4	U23CCE612	Artificial Neural Networks
5	U23ITEC02	Natural Language Processing
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE713	Optical and Satellite Communication
2	U23CCE714	Deep Learning and Applications
3	U23CCE715	Software Design and Project Management
4	U23CCE716	Quantum Cryptography
5	U23ITEC03	Robotic Process Automation
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE817	Massive MIMO Networks
2	U23CCE818	Telecommunication and Switching Techniques
3	U23CCE819	Generative AI for Communication
4	U23CCE820	Game Theory and its Application
5	U23ECEC03	High Speed Networks
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE821	4G/5G Communication Networks
2	U23CCE822	AI Principles for Edge Computing
3	U23CCE823	Bigdata Analytics
4	U23CCE824	Mobile Application Engineering
5	U23ITEC04	Human Computer Interaction

Annexure – II

OPEN ELECTIVE COURSES

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I / II (Offered in Semester V/VI)				
1	U23CCOC01	Introduction to Communication Technologies	CCE	EEE, MECH, CSE, IT, CIVIL, ICE, Mechatronics, BME, AI&DS
2	U23CCOC02	Introduction to Computer Networks	CCE	EEE, MECH, CIVIL, ICE, Mechatronics, BME, AI&DS
Open Elective – III (Offered in Semester VII)				
3	U23CCOC03	Flutter Application Development	CCE	EEE, ECE, MECH, CSE, IT, CIVIL, ICE, Mechatronics, BME, AI&DS
4	U23CCOC04	Network Essentials and Security	CCE	EEE, MECH, CSE, IT, CIVIL, ICE, Mechatronics, BME, AI&DS

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Annexure – III

ABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

S. No	Course Code	Course Title	Certified By
1	U23CCCX01	Adobe Photoshop	Adobe
2	U23CCCX02	Adobe Animate	Adobe
3	U23CCCX03	Adobe Dreamweaver	Adobe
4	U23CCCX04	Adobe After Effects	Adobe
5	U23CCCX05	Adobe Illustrator	Adobe
6	U23CCCX06	Adobe InDesign	Adobe
7	U23CCCX07	Autodesk AutoCAD -ACU	Autodesk
8	U23CCCX08	Autodesk Inventor - ACU	Autodesk
9	U23CCCX09	Autodesk Revit - ACU	Autodesk
10	U23CCCX10	Autodesk Fusion 360 - ACU	Autodesk
11	U23CCCX11	Autodesk 3ds Max - ACU	Autodesk
12	U23CCCX12	Autodesk Maya - ACU	Autodesk
13	U23CCCX13	Cloud Security Foundations	AWS
14	U23CCCX14	Cloud Computing Architecture	AWS
15	U23CCCX15	Cloud Foundation	AWS
16	U23CCCX16	Cloud Practitioner	AWS
17	U23CCCX17	Cloud Solution Architect	AWS
18	U23CCCX18	Data Engineering	AWS
19	U23CCCX19	Machine Learning Foundation	AWS
20	U23CCCX20	Robotic Process Automation / Medical Robotics	Blue Prism
21	U23CCCX21	Advance Programming Using C	CISCO
22	U23CCCX22	Advance Programming Using C ++	CISCO
23	U23CCCX23	C Programming	CISCO
24	U23CCCX24	C++ Programming	CISCO
25	U23CCCX25	CCNP Enterprise: Advanced Routing	CISCO
26	U23CCCX26	CCNP Enterprise: Core Networking	CISCO
27	U23CCCX27	Cisco Certified Network Associate - Level 2	CISCO
28	U23CCCX28	Cisco Certified Network Associate- Level 1	CISCO
29	U23CCCX29	Cisco Certified Network Associate- Level 3	CISCO
30	U23CCCX30	Fundamentals Of Internet of Things	CISCO
31	U23CCCX31	Internet Of Things / Solar and Smart Energy System with IoT	CISCO
32	U23CCCX32	Java Script Programming	CISCO
33	U23CCCX33	NGD Linux Essentials	CISCO
34	U23CCCX34	NGD Linux I	CISCO
35	U23CCCX35	NGD Linux II	CISCO
36	U23CCCX36	Advance Java Programming	Ethnotech
37	U23CCCX37	Android Programming / Android Medical App Development	Ethnotech
38	U23CCCX38	Angular JS	Ethnotech

39	U23CCCX39	Catia	Ethnotech
40	U23CCCX40	Communication Skills for Business	Ethnotech
41	U23CCCX41	Coral Draw	Ethnotech
42	U23CCCX42	Data Science Using R	Ethnotech
43	U23CCCX43	Digital Marketing	Ethnotech
44	U23CCCX44	Embedded System Using C	Ethnotech
45	U23CCCX45	Embedded System with IOT / Arduino	Ethnotech
46	U23CCCX46	English For IT	Ethnotech
47	U23CCCX47	Plaxis	Ethnotech
48	U23CCCX48	Sketch Up	Ethnotech
49	U23CCCX49	Financial Planning, Banking and Investment Management	Ethnotech
50	U23CCCX50	Foundation Of Stock Market Investing	Ethnotech
51	U23CCCX51	Machine Learning / Machine Learning for Medical Diagnosis	Ethnotech
52	U23CCCX52	IOT Using Python	Ethnotech
53	U23CCCX53	Creo (Modelling & Simulation)	Ethnotech
54	U23CCCX54	Soft Skills, Verbal, Aptitude	Ethnotech
55	U23CCCX55	Software Testing	Ethnotech
56	U23CCCX56	MX-Road	Ethnotech
57	U23CCCX57	CLO 3D	Ethnotech
58	U23CCCX58	Solid works	Ethnotech
59	U23CCCX59	Staad Pro	Ethnotech
60	U23CCCX60	Total Station	Ethnotech
61	U23CCCX61	Hydraulic Automation	Festo
62	U23CCCX62	Industrial Automation	Festo
63	U23CCCX63	Pneumatics Automation	Festo
64	U23CCCX64	Agile Methodologies	IBM
65	U23CCCX65	Block Chain	IBM
66	U23CCCX66	Devops	IBM
67	U23CCCX67	Artificial Intelligence	ITS
68	U23CCCX68	Cloud Computing	ITS
69	U23CCCX69	Computational Thinking	ITS
70	U23CCCX70	Cyber Security	ITS
71	U23CCCX71	Data Analytics	ITS
72	U23CCCX72	Databases	ITS
73	U23CCCX73	Java Programming	ITS
74	U23CCCX74	Networking	ITS
75	U23CCCX75	Python Programming	ITS
76	U23CCCX76	Web Application Development (HTML, CSS, JS)	ITS
77	U23CCCX77	Network Security	ITS & Palo alto
78	U23CCCX78	MATLAB	MathWorks
79	U23CCCX79	Azure Fundamentals	Microsoft
80	U23CCCX80	Azure AI (AI-900)	Microsoft
81	U23CCCX81	Azure Data (DP -900)	Microsoft
82	U23CCCX82	Microsoft 365 Fundamentals (SS-900)	Microsoft

83	U23CCCX83	Microsoft Security, Compliance and Identity (SC-900)	Microsoft
84	U23CCCX84	Microsoft Power Platform (PI-900)	Microsoft
85	U23CCCX85	Microsoft Dynamics Fundamentals 365 – CRM	Microsoft
86	U23CCCX86	Microsoft Excel	Microsoft
87	U23CCCX87	Microsoft Excel Expert	Microsoft
88	U23CCCX88	Securities Market Foundation	NISM
89	U23CCCX89	Derivatives Equinity	NISM
90	U23CCCX90	Research Analyst	NISM
91	U23CCCX91	Portfolio Management Services	NISM
92	U23CCCX92	Cyber Security	Palo alto
93	U23CCCX93	Cloud Security	Palo alto
94	U23CCCX94	PMI – Ready	PMI
95	U23CCCX95	Tally – GST & TDS	Tally
96	U23CCCX96	Advance Tally	Tally
97	U23CCCX97	Associate Artist	Unity
98	U23CCCX98	Certified Unity Programming	Unity
99	U23CCCX99	VR Development	Unity

Annexure – IV

ABILITY ENHANCEMENT COURSES – (B). SKILL ENHANCEMENT COURSES

Sl. No	Course Code	Course Title
1	U23CCS301	Skill Enhancement Course I: *
		1)Computer on Office Automation
		2)Animation Practices
		3)PCB and Circuit Design
2	U23CCS402	Skill Enhancemet Course II: *
		1)Computer Hardware and Troubleshooting
		2)Mobile Servicing
		3)Android App Development

**** Any one course to be selected from the list***

Annexure – V

- B.Tech. Computer and Communication Engineering Honours in **Cyber Security**

Courses Offered in various Semesters

S. No	Semester	Course Code	Course Title	Category	Periods			Credits	Max.Marks		
					L	T	P		CAM	ESM	Total
1	IV	U23KXB401	Cryptography and Cyber Security	PC	2	0	2	4	50	50	100
2	V	U23KXT502	Cyber Security Essentials	PC	3	0	0	3	25	75	100
3	VI	U23KXT603	Ethical Hacking	PC	3	0	0	3	25	75	100
4	VII	U23KXB704	Artificial Intelligence for Cyber Security	PC	2	0	2	4	50	50	100
5	VIII	U23KXT805	Security Incident and Response Management	PC	3	0	0	3	25	75	100
6	VIII	U23KXW806	Project	PW	0	0	4	2	50	50	100
Total								**19**	**225**	**375**	**600**
Equivalent NPTEL courses[##]											
1	IV to VII Sem	U23KXN01	**Cyber Security Equivalent NPTEL courses**					**3**	**12 Weeks Course**		

[##] students shall be given an option to earn 3 credits through one equivalent 12 weeks NPTEL course instead of any one course listed for honours degree programme that should be completed before the commencement of eighth semester. The Equivalent courses are subject to change based on its availability as per NPTEL course list.

- B.Tech. Computer and Communication Engineering Honours in **Artificial Intelligence & Machine Learning**

Courses Offered in various Semesters

COURSE DETAILS											
Sl. No.	**Semester**	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
					L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory											
1	IV	U23MXT401	Parallel Programming and High Performance Computing	PC	3	0	0	3	25	75	100
2	V	U23MXB501	Advanced Deep Learning	PC	3	0	2	4	50	50	100
3	VI	U23MXB602	Reinforcement Learning	PC	3	0	2	4	50	50	100
4	VII	U23MXT702	Image and Video Analytics	PC	3	0	0	3	25	75	100
5	VIII	U23MXT803	Prompt Engineering	PC	3	0	0	3	25	75	100
6	VIII	U23MXW801	Project	PA	0	0	4	2	50	50	100
	Total							**19**	**225**	**375**	**600**
Equivalent NPTEL courses[##]											
1	IV, VII, VIII Semester	U23MXTN01	**AI and ML Equivalent NPTEL courses**					**3**	**12 Weeks Course**		

[##] students shall be given an option to earn 3 credits through one equivalent 12 weeks NPTEL course instead of any one course listed for honours degree programme that should be completed before the commencement of eighth semester. The Equivalent courses are subject to change based on its availability as per NPTEL course list.

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **BS**			*End Semester Exam Type: **TE**			
Course Code	U23MATC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MATHEMATICS – I**	**3**	**1**	**-**	**4**	**25**	**75**	**100**
(Common to All Branches Except CSBS)								

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concept of Eigen values and Eigen vectors, Diagonalization of a Matrix	**K3**
	CO2 Solve higher order differential equations	**K3**
	CO3 Understand the different types of partial differential equations	**K3**
	CO4 Know about the Applications of double and triple integrals	**K3**
	CO5 Gain the knowledge about Vector Calculus and its Applications	**K3**

UNIT – I	**MATRICES**	**Periods:12**
Rank of a Matrix – Systems of Linear Equations – Characteristic equation – Cayley Hamilton Theorem – Eigen values and Eigen vectors of a real Matrix–Diagonalization of Matrices.		**CO1**
UNIT – II	**DIFFERENTIAL EQUATIONS (HIGHER ORDER)**	**Periods:12**
Linear Differential equations of higher order with constant coefficients – Euler's linear equation of higher order with variable coefficients –Method of Variation of parameters.		**CO2**
UNIT – III	**FUNCTIONS OF SEVERAL VARIABLES**	**Periods:12**
Partial derivatives – Total derivatives – Maxima of two variables and Minima of two variables – Lagrange's Method of multipliers.		**CO3**
UNIT – IV	**MULTIPLE INTEGRALS**	**Periods:12**
Multiple Integrals – Change of order of integration (Cartesian form). Applications: Areas as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form)		**CO4**
UNIT – V	**VECTOR CALCULUS**	**Periods:12**
Gradient – Divergence and Curl – Directional derivatives – Irrotational and Solenoidal vector fields – Properties (Statement only) – Gauss Divergence Theorem and Stokes Theorem applications (without proofs).		**CO5**

Lecture Periods:45	**Tutorial Periods:15**	**Practical Periods: -**	**Total Periods:60**

Text Books

1. M.K. Venkataraman, "Engineering Mathematics, The National Publishing Company, Madras, 2016.
2. N. P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018.
3. S. Narayanan and T.K. Manicavachagom Pillay," Differential Equations and Its Applications", Viswanathan.S, Printers & Publishers Pvt Ltd, 2009.

Reference Books

1. G. Balaji, "Matrices and Calculus (Engineering Mathematics – I)" Balaji Publications, 9th Edition, 2023
2. Dr. A. Singaravelu, "Engineering Mathematics – I", Meenakshi publications, Tamil Nadu, 2019.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", Wiley, 10th Edition, 2019.
4. B.V.Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. C W. Evans, "Engineering Mathematics", A Programmed Approach, 3rd Edition, 2019.

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra –slides- systems of equation-handout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/

5. https://nptel.ac.in/courses/111/108/111108081/

*

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	2	1	1	-	-	-	-	1	3	-	-
2	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
5	2	2	1	-	-	-	1	-	-	-	-	1	3	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **ES**			*End Semester Exam Type: **TE**			
Course Code	U23CSTC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN C**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
	(Common to All Branches)							
Prerequisite	NIL							

Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Comprehend the basic of Computers.	**K2**
	CO2 Illustrate the basics constructs of C programming concepts of control structures and looping in C Program.	**K2**
	CO3 Implement programs using arrays and functions.	**K3**
	CO4 Demonstrate programs using Structure and Pointers.	**K3**
	CO5 Build programs Union and understand the concept of File management Operations.	**K3**

UNIT- I	**Introduction**	**Periods: 09**
Generation and Classification of Computers - Block Diagram of a Computer –Categories of Software – Network Structure - Number System – Binary – Decimal – Conversion – Algorithm – Pseudo code – Flow Chart.		**CO1**
UNIT- II	**C Programming Basics**	**Periods: 09**
Introduction to ' C' Programming – Basic structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements.		**CO2**
UNIT- III	**Arrays and Functions**	**Periods: 09**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations- Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion		**CO3**
UNIT- IV	**Structure and Pointers**	**Periods: 09**
Structure Introduction – Structure definition – Structure declaration – Structure within a structure –Self Referential Structure. Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays -Pointer to Function –Pointer and Structure- Simple programs.		**CO4**
UNIT- V	**Unions and Files**	**Periods: 09**
Union Introduction - Programs Using Structures and Unions – Introduction to File - File Operations - File Input and Output Functions - Random Access to Files - File System Functions - Command Line Arguments- Storage Classes - Pre-Processor Directives- Dynamic Memory Functions.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, 8th Edition,2019.
2. YashvantKanetkar, "Let us C", BPB Publications, 16th Edition, 2017
3. Herbert Schildt," C: The Complete Reference", McGraw Hill, 4th Edition,2014

Reference Books

1. Vikas B. Agarwal Jyoti P. Mirani, "Computer Fundamentals , Nirali Prakashan 2019
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression,2012.
3. VikasVerma, "A Workbook on C ", Cengage Learning, 2nd Edition,2012.
4. P.Visu, R.Srinivasan and S.Koteeswaran, "Fundamentals of Computing and Programming", Sri Krishna Publications, 4th Edition, 2012.
5. Pradip Dev, Manas Ghoush, "Programming in C", Oxford University Press, 2nd Edition, 2011.

Web References

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c

5. https://nptel.ac.in/courses/106/104/106104128/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech**						
Semester	**I**	Course Category: **ES**				*End Semester Exam Type: **TE**		
Course Code	U23CSTC02	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROBLEM SOLVING APPROACH**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
(Common to CSE,ICE and CCE)								
Prerequisite								

Course Outcome	After completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the basic concepts of computational thinking and problem solving.	**K2**
	CO2 Explain basic concepts of algorithm and data organization.	**K2**
	CO3 Illustrate algorithmic solution to problem solving.	**K3**
	CO4 Explain the concepts of array, merging, sorting & searching.	**K2**
	CO5 Implement recursive algorithm to solve problems.	**K3**

UNIT-I	**COMPUTATIONAL THINKING AND LOGIC-SOLVING PROBLEMS**	**Periods: 9**
Computational Thinking – Information and Data – Converting Information into Data – Data Capacity – Data Types and Encoding – Logic-Solving Problems – Limits of Computation – Pseudocode and Flow Chart.		**CO1**
UNIT-II	**ALGORITHMIC THINKING AND DATA ORGANIZATION**	**Periods: 9**
Algorithmic Thinking: Algorithms – Software and Programming Languages – Actions. Data Organization: Name list, Graph Hierarchies – Spread Sheets – Text processing – Patterns – Pseudocode and Flow Chart.		**CO2**
UNIT-III	**FUNDAMENTAL ALGORITHMS AND FACTORING METHODS**	**Periods: 9**
Fundamental Algorithms: Exchanging – Counting – Summing – Factorial Computation – Fibonacci Sequence – Reversing the Digit-Base Conversion – Character to number conversion. Factorial Methods: Finding Square Root – Greatest Common Divisor – Prime Number – Prime Factor – Pseudocode and Flow Chart.		**CO3**
UNIT-IV	**ARRAY, MERGING, SORTING AND SEARCHING**	**Periods: 9**
Array Techniques: Introduction – Array order reversal – Array Counting or Histogramming – Maximum and Minimum of a Set – Removal of Duplicate – Partitioning – Longest monotone. Sorting and searching: Sorting by Bubble, Selection, Insertion. Searching: Linear, Binary – Pseudocode and Flow Chart.		**CO4**
UNIT-V	**TEXT PROCESSING, PATTERN SEARCHING AND RECURCIVE ALGORITHMS**	**Periods: 9**
Key word Searching – Text Line Adjustment – Linear Pattern Search – Sub Linear Pattern Search. Recursion: Towers of Hanoi – Sample Generation – Combination Generation – Permutation Generation – Pseudocode and Flow Chart.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. David Riley and Kenny Hunt, “Computational Thinking for Modern Problem Solver”, Chapman & Hall/CRC Textbooks in Computing, 2014.
2. R.G.Dromey, “How to solve it by Computer”,PHI,2008.
3. Vickers Paul, “How to Think like a Programmer: Problem Solving for the Bewildered”, Cengage Learning EMEA,2008.

Reference Books

1. Kathryn Rentz, Paula Lentz, “A Problem-solving Approach”, McGraw-Hill Education,2018.
2. Don McAdam, Roger Winn, “A Problem-solving Approach”, Prentive Hall Canada; 2nd Edition, 2017.
3. V Anton Spraul, “Think Like a Programmer: An Introduction to Creative Problem Solving”, Cengage Learning EMEA, 2012.
4. Sham Tickoo “A Problem-solving Approach”, Delmar/Cengage Learning, 2009.
5. Harold Abelson & Gerald Jay Sussman, “Structure and Interpretation of Computer Programs”, McGraw-Hill Book Company, 1997.

Web References

1. https://www.edx.org/learn/problem-solving

2. https://www.lynda.com/Business-Skills-tutorials/Problem-Solving-Techniques/553700-2.html
3. https://www.classcentral.com/course/problem-solving-skills-6687

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	1	-	-	-	1	-	-	1	3	2	3
2	2	1	-	-	1	-	-	-	-	-	-	1	3	2	3
3	2	1	-	-	1	-	-	-	-	-	-	1	3	2	3
4	2	1	-	-	1		-	-	-	-	-	1	3	2	3
5	3	2	1	1	1	-	-	-	-	-	-	1	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**EEE/ECE**			Programme: **B.Tech.**				
Semester	**I/II**			Course Category: **ES**			*End Semester Exam Type: **TE**	
Course Code	U23ESTC03			Periods/Week			Credit	Maximum Marks		
				L	T	P	C	CAM	ESE	TM
Course Name	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**			**3**	**-**	**-**	**3**	**25**	**75**	**100**
(Common to CSE, IT, MECH, CIVIL,CCE,AI&DS, FT, MCTR, CSBS Branches)										
Prerequisite	Mathematics and Physics									
Course Outcomes	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Apply the basic concepts and various laws in DC circuits.								**K3**
	CO2	Analyze the AC circuits and develop resonance conditions for transmitter and receiver circuits.								**K3**
	CO3	Gain the knowledge of power system components, importance of electrical safety measures and real time applications of transformer and motor.								**K2**
	CO4	Understand the operator of semiconductor diode and its applications.								**K2**
	CO5	Explain the characteristics and operation of BJT and FET.								**K2**
	CO6	Relate and Explain Different Communication Systems.								**K2**

SECTION A - ELECTRICAL ENGINEERING

UNIT-I	**DC CIRCUITS**	**Periods:10**
Concept of Potential Difference, Current, Resistance, Inductance and Capacitance, Work, Power, Energy, Current and Voltage sources - ideal and practical sources - concept of dependent and independent sources, Ohm's law, Kirchhoff's law, Series parallel combination of R, L, C components, Voltage Divider and Current Divider Rules, Mesh and Nodal analysis, Star/Delta transformation, Network Theorems - Superposition, Thevenin, Norton and Maximum Power Transfer.		**CO1**
UNIT-II	**AC CIRCUITS**	**Periods:10**
AC waveform definitions - form factor, peak factor, R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, Resonance in series and parallel circuits, band-width and quality factor, Three Phase balanced AC Circuits (Y-Δ and Y-Y) - Power Measurement – Two Wattmeter method.		**CO2**
UNIT-III	**ELECTRICAL SAFETY AND ELECTRICAL MACHINES**	**Periods:10**
Need for Modulation – Block diagram of analog communication System - AM, FM, PM Definitions and Waveforms – Comparison of digital and analog communication system- Block diagram of digital communication system – Electromagnetic Spectrum. Wired and wireless Channel – Block diagram of communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.		**CO3**

SECTION B – ELECTRONICS ENGINEERING

UNIT-IV	**SEMICONDUCTOR DIODES AND APPLICATIONS**	**Periods:10**
Introduction semiconductor materials – Doping - Intrinsic and Extrinsic Semiconductor – PN junction diode, structure, characteristics - diffusion and depletion capacitance - Rectifier, Half wave and Full wave rectifier - zener diode characteristics - zener diode as regulator – Light Emitting Diode (LED) - Solar Cell.		**CO4**
UNIT-V	**TRANSISTORS**	**Periods:10**
Bipolar Junction Transistor - construction – operation - Common Base, Common Emitter, Common collector Configuration –characteristics – Biasing - numerical application. Junction Field Effect Transistor (JFET), Metal oxide semiconductor Field Effect Transistor, EMOSFET-DMOSFET operation characteristics - Numerical application.		**CO5**
UNIT-VI	**COMMUNICATION SYSTEMS**	**Periods:10**
Need for Modulation – Block diagram of analog communication System - AM, FM, PM Definitions and Waveforms – Comparison of digital and analog communication system- Block diagram of digital communication system – Electromagnetic Spectrum. Wired and wireless Channel – Block diagram of communication systems – satellite communication – Cellular Mobile Communication – Fiber Optical Communication System.		**CO6**

Lecture Periods:45	**Tutorial Periods:-15**	**Practical Periods:-**	**TotalPeriods:60**

Text Books

1. R.K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press,2nd Edition, 2012
2. R. Saravanakumar V. Jegathesan, K. Vinoth Kumar, "Basic Electrical and Electronics Engineering", Wielly, 2022
3. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2018

Reference Books

1. Sudhakar.A and ShyamMohan.S.P, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th edition, 2017.
2. D.P.Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. Theraja B. L and Theraja A. K., "A Textbook of Electrical Technology", Vol. II, S Chand & Co. Ltd., New Delhi, 2009.
4. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, 4th Edition, 2020
5. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", 6th Edition, Pearson Education, 2018.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electrical4u.com/
3. https://nptel.ac.in/courses/108/102/108102146/
4. https://onlinecourses.nptel.ac.in/noc21_ee55/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
2	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
3	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
4	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
5	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
6	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **HS**			End Semester Exam Type: **TE**			
Course Code	U23HSTC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**UNIVERSAL HUMAN VALUES - II**	**2**	**-**	**-**	**2**	**25**	**75**	**100**
	(Common to all Branches)							

Prerequisite	UHV-I: Universal Human Values-Introduction		
Course Outcomes	The course will enable the student to		BT Mapping (Highest Level)
	CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession	**K2**
	CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	**K2**
	CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession	**K2**
	CO4	Examine the role of a human being in ensuring harmony in society and nature.	**K2**
	CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	**K2**

UNIT-I	**Introduction to Value Education**	**Periods: 06**	
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Understanding Value Education - Self-exploration as the Process for Value Education - Basic Human Aspirations - Happiness and Prosperity - Current Scenario- Method to Fulfil the Basic Human Aspirations			**CO1**
UNIT-II	**Harmony in the Human Being**	**Periods: 06**	
Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Harmony of the Self with the Body-Programme to ensure self-regulation and Health			**CO2**
UNIT-III	**Harmony in the Family and Society**	**Periods: 06**	
Harmony in the Family - Basic Unit of Human Interaction- 'trust' - Foundational Value in Relationship - 'Respect' - as the Right Evaluation - Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society-Vision for the Universal Human Order.			**CO3**
UNIT-IV	**Harmony in the Nature/Existence**	**Periods: 06**	
Understanding Harmony in the Nature-Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels - Holistic Perception of Harmony in Existence			**CO4**
UNIT-V	**Implications of the Holistic Understanding - a Look at Professional Ethics**	**Periods: 06**	
Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models-Typical Case Studies-Strategies for Transition towards Value - based Life and Profession			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Book

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Web References

1. https://www.uhv.org.in/uhv-ii
2. http://www.storyofstuff.com
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://fdp-si.aicte-india.org/8dayUHV_download.php
5. https://www.youtube.com/watch?v=8ovkLRYXIjE

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
5	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**					
Semester	**I**	Course Category : HS			End Semester Exam Type:**TE**		
Course Code	U23ENBC01	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Communicative English - I**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the communication flow in organization and its objectives	**K2**
	CO2 Write the technical contents with grammatically precise sentences	**K2**
	CO3 Articulate with correct pronunciation and overcome vernacular impact in speaking	**K3**
	CO4 Express opinions confidently in formal and informal communicative contexts	**K2**
	CO5 Attend interview with assertiveness	**K3**

UNIT- I	**Workstead Communication**	**Periods:10**	
Communication, Definition, Process, Channels, Barriers, Strategies for Effective Communication, Verbal and Nonverbal Communication - Listening, Types, Barriers, Enhancing Listening Skills - Bibliography: Book, Journal and Internet References			**CO1**
UNIT- II	**Common Errors In Writing And Comprehension Strategies**	**Periods:10**	
Subject Verb Agreement, Misplaced Modifiers, Squinting Modifiers, Dangling Modifier, Fused Sentence, Comma Splice, Sentence Fragment - Reading Comprehension: Technical passage, Strategies: Skimming, Scanning, Intensive and Extensive Reading, Prediction, and Contextual Meaning			**CO2**
UNIT- III	**Phonetics**	**Periods:10**	
Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non-silent Letters, Intonation, Spelling Rules and Words often misspelled, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue			**CO3**
UNIT- IV	**Communication Practice-I**	**Periods:15**	
List of Exercises **Listening**: Self Introduction videos **Speaking**: Self-Introduction, Extempore, and Role Play **Reading**: Non-Technical Comprehension Passage **Writing:** Common Errors in Writing			**CO4**
UNIT-V	**Interpersonal Communication-I**	**Periods:15**	
List of Exercises **Listening:** Speech Sounds, Interview Videos **Speaking**: Debate, Structured Group Discussion, and Conversation **Reading**: Commonly Confused Words **Writing:** Transcription			**CO5**

Lecture Periods:30	**Tutorial Periods:-**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. Richa Mishra , RatnaRao, “A textbook of English Language Communication Skills”, Macmillan Publishers India Private Ltd., Revised Edition 2021.
2. Rizvi M. Ashraf, “Effective Technical Communication”, New Delhi: Tata-McGraw-Hill Publishing Company Limited, 4th Edition, 2010.
3. Balasubramanian T, “English Phonetics for Indian students workbook”, 2nd Edition, Trinity Press, 2016.

Reference Books

1. N.P.Sudharshana, C. Savitha,” English for Engineers”, Cambridge University Press, 2018.
2. Raman, Meenakshi, and Sharma, Sangeetha, “Technical Communication - Principles and Practice”, 3rd Edition, Oxford University Press, 2017.
3. Comfort, Jeremy,etal., “Speaking Effectively: Developing Speaking Skills for Business English”, Cambridge University Press, Cambridge, Reprint 2011.
4. Wren & Martin, “High School English Grammar and Composition”, S Chandh &Co. Ltd, 2015.
5. Boove, Courtland L, “Business Communication Today”, Pearson Education, New Delhi,2002.

Web References

1. https://lemongrad.com/subject-verb-agreement-rules/
2. https://opentextbc.ca/advancedenglish/chapter/misplaced-and-dangling-modifiers/
3. https://www.hitbullseye.com/Reading-Comprehension-Tricks.php
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://worldscholarshipvault.com/neutralize-mother-tongue-interference/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	1	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		40
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

- **LRW components of Practical can be evaluated through Language Lab Software**

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category : **ES**			*End Semester Exam Type: **LE**			
Course Code	U23CSPC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN C LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
	(Common to All Branches)							

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implement logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2 Execute C programs for simple applications making use of basic constructs, arrays and strings.	**K3**
	CO3 Experiment C programs involving functions, recursion, pointers, and structures.	**K3**
	CO4 Demonstrate applications using sequential and random access file processing.	**K3**
	CO5 Build solutions for online coding challenges.	**K3**

List of Exercises **Periods: 09**

1. Create a C program to find the Area of the triangle.
2. Develop a C program to read a three-digit number and produce output like
   1 hundreds
   7 tens
   2 units
   For an input of 172.
3. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
4. Print the numbers from 1 to 10 along with their squares using C program.
5. Demonstrate do—While loop in C to find the sum of ‘n’ numbers.
6. Find the factorial of a given number using Functions in C.
7. Check whether a given string is palindrome or not?
8. Check whether a value is prime or not?
9. Develop a C program to swap two numbers using call by value and call by reference.
10. Construct a C program to find the smallest and largest element in an array.
11. Implement matrix multiplication using C program.
12. Create a C program to perform various string handling functions like strlen, strcpy, strcat, strcmp.
13. Develop a C program to remove all characters in a string except alphabets.
14. Create a C program to find the sum of an integer array using pointers.
15. Find the Maximum element in an integer array using pointers.
16. Construct a C program to display Employee details using Structures
17. Display the contents of a file on the monitor screen.
18. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
19. Write a C program to create two files with a set of values. Merge the two file contents to form a single file
20. Create a C program to pass the parameter using command line arguments.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Zed A Shaw,”Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)”, Addison Wesley,2016.
2. Anita Goel and Ajay Mittal, ”Computer Fundamentals and programming in C”,Pearson Education,First edition, 2011.
3. Maureen Sprankle,Jim Hubbard,” Problem Solving and Programming Concepts,” Pearson,9th Edition, 2011.
4. Yashwanth Kanethkar, “Let us C”, BPB Publications,13th Edition,2008.
5. B.W.Kernighan and D.M. Ritchie, “The C Programming Language”, Pearson Education, 2nd Edition, 2006.

Web References

1. https://alison.com/course/introduction-to-c-programming

2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**EEE and ECE**	Programme: **B.Tech.**						
Semester	**I/II**	Course Category: **ES**			*End Semester Exam Type: **LE**			
Course Code	U23ESPC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to CSE, IT, MECH, CIVIL,CCE, AI&DS, FT, MCTR, CSBS Branches)

Prerequisite	Mathematics and Physics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Build the different wirings for domestic and commercial applications.	**K3**
	CO2 Design and analyze the domestic power distribution.	**K3**
	CO3 Estimate the performance of transformer and motors by conducting load test.	**K3**
	CO4 Describe characteristics of semiconductor diode and utilize it for different applications	**K5**
	CO5 Relate the characteristics of various transistor	**K2**
	CO6 Understand Rectifiers and Regulators	**K2**

List of Experiments

PART – A
ELECTRICAL EXPERIMENTS

Demonstration on Power Sources, Ammeters, Voltmeters, Wattmeter and Energy meter are Pre-requisite for conducting this Electrical Engineering Lab.

1. Electrical safety precautions and study of tools, accessories, electrical joints and electrical symbols.
2. Domestic Wiring Practice
   - Staircase wiring
   - Doctor's room wiring
   - Godown wiring
   - Wiring of Ceiling fan, LED lamps and Iron Box.
3. Design of Domestic power distribution.
4. Measurement of 3-phase power using two wattmeter method.
5. Load test on DC shunt motor.
6. Load test on single phase transformer.
7. Load test on single phase Induction Motor.

PART – B
ELECTRONICS EXPERIMENTS

1. Study of Electronic components and equipment: Resistor, Capacitor
2. Measurement of AC signal parameter (Peak-Peak, rms period, frequency) using CRO.
3. VI Characteristics of PN junction diode, Zener diode
4. Input and output characteristics of Common Emitter configuration of BJT
5. Characteristics of JFET
6. Measurement of Ripple factor of HWR, FWR
7. Voltage Regulator using Zener Diode.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. T.Jeyapoovan Nadar, "Engineering Practices Lab Manual", Vikas Publishing House Private Limited, New Delhi, 5th edition, 2014.
2. A.Sudhakar and Shyam Mohan.S.P, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th edition, 2017.
3. D.P.Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.

4. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, Electrical and Electronics Technology, Pearson Education Limited, New Delhi, 10th edition 2010.
5. S.K. Sahdev, “Fundamentals of Electrical Engineering and Electronics”, DhanpatRai and Co, 2017.

Web References

1. http://eie.sliet.ac.in/laboratories/basic-electrical-engineering-lab/
2. https://www.electronics-tutorials.ws/accircuits/series-circuit.html
3. https://www.allaboutcircuits.com/textbook/experiments/
4. https://www.electronicshub.org/measurements-of-ac-current/
5. http://www.electronics-tutorials.ws

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
2	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
3	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
4	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
5	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
6	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Mechanical Engineering**	Programme: **B.Tech.**						
Semester	I/II	Course Category : **ES**			*End Semester Exam Type: **LE**			
Course Code	U23ESPC03	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING GRAPHICS USING AUTO CAD**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
	(Common to All Branches)							
Prerequisite	-							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Familiarize with the fundamentals and standards of engineering graphics.	**K2**
	CO2	Perform drawing of basic geometrical constructions and multiple views of objects.	**K2**
	CO3	Visualize the isometric and perspective sections of simple solids.	**K3**
	CO4	Connect side view associate on front view.	**K4**
	CO5	Correlate sectional views and lateral surface developments of various solids.	**K4**

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing a Title Block with necessary text and projection symbol.
3. Drawing 2D sketch by applying modify tools like fillet, mirror, array, etc.,
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Simple stool, V-block, Mixie Base).
6. Drawing a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing lateral surface development of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creating 3D model of simple object and obtaining 2D multi-view drawings.
11. Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st Edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson **Education** Publication, 2011.
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.
6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012.
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016.
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
2	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
3	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
4	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
5	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category : **AEC**			*End Semester Exam Type:			
Course Code	U23CCC1XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE- I**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

(Common to all Branches)

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered throughCentre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years.Pass in this course is mandatory for the award of degree.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	U23CCM101	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUCTION PROGRAMME**	-	-	-	Non-Credit	-	-	-
Prerequisite	**-**							

Course Outcomes	The course will enable the student to	BT Mapping (Highest Level)
	CO1 Develop holistic attitude and harmony in the individual, family, and Society	**K2**
	CO2 Acquire grammar skills and capable to write and speak English confidently	**K2**
	CO3 Understand the basic concepts in Mathematics and Programming	**K2**
	CO4 Know about the art and culture, language and literature of this vast secular nation	**K2**
	CO5 Identify the inherent talent and develop it professionally	**K3**

UNIT-I	**Universal Human Values**	**Periods: 12**
Welcome and Introductions - Getting to know each other, Aspirations and Concerns - Individual Academic and Career, Expectations of Family, Peers, Society, Nation, Fixing one's Goals, Self-Management - Self-confidence, Peer Pressure, Time Management, Anger, Stress Personality Development, Self-improvement, Health - Health issues, Healthy diet, Healthy lifestyle, Hostel life, Relationships - Home sickness, Gratitude towards Parents, Teachers and others Ragging and interaction, Competition and Cooperation, Peer Pressure, Society - Participation in Society, Natural Environment - Participation in Nature, Sum Up - Role of Education, Need for a Holistic Perspective, Self-evaluation and Closure - Sharing and feedback.		**CO1**

UNIT-II	**Proficiency in English**	**Periods: 12**
Communication skills - Prognostic test on Grammar - Synonyms, Antonyms, Tenses, Sentence Completion, Idioms and Phrases, One-word Substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb Agreement - Writing - Paragraph writing, Letter writing, Essay writing, Story Development.		**CO2**

UNIT-III	**Bridge course in Mathematics and C Programming**	**Periods: 12**
Mathematics: Fundamentals of differential and integral calculus: Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept of derivative - Slope of a curve - Differentiation Techniques - Derivatives of elementary functions from first principle - Derivatives of inverse functions - Logarithmic differentiation - Method of substitution - Differentiation of parametric functions - Differentiation of implicit functions - Higher order derivatives. Integrals of functions containing linear functions - Method of integration (Decomposition method, method of substitution, integration by parts) - Definite integrals. Simple definite integrals - Properties of Definite integrals - Reduction formulae - Area and volume - Length of curve - surface area of a solid. **C Programming:** Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs.		**CO3**

UNIT-IV	**Literary activities**	**Periods: 12**
Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, சிறப்பு சொற்பொழிவு - தமிழர் மரபு மற்றும் தமிழர் தொழில்நுட்பம்.		**CO4**

UNIT-V	**Creative arts**	**Periods: 12**
Introduction to painting and renowned artworks - Documentary and Short films - Music - Vocal, Instrumental - Dance - Classical, Cinematic - Mimicry - Mime.		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Reference Books

1. A Foundation Course in Human Values and Professional Ethics, R.R Gaur, R. Asthana, G.P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Kumar Mohan R, “English Grammar for all (Functional and Applied Grammar)”, Unicare Academy, 2022.
3. Seely, John. Oxford A-Z of Grammar and Punctuation. Oxford Publication, 2013.
4. B.V. Ramana,” Higher Engineering Mathematics”, Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. Dr. A. Singaravelu, “Engineering Mathematics - I”, Meenakshi publications, Tamil Nadu, 2019.
6. E. Balagurusamy, "PROGRAMMING IN ANSI C", Mc Graw Hill, 8th Edition, 2019.
7. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL
8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)
9. தமிழக வரலாறு - மக்களும் பண்பாடும், பிள்ளை, கே. கே. , சென்னை : உலகத் தமிழாராய்ச்சி நிறுவனம் , 2002.
10. கணினித்தமிழ் - முனைவர் இல.சுந்தரம், விகடன் பிரசுரம்.
11. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம், தமிழக தொல்லியல் துறை

Web References

1. http://www.newsociety.com/Books/S/Slow-isBeautiful
2. https://www.aplustopper.com/formal-letter/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. http://www.math.cum.edu/~wn0g/2ch6a.pdf

Department	**Mathematics**	Programme : **B.Tech.**						
Semester	**II**	Course Category :**BS**			*End Semester Exam Type: **TE**			
Course Code	U23MATC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MATHEMATICS – II**	**3**	**1**	**-**	**4**	**25**	**75**	**100**
(Common to ALL Branches Except CSBS,FT)								

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Convert a periodic function into series form.	**K2**
	CO2 Compute Fourier transforms of various functions.	**K3**
	CO3 Solve Differential Equations using Laplace transforms.	**K3**
	CO4 Apply inverse Laplace transform of simple functions.	**K3**
	CO5 Solve difference equations using Z – transforms.	**K3**

UNIT – I	**FOURIER SERIES**	**Periods:12**
Dirichlet's conditions – General Fourier series – Odd and Even functions – Half-Range sine and cosine series – Change of intervals – Parseval's Identity.		**CO1**

UNIT – II	**FOURIER TRANSFORMS**	**Periods:12**
Fourier Transforms and its inverse – Properties of Fourier Transform (without proof) – Fourier sine and cosine Transforms and their properties (excluding proof).		**CO2**

UNIT – III	**LAPLACE TRANSFORMS**	**Periods:12**
Laplace transforms of elementary functions and Periodic functions – Basic properties (excluding proof) – Laplace transforms of derivatives and integrals – Initial and final value theorems.		**CO3**

UNIT – IV	**INVERSE LAPLACE TRANSFORMS**	**Periods:12**
Definition of inverse Laplace Transforms – Convolution theorem (excluding proof) – Solutions of Linear ODE of second order with constant coefficients.		**CO4**

UNIT – V	**Z – TRANSFORMS**	**Periods:12**
Standard Z-transforms – Elementary Properties – Inverse Z-transforms (using partial fraction and Residues) – Solution of second order difference equations.		**CO5**

Lecture Periods:45	**Tutorial Periods:15**	**Practical Periods:-**	**Total Periods:60**

Text Books

1. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.
2. C. P. Gupta, Shree Ram Singh. M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi 2016.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Co. New Delhi, 2019.

Reference Books

1. N.P. Bali and Dr. Manish Goyal, "A TEXTBOOK OF ENGINEERING MATHEMATICS", UNIVERSITY SCIENCE PRESS, India, 8th Edition, 2016.
2. P. Sivaramakrishna Das , and C. Vijayakumari, "Engineering Mathematics", Pearson Education India Education services Pvt. Ltd 2017.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition 2019.
4. G.Balaji, "Engineering Mathematics - Transforms and Partial Differential Equatiojs", G.Balaji Publishers, 18th Edition, 2022.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi 2017.

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1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/11110711
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	1	-	-	-	-	-	1	1	-	-
2	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-
5	3	2	1	1	-	1	-	-	-	-	-	1	3	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Physics and Chemistry**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **BS**			*End Semester Exam Type: **TE**			
Course Code	U23BSTC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PHYSICAL SCIENCE FOR ENGINEERS**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
(Common to all Branches)								
Prerequisite	Physics of 12th standard or equivalent / Chemistry of 12th standard or equivalent.							

Course Outcome		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Understand the basic of properties of magnetic, dielectric and superconductors.	**K2**
	CO2	Identify the wave nature of the particles, physical significance of wave functions	**K3**
	CO3	Understand the basic principles of laser and fiber optics communication	**K2**
	CO4	Understand and familiar with the water treatment.	**K2**
	CO5	Understand the electrode potential for its feasibility in electrochemical reaction and uses of various batteries.	**K2**
	CO6	Understand the specific operating condition under which corrosion occurs and suggest a method to control corrosion.	**K2**

SECTION A - PHYSICS

UNIT-I	**MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS**	**Periods: 8**	
Introduction to magnetic materials, Ferromagnetism- Domain theory-Types of energy-Hysteresis-Hard and Soft magnetic materials-ferrites-Dielectric materials-Types of polarization – Langevin-Debye equation-Frequency effects on polarization-Dielectric breakdown- Ferroelectric materials-Superconducting materials and their properties.			**CO1**
UNIT-II	**QUANTUM MECHANICS**	**Periods: 7**	
Matter Waves - de Broglie Wavelength - Uncertainty Principle –Physical Significance of wave functions - Schrodinger wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Tunnel Diode.			**CO2**
UNIT-III	**LASER AND FIBER OPTICS**	**Periods: 7**	
Lasers - Principles of Laser - Spontaneous and Stimulated Emissions - Einstein's Coefficients - Population Inversion and Laser Action –components of laser - Types of Lasers - NdYAG, CO_2 laser, GaAs Laser Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)			**CO3**

SECTION B – CHEMISTRY

UNIT-IV	**WATER AND ITS TREATMENT**	**Periods: 8**	
Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse osmosis-disadvantages of using hard water in boiler - Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment–Ion exchange demineralization and zeolite process.			**CO4**
UNIT-V	**ELECTROCHEMICAL CELLS AND STORAGE DEVICES**	**Periods: 8**	
Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel and Ag/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H_2 - O_2 fuel cell-applications.			**CO5**
UNIT-VI	**CORROSION**	**Periods: 7**	
Corrosion –Introduction - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electroless plating of nickel.			**CO6**

Lecture Periods: 45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 45**

Text Books

1. V Rajendran, "Engineering Physics", 2nd Edition, TMH, New Delhi 2011.
2. S.S Dara – "A text book of Engineering Chemistry" - 15th Edition, 2021. S.Chand Publications.
3. C.Jain, Monica Jain, —" Engineering Chemistryll" 17thEd. DhanpatRai Pub. Co., NewDelhi, (2015).

Reference Books

1. R.Murugeshan, "Modern Physics", S. Chand &Co, New Delhi 2006.
2. William D Callister Jr., "Material Science and Engineering", 6th Edition, John Wiley and sons, 2009.
3. Jain & Jain "Engineering chemistry", 23rd Edition, DhanpatRai Publishing Company. 2022
4. Mars Fontana "Corrosion Engineering", July 2017
5. JinaRedlin, "Handbook of Electrochemistry", March 28, 2005

Web References

1. https://www.sciencedaily.com/terms/materials_science.htm.
2. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials science.html.
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html
4. https://mechanicalc.com/reference/engineering-materials
5. http://ndl.ethernet.edu.et/bitstream/123456789/89589/1/%5BPerez_N.%5D_Electrochemistry_and_corrosion%28BookZZ.org%29.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
3	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**II/III**	Course Category: **ES**			*End Semester Exam Type: **TE**			
Course Code	U23CSTC03	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to all branches)

Prerequisite	Any Programming knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Compute time and space complexity for given problems	**K3**
	CO2 Demonstrate stack, queue and its operation.	**K3**
	CO3 Illustrate the various operations of linked list.	**K3**
	CO4 Use the concepts of tree for various applications.	**K3**
	CO5 Outline the various Tables, Graphs and Sets techniques.	**K3**

UNIT-I	**Basic Terminologies of Data Structures**	**Periods: 09**	
Introduction: Basic Terminologies – Asymptotic Notations: Complexity analysis. Array and its operations - Searching: Linear Search and Binary Search Techniques. Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort. Performance and Comparison among the sorting methods.			**CO1**

UNIT-II	**Stack and Queue Operations**	**Periods: 09**	
Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.			**CO2**

UNIT-III	**Linked List Operations**	**Periods: 09**	
Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.			**CO3**

UNIT-IV	**Trees**	**Periods: 09**	
Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree – Threaded Binary Tree – Binary Search Tree – Binary Tree Traversals – AVL Tree- Red Black Tree.			**CO4**

UNIT-V	**Graphs, Tables and Sets**	**Periods: 09**	
Graph: Basic Terminologies and Representations – Graph traversal algorithms. Tables: Different types of tables – Hash Table and its operations - Applications. Sets: Representation of Sets- Operations and its applications.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4th Edition, 2009.

Reference Books.

1. D.Samanta, "Classic Data Structures, Prentice-Hall of India, Second Edition, 2012.
2. Robert Kruse, C.L. Tondo and Bruce Leung, "Data Structures and Program Design in c", Prentice-Hall of India, Second Edition, 2007.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second Edition,2006.
4. Mark Allen Weiss, "Algorithms, Data Structures and Problem Solving with C++", Addison- Wesley Publishing Company, Illustrated Edition, 1995.
5. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.

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1. https://www.geeksforgeeks.org/data-structures/

2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**II/III**	Course Category: **ES**			*End Semester Exam Type: **TE**			
Course Code	U23ADTC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN PYTHON**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to all branches)

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the basic concepts of Python programs	**K2**
	CO2 Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts	**K2**
	CO3 Experiment with Numpy package	**K3**
	CO4 Apply and analyze Data Manipulation with Pandas.	**K3**
	CO5 Illustrate programming concept for Visualization with Matplotlib	**K3**

UNIT-I	**Introduction to Python**	**Periods: 09**	
Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.			**CO1**
UNIT-II	**Sequence Datatypes and Object Oriented Programming**	**Periods: 09**	
Sequences – Mapping and Sets – Dictionaries. Classes: Classes and Instances – Inheritance – Exception Handling – Introduction to Regular Expressions using "re" module.			**CO2**
UNIT-III	**Using Numpy**	**Periods: 09**	
Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays – Structured Data: NumPy's Structured Array.			**CO3**
UNIT-IV	**Data Manipulation with Pandas**	**Periods: 09**	
Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Sets. Aggregation and Grouping – Pivot Tables –Vectorized String Operations – Working with Time Series – High Performance Pandas – eval() and query().			**CO4**
UNIT-V	**Visualization with Matplotlib**	**Periods: 09**	
Basic functions of Matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars – Three-Dimensional Plotting in Matplotlib.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jake VanderPlas, "Python Data Science Handbook - Essential Tools for Working with Data", O'Reily Media Inc, 2016.
2. Zhang.Y, "An Introduction to Python and Computer Programming", Springer Publications, 2016.
3. Wesley J Chun, "Core Python Programming", Pearson Education, 2nd Edition, 2006.

Reference Books.

1. John Paul Mueller, Luca Massaron, "Python for Data Science for Dummies", 2nd Edition, John Wiley& Sons, 2019.
2. Jesus Rogel-Salazar, "Data Science and Analytics with Python", CRC Press Taylor and Francis Group, 2017.
3. Brian Draper, "Python Programming A Complete Guide for Beginners to Master and Become an Expert in Python Programming Language", CreateSpace Independent Publishing Platform, 2016.
4. Mark Lutz, Laura Lewin, Frank Willison, "Programming Python", O'Reilly Media, 3rd Edition, 2006.
5. Gowrishankar S, Veena A, "Introduction to Python Programming", CRC Press, 2018..

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	2	1	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	3	2	3
4	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
5	3	3	2	3	-	-	-	-	-	-	-	2	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	U23CCT201	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL ELECTRONICS**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite	Nil							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret fundamental concepts of digital electronics like numbering system and numbering system conversion	**K3**
	CO2	Use Boolean theorems, k-maps and tabulation method for simplification of logical expression	**K3**
	CO3	Implement various combinational circuits using logic gates	**K3**
	CO4	Illustrate design procedures for synchronous sequential circuits	**K3**
	CO5	Design combinational circuits using programmable logic devices.	**K3**

UNIT-I	**Introduction**	**Periods: 09**
Introduction to Digital Electronics- Number Systems – Decimal, Binary, Octal, Hexadecimal Numbering Systems- Conversion of one numbering system to another- Binary numbering system for signed numbers- Sign Magnitude,1's and 2's complements, 1's and 2's Complement Arithmetic-Introduction Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes		**CO1**

UNIT-II	**Boolean Algebra and Simplification Techniques**	**Periods: 09**
Introduction logic gates- universal gates-Introduction to Boolean Algebra-Boolean theorems-Demorgan's theorem, Simplification of Boolean expression- , Sum of products and product of sums, Minterms and Maxterms, Karnaugh map for 2,3,4 and 5 variable- Minimization and Quine-McCluskey method of minimization		**CO2**

UNIT-III	**Combinational Circuit Design**	**Periods: 09**
Introduction to Combinational circuits-Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.		**CO3**

UNIT-IV	**Synchronous Sequential Circuits**	**Periods: 09**
Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. programs.		**CO4**

UNIT-V	**Programmable Logic Devices**	**Periods: 09**
Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL. Introduction to VHDL-statements- logic expression-Implementation of AND, OR, half adder and full adder and Flip-Flops		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
3. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011

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1. S.Salivahanan and S.Arivazhagan, "Digital Electronics", Ist Edition, Vikas Publishing House pvt Ltd, 2012.
2. Anil K.Maini, "Digital Electronics", Wiley, 2014.
3. A.Anand Kumar, "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016.
4. Soumitra Kumar Mandal, "Digital Electronics", McGraw Hill Education Private Limited, 2016.
5. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design.",Vikas Publisher, 2009.

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1. https://www.electronics-tutorials.ws/boolean/bool_1.html
2. https://www.electronics-tutorials.ws/logic/logic_1.html
3. https://nptel.ac.in/courses/117/103/117103064/
4. http://www.asic-world.com/digital/tutorial.html
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	-	1	1	-	1	1	1	1	1	-	-
2	3	2	3	2	-	1	1	-	1	1	1	1	1	-	-
3	3	2	3	2	-	1	1	-	1	1	1	1	1	-	-
4	3	2	3	2	-	1	1	-	1	1	1	1	1	-	-
5	3	2	3	3	2	1	1	-	1	1	1	1	1	-	-

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**II**	Course Category : HS			End Semester Exam Type:**TE**			
Course Code	U23ENBC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Communicative English - II**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Draft effective written communication in professional environment	**K2**
	CO2 Apply the mechanics of creative writing with precision and clarity	**K3**
	CO3 Acquire language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation	**K2**
	CO4 Develop language fluency and gain self-confidence	**K3**
	CO5 Express thoughts and ideas with clarity and focus	**K2**

UNIT-I	**Business Correspondence**	**Periods:10**	
Business Writing: Circular, Agenda, Memoranda, Notice, Instruction, Minutes, Email Writing ,Report Writing- Official and Demi Official Letters : Applying for Educational / Car / Home Loans / Joining Report, Leave Letter, Industrial Visit, In plant Training, Letter to the Editor, Calling for a quotation, Placing Order, Letter of Complaints, Letter seeking Clarification, Resume', Job Application Letter, Bio-data, CV			**CO1**
UNIT-II	**Functional Writing Skills**	**Periods:10**	
Four Modes of Writing, Sentence Structure , Art of condensation: Summary Writing and Note Making, Use of phrase and clause in sentence, Principles of paragraph writing, Techniques of Essay Writing, Jumbled Sentence, Paraphrasing			**CO2**
UNIT-III	**Etiquettes**	**Periods:10**	
Etiquette: Meaning, Kinds: Corporate Etiquette, Meeting Etiquette, Telephone Etiquette, Email Etiquette, Social Media Etiquette, Dining Etiquette, Communication Etiquette			**CO3**
UNIT-IV	**Communication Practice-II**	**Periods:15**	
List of Exercises **Listening:** Letter writing tips **Speaking:** Just a Minute, Impromptu Speech, Contemporary Issues **Reading:** Variety of examples for Modes of Writing **Writing:** Different types of letters			**CO4**
UNIT-V	**Interpersonal Communication-II**	**Periods:15**	
List of Exercises **Listening:** Videos on different types of Etiquettes **Speaking:** Team Presentation, Negotiation Skills **Reading:** Phrases and Clauses **Writing:** Free writing on any given topic, Paraphrasing Practice			**CO5**

LecturePeriods:30	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. PC Das, "Letter Writing including Official and Business Letters", New Central Book Agency, 2020.
2. Kumar, Sanjay, Pushpalatha," Communication Skills". Oxford University Press, 2018.
3. Raman, Meenakshi&Sangeetha Sharma," Communication Skills", New Delhi: OUP,2018.

Reference Books

1. Sahukar, Nimeran , Bhalla, Prem,, "The book of Etiquettes and Manners".PustakMahal Publisher, New Delhi; 1st Edition 2009.
2. Gerson Sharon J, Steven M. Gerson, "Technical Writing Process and Product", Pearson Education Pvt. Ltd. 3rd Edition, 2009.
3. Grussendorf, Marion, "English for Presentations". Oxford University Press, Oxford, 2007.

4. Seely John, “The Oxford Guide to Writing and Speaking”, Oxford University Press, 2006.
5. R.C. Sharma, Krishna Mohan, “Business Correspondence and Report Writing”, Tata McGraw Hill &Co.Ltd., New Delhi, 2001.

Web References

1. https://www.indeed.com/career-advice/finding-a-job/how-to-write-an-application-letter
2. https://owlcation.com/humanities/Four-Types-of-Writing
3. https://targetstudy.com/languages/english/paragraph-writing.html
4. https://www.businessnewsdaily.com/8262-email-etiquette-tips.html
5. https://www.youtube.com/watch?v=UOceysteIjo

Os/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		40
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

- **LRW components of Practical can be evaluated through Language Lab Software**

*

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech.**						
Semester	**II/III**	Course Category: **ES**			*End Semester Exam Type: **LE**			
Course Code	U23ADPC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN PYTHON LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to All branches)

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe common Python functionality and features used for data science.	**K2**
	CO2 Query Data Frame structures for cleaning and processing.	**K2**
	CO3 Configure your programming environment.	**K3**
	CO4 Experiment the concept using data visualization.	**K3**
	CO5 Analyze real time datasets.	**K3**

List of Experiments:

1. Build a python program to implement Fibonacci series.
2. Build a python program to get a range of numbers from user and to separate even numbers and odd numbers respectively.
3. Build a function in Python to check duplicate letters. It must accept a string, i.e., a sentence. The function should return True if the sentence has any word with duplicate letters, else return False.
4. Build a program to perform arithmetic operations using lambda function.
5. Build a Python program that takes a list of numbers as input and returns a new list containing only the even numbers from the input list.
6. Build a python program to create a class called Car with attributes Company, model, and year. Implement a method that returns the age of the car in years.
7. Build a python program to create a base class called Shape that has a method called area which returns the area of the shape (set it to 0 for now). Then, create two derived classes Rectangle and Circle that inherit from the Shape class to calculate the area of derived classes.
8. Build a python program to implement aggregation using Numpy
9. Build a python program to perform Indexing and Sorting.
10. Build a python program to perform Handling of missing data.
11. Build a python program to perform usage of Pivot table using Titanic datasets
12. Build a python program to perform use of eval() and query()
13. Build a python program to perform Scatter Plot
14. Build a python program to perform 3D plotting
15. 15. Implement an application to process a real time data.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.
2. Siddhartha Chatterjee, Michal Krystyanczuk, “Python Social Media Analytics”, Packt Publishing, 2017.
3. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reily Media Inc, 2016.
4. Zhang.Y, “An Introduction to Python and Computer Programming”, Springer Publications, 2016.
5. Wesley J Chun, “Core Python Programming”, Pearson Education, 2nd Edition, 2006.

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	3	-	-	-	-	-	-	-	2	2	2
2	2	3	2	2	3	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme: **B.Tech**						
Semester	**II/III**	Course Category: **ES**			*End Semester Exam Type: **LE**			
Course Code	U23CSPC02	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)								
Prerequisite	Basic Programming Knowledge							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Analyze the algorithm's / program's efficiency in terms of time and space complexity.	**K3**
	CO2	Solve the given problem by identifying the appropriate Data Structure.	**K3**
	CO3	Solve the problems of searching and sorting techniques.	**K3**
	CO4	Solve problems in linear Data Structures.	**K4**
	CO5	Solve problems in non-linear Data Structures.	**K4**

List of Experiments:

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. a) Delete an element from list b) Search for a key element in list c) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in
   a) Preorder b) Inorder c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.
11. Write a C program to implement the Set operations.
    a) Union b) Intersection c) Difference.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
2. Tenebaum Aaron M, "Data Structures using C', Pearson Publisher, 1st Edition, 2019.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India 1st Edition, 2017.
4. Reema Thareja, "Data structures using C", Oxford University, 2nd Edition, 2014.
5. Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st Edition, 2013.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	Computer and Communication Engineering	Programme: **B.Tech.**						
Semester	**II**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	U23CCP201	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL ELECTRONICS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
Prerequisite	Nil							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Verify Boolean laws using logic gate.	**K3**
	CO2 Design and verify various combination circuits using logic gates.	**K4**
	CO3 Design and implement combinational circuits using MSI devices.	**K4**
	CO4 Design and verify sequential circuits	**K4**
	CO5 Write VHDL code for combinational circuits.	**K4**

List of Experiments:

1. Verification of Boolean Theorems using basic gates.
2. Design and verify Half adder and Full adder using basic gates
3. Design and verify 4-bit Adder / Subtractor Circuits using IC 7483.
4. Design and test Code Converters for BCD to Gray conversion and Excess-3-code to BCD and vice versa
5. Design and test 2-bit Magnitude Comparator and 4x16 decoder using 3 to 8 decoder
6. Design and test 4 to 1 multiplexer and de-multiplexer using IC74153.
7. Design and test Shift Registers using D-flip-flops
8. Design and test magnitude comparator using IC7404, IC7408, and IC7486.
9. Design and test Asynchronous Counters using IC 7476
10. Design and verify Synchronous Counter using IC 7476
11. Design and verify Moore and Mealy Circuits
12. VHDL code for Half adder, Full adder and decoder

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 30	Total Periods: 30

Reference Books

1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 5th Edition, Pearson, 2014.
2. Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.
3. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, 2011
4. S.Salivahanan and S.Arivazhagan, “Digital Electronics”, Ist Edition, Vikas Publishing House pvt Ltd, 2012.
5. Anil K.Maini, “Digital Electronics”, Wiley, 2014.
6. A.Anand Kumar, “Fundamentals of Digital Circuits”, 4th Edition, PHI Learning Private Limited, 2016.
7. Soumitra Kumar Mandal, “Digital Electronics”, McGraw Hill Education Private Limited, 2016.
8. S. Salivahanan and S. Arivazhagan, “Digital Circuits and Design.”,Vikas Publisher, 2009

Web References

1. https://www.electronics-tutorials.ws/boolean/bool_1.html
2. https://www.electronics-tutorials.ws/logic/logic_1.html
3. https://nptel.ac.in/courses/117/103/117103064/
4. http://www.asic-world.com/digital/tutorial.html
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
2	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
3	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
4	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
5	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Mechanical**	Programme: **B.Tech.**						
Semester	**II/I**	Course Category : **ES**			*End Semester Exam Type: **LE**			
Course Code	U23ESPC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DESIGN THINKING AND IDEA LAB**	**-**	**-**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)								
Prerequisite	Basic Knowledge of Science							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Demonstrate a comprehensive understanding of the tools and inventory associated with the IDEA Lab.	**K2**
	CO2	Develop proficiency in ideation techniques to generate creative and innovative solutions for various design challenges and problems	**K3**
	CO3	Acquire practical knowledge of mechanical and electronic fabrication processes, including hands-on experience with machinery, tools, and techniques used in the manufacturing and assembly of physical components.	**K3**
	CO4	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends, and technological advancements into the design process.	**K4**
	CO5	Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects	**K4**

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team -Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design, Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.

List of Lab Activities and Experiments

1 Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2 Machining of 3D geometry on soft material such as softwood or modelling wax.
3 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6 Familiarity and use of welding equipment.
7 Familiarity and use of normal and wood lathe.
8 Embedded programming using Arduino and/or Raspberry Pi.
9 Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10 Discussion and implementation of a mini project.
11 Documentation of the mini project (Report and video).

Text Books

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd
2. Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.

Reference Books

1. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
2. Chris Hackett., "The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects"; Weldon Owen, 2018.
3. Sean Michael Ragan, "The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product",. Weldon Owen; 2017.
4. Paul Horowitz and Winfield Hill, "The Art of Electronics", 3rd edition.. Cambridge University Press.
5. Paul Sherz and Simon Monk, "Practical Electronics for Inventors", 4th edition.. McGraw Hill.
6. Simon Monk and Duncan Amos, "Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards".. McGraw Hill Education.
7. Simon Monk, "Programming Arduino: Getting Started with Sketches", 2nd edition. McGraw Hill.
8. Venuvinod, PK., MA. W., "Rapid Prototyping – Laser Based and Other Technologies", Kluwer Academic Publisher, 2004
9. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and Distributors, 5th Edition, 2002.

Web References

https://onlinecourses.nptel.ac.in/noc23_mg72

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	2	-	-	2	-	3	2	-	-	-
2	3	3	3	2	2	2	-	-	2	-	3	2	-	-	-
3	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
4	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
5	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **AEC**			*End Semester Exam Type:			
Course Code	**U23CCC2XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - II**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(Common to all Branches)								

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, E-plan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered throughCentre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years.Pass in this course is mandatory for the award of degree.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23CCM202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sports Yoga and NSS**	0	0	2	Non-Credit	100	-	100
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility and relaxation.	**K2**
	CO2 Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	**K2**
	CO3 Develop understanding of psychological problems associated with age and lifestyle.	**K2**
	CO4 Recognize the importance of national service in community development.	**K2**
	CO5 Convert existing skills into socially relevant life skills.	**K2**

UNIT-I	**INTRODUCTION TO PHYSICAL EDUCATION**	**Periods: 06**
Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education **Physical Fitness, Wellness and Lifestyle:** Importance of Physical Fitness and Wellness - Components of Physical fitness -Components of Health related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.		**CO1**
UNIT-II	**YOGA AND LIFESTYLE**	**Periods: 06**
Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures – Hypertension – Obesity - Back Pain-Diabetes - Asthema.		**CO2**
UNIT-III	**TRAINING AND PLANNING IN SPORTS**	**Periods: 06**
Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination. **Psychology and Sports** - Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies		**CO3**
UNIT-IV	**INTRODUCTION TO NATIONAL SERVICE SCHEME**	**Periods: 06**
Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc.,		**CO4**
UNIT-V	**COMMUNITY ISSUES AND THE USE OF TECHNOLOGY**	**Periods: 06**
Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages.		**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Brar Ajmer Singh, Gill Jagtar Singh, Bains Jagdish, “Modern Textbook of Physical Education Health and Sports- I”, Kalyani Publishers , 6th Edition, 2014
2. B.K.S. Iyengar, “Light on Yoga: The Definitive Guide to Yoga Practice”,Thorsons Publishers, Thorsons Classics edition, 2015
3. Joseph, Siby K, Mahodaya, “Bharat Essays on Conflict Resolution”, Institute of Gandhian Studies Publishers, 2007

4. Barman Prateeti , Goswami, “Document on Peace Education”, Triveni Akansha Publishing House, New Delhi, 2009
5. Prof R.B.S. Verma, “Field Work Practicum in Social Work-Emerging Concerns”, Rapid Publisher, Lucknow, 2020
6. Sibereisen, K , Richard M, “Lerner Approaches to Positive Youth Development”, Sage Publications, New Delhi, 2007
7. Hoshiar Singh, “Administration of Rural Development in India”,Sterling Publisher, the University of Michigan, 2009

Web References

1. http://www.thebetterindia.com/140/national-service-scheme-nss
2. http://en.wikipedia.org/wiki/national-service-scheme 19=http://nss.nic.in/adminstruct
3. http://nss.nic. in
4. http://socialworknss.org/about.html
5. Young Journal on Youth published by SAGE: http://you.sagepub.com

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **BS**				*End Semester Exam Type:**TE**		
Course Code	**U23MATC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Probability and Statistics**	**3**	**1**	**0**	**4**	**25**	**75**	**100**
(Common to All Branches Except CSBS)								
Prerequisite	Basic Probability							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Understand the concept of probability.	**K3**
CO2	Solve the problem on Random variables.	**K3**
CO3	Understand the concepts of Analysis of variance.	**K3**
CO4	Learn the applications of Large Samples.	**K3**
CO5	Analyze the problems in small samples.	**K3**

UNIT – I	**THEORY OF PROBABILITY**	**Periods:12**	
Random Experiments - Sample Space - Exhaustive events- Axioms of probability – Conditional probability – Total probability – Bayes theorem.			**CO1**
UNIT – II	**RANDOM VARIABLES**	**Periods:12**	
Discrete Random Variable – Binomial distribution – Poisson distribution. Continuous Random Variable – Exponential distribution – Normal distribution (Excluding Derivation of Mean, Variance and MGF).			**CO2**
UNIT – III	**STATISTICS & ANALYSIS OF VARIANCES**	**Periods:12**	
Correlation – Rank correlation and Regression. Analysis of variance: One-way classifications. and two-way classifications.			**CO3**
UNIT – IV	**LARGE SAMPLES**	**Periods:12**	
Large Samples: Single Propositions – Difference of Proportions – Single Mean – Difference of Mean – Difference of Standard Deviations.			**CO4**
UNIT – V	**SMALL SAMPLES**	**Periods:12**	
Test for Single and Difference Mean – Test for Ratio of Variances – Chi-Square test for Goodness of Fit and Independence of Attributes.			**CO5**

Lecture Periods:45	**Tutorial Periods:15**	**Practical Periods: -**	**Total Periods:60**

Text Books

1. T. Veerarajan, “Probability, Statistics and Random Processes”, Tata McGraw-Hill, 3rd Edition, 2008.
2. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, 2019.
3. S.C. Gupta, V.K. Kapur “Fundamental of Mathematical Statistics” Sultan Chand & sons, 12th Edition, 2022.

Reference Books

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna publishers, 3rd Edition,2017
2. William Mendenhall, Robert J. Beaver and Barbara M. Beaver: “Introduction to Probability & Statistics”, Cengage Learning, 15thEdition, 2019.
3. Richard. A. Johnson, Irwin Miller and John E. Freund,” Probability and Statistics for Engineers”, Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, “An Introduction to Probability and Statistics”, Wiley, 3rd Edition 2008.

Web References

1. www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
3	2	2	-	-	-	1	-	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	-	-	-	1	-	1	3	-	1
5	3	2	1	1	-	1	-	-	-	1	-	1	3	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CCT302**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Principles of Computer Organization**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Computer Basics							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the basic functional blocks of computer	**K2**
	CO2 Describing the basic Computer organization and addressing modes	**K2**
	CO3 Solve arithmetic problems by 2's complement and Booth's algorithm	**K3**
	CO4 Classify types of memory used for various applications	**K3**
	CO5 Classify various Input-Output Interface and Multiprocessors	**K3**

UNIT-I	**Structure of Computers**	**Periods:09**
Introduction - IAS Computer - Von Neumann Architecture - Bus Structure and its Types. Data Representation, CPU Organization: Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer. CISC &RISC processors, Performance - Processor clock, Basic performance equation, Clock rate, Performance measurement.		**CO1**
UNIT-II	**Basic Computer Organization and Design**	**Periods:09**
Instruction Codes-Computer Instructions-Instruction Cycle-Timing and Control. Central processing unit: Stack Organization- Instruction Formats -Addressing Modes - Data Transfer and manipulation-Program Control.		**CO2**
UNIT-III	**ALU**	**Periods:09**
Basic Structure of ALU, Addressing mode, Instruction Formats, Handling of interrupts and subroutines, Combinational ALU, 2's Complement Addition, Subtraction Unit, Booth's Algorithm for multiplication and division.		**CO3**
UNIT-IV	**Memory System**	**Periods:09**
Memory System: Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations.		**CO4**
UNIT-V	**Input-Output and Multiprocessors**	**Periods:09**
Input Output: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA. Multiprocessors: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Book

1. M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.
2. J.P.Hayes, "Computer Architecture and Organization", 3rd edition, TMH, 2017.
3. Thomas C. Bartee, "Computer Architecture and Logic Design", Mc. Graw Hill, 2010

Reference Books

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.
2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,
4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

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1. https://nptel.ac.in/courses/106/106/106106092/
2. https://nptel.ac.in/courses/106/106/106106166/
3. https://nptel.ac.in/courses/106/105/106105163/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	1	-	-	-	-	-	-	1	1	1	-	-
2	3	1	2	1	-	-	-	-	-	-	1	1	1	-	-
3	3	1	2	1	-	-	-	-	-	-	1	1	1	-	-
4	3	1	2	1	-	-	-	-	-	-	1	1	1	-	-
5	3	1	2	1	-	-	-	-	-	-	1	1	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23CCT303**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Analog Electronics**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
		(CCE)						
Prerequisite	Basic Electronics							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Design BJT amplifier using different types of Biasing	**K3**
	CO2 Describe different types of power amplifier and its efficiency	**K2**
	CO3 Design and analyze different type of oscillators	**K3**
	CO4 Describe characteristics of operational amplifier and design basic circuits using opamp	**K2**
	CO5 Use opamp for designing basic active electronic circuits	**K3**

UNIT – I	**BJT AMPLIFIER**	**Periods:09**	
BJT– Need for biasing – DC Load Line and Bias Point – DC analysis of Transistor circuits – Various biasing methods of BJT – Bias Circuit Design – Thermal stability – Stability factors – Bias compensation techniques using Diode, thermistor and sensistor- Features and Comparison of CB,CC and CE amplifiers			**CO1**
UNIT – II	**POWER AMPLIFIER**	**Periods:09**	
Introduction, series –fed Class A amplifier, Transformer-Coupled Class A amplifier, Class B amplifier operation, Class B amplifier circuits, Amplifier distortion, Class C and Class D amplifier			**CO2**
UNIT – III	**OSCILLATORS**	**Periods:09**	
Classification of oscillators, Barkhausen criterion, Analysis of RC phase shift and Wien bridge oscillators, Working of Hartley, Colpitts and Crystal oscillators			**CO3**
UNIT – IV	**OPERATIONAL AMPLIFIERS**	**Periods:09**	
Functional block diagram of Operational amplifier- Ideal Characteristics of an operational Amplifier , frequency response of OP-AMP–Common Mode Rejection Ratio-CMRR, Basic Applications of OP-Amp as an Inverting and Non-Inverting Amplifier, Integrator, Differentiator, Summer ,Subtractor, V to I converter, I to V converter.			**CO4**
UNIT – V	**APPLICATIONS OF OPERATIONAL AMPLIFIERS**	**Periods:09**	
Instrumentation amplifier, Log and Antilog Amplifiers, first order active filters, comparators, multivibrators, waveform generators, S and H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps			**CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:**	**Total Periods:45**

Text Books

1. Adel .S. Sedra, Kenneth C. Smith, “Micro Electronic Circuits”, 6th Edition, Oxford University Press, 2013.
2. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education /PHI, 2008.
3. D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 5th Edition, 2018

Reference Books

1. David A., Bell “Electronic Devices and Circuits”, Oxford Higher Education Press, 5th Edition, 2010
2. D.Schilling and C.Belove, “Electronic Circuits”, 3rd Edition, McGraw Hill, 2009
3. Donald .A. Neamen, “Electronic Circuit Analysis and Design”, 2nd Edition,Tata McGraw Hill, 2009
4. Millman J. and C. Halkias, Integrated Electronics, 2/e, McGraw-Hill, 2010·
5. R.S.Sedha, “Applied Electronics”, S.Chand& co, 2000

Web References

1. http://www.build-electronic-circuits.com/
2. https://www.allaboutcircuits.com/
3. https://www.electronics-tutorials.ws/amplifier/amp_1.html
4. https://nptel.ac.in/courses/117/103/117103063/
5. https://www.electronics-lab.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	1	1			1	1	1	2	2	-
2	3	3	2	1	2	1	1			1	1	1	2	2	-
3	3	3	3	2	2	1	1			1	1	1	2	2	-
4	3	3	3	2	2	1	1			1	2	1	2	2	-
5	3	3	2	1	2	1	1			1	2	1	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**III**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CCT304**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Principles of Communication Engineering**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Comprehend needs of modulation and various analog modulation techniques	**K2**
	CO2 Describe the principles of Angle Modulation techniques	**K2**
	CO3 Illustrate pulse modulation techniques.	**K3**
	CO4 Describe the concept of Digital modulation techniques	**K3**
	CO5 Impart knowledge on the concepts of fiber optical communication system.	**K3**

UNIT-I	**Amplitude Modulation**	**Periods: 09**	
Amplitude modulation – frequency spectrum of AM– Power in AM wave – Generation of AM signal - square law modulator, switching modulator, AM demodulation - Envelope and square law demodulation. DSB-SC modulation Balanced and Ring Modulator DSBSC-coherent detector & Costas receiver SSB-SC, VSB generation and demodulation- –Comparison of different AM techniques, Superheterodyne Receiver.			**CO1**
UNIT-II	**Angle Modulation**	**Periods: 09**	
Basic Definitions, Types of Angle Modulation, Relationship between PM and FM Frequency deviation – Types of FM – Single tone Narrow Band, Wide-Band FM, Remarks about PM – Multi tone Wide-Band FM – Transmission Bandwidth of FM Waves– FM Modulators–Parameter Variation Method (Direct Method), Armstrong method (Indirect Method) – FM Demodulators – Slope Detector, Balanced Slope Detector, Foster Seely Discriminator – Ratio Detector.			**CO2**
UNIT-III	**Pulse Modulation**	**Periods: 09**	
Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM Pulse Modulation-Principles of pulse modulation – sampling theorem - PCM - DPCM - Delta modulation and Adaptive delta modulation.			**CO3**
UNIT-IV	**Digital Modulation**	**Periods: 09**	
Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Eye pattern, equalizers.			**CO4**
UNIT-V	**Fiber Optical Communication Systems**	**Periods: 09**	
Need for fiber optics, introduction to optical fiber, principle of light transmission through a fiber, fiber characteristics and classification, various fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system- Power budget analysis for a optical link-Recent applications of fiber optics.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems”, 4th edition, TMH 2017
2. B.P.Lathi,” Modern Digital and Analog Communication Systems”, 4th edition, Oxford University Press, 2011.
3. Gerd Keiser, Optical fiber Communications, McGraw Hill International Edition, 5th edition, 2017.

Reference Books

1. H P Hsu, Schaum Outline Series, “Analog and Digital Communications”, TMH 2006
2. Wayne Tomasi, Electronics Communication systems, Pearson Education Private Limited, 5th edition, 2004.
3. A.Bource Carson and Paul B.Crilly, “Communication Systems”, 5th Edition, Mc Graw Hill, 2010
4. Torrieri, Don, “Principles of Spread Spectrum Communication Systems”, Springer, 2015
5. S. Haykin, “Digital Communications”, John Wiley 1st edition 2013

Web References

1. www.allaboutcircuits.com
2. https://nptel.ac.in/courses/108/102/108102096/
3. http://www.electronics-tutorials.ws
4. www.tutorialspoint.com

5. https://nptel.ac.in/courses/108/104/108104091/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	1	-	-	-	-	-	1	-	1	2	3	-
2	3	1	2	3	-	-	-	-	-	1	-	1	2	2	-
2	3	1	2	3	-	-	-	-	-	1	1	1	2	2	-
3	3	1	2	3	-	-	-	-	1	1	1	1	2	3	-
2	3	1	2	3	-	-	-	-	1	1	1	1	2	3	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **PC**			*End Semester Exam Type:**TE**			
Course Code	U23CCT305	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Software Engineering Principles and Testing Techniques**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify various Software Development Life Cycle Models.	**K3**
	CO2 Utilize Project Management and Requirement Analysis.	**K3**
	CO3 Apply the appropriate Software Design.	**K3**
	CO4 Identify appropriate test strategies that can be applied to a given software application.	**K3**
	CO5 Demonstrate various Quality Metrics and Management Techniques.	**K3**

UNIT-I	**INTRODUCTION**	**Periods: 09**	
Introduction to Software engineering concepts – The Software Process- Development activities – Software lifecycle models - Waterfall - Incremental – Prototyping – Evolutionary - RAD - Spiral – Agile Development.			**CO1**
UNIT-II	**SOFTWARE MANAGEMENT AND REQUIREMENTS**	**Periods: 09**	
Software Project management – Project planning – Estimation –Metrics for Project Size Estimation-– Empirical Estimation Techniques – COCOMO -Scheduling –Organization and Team structures – Staffing – Risk management – Software configuration management. Requirements Gathering and Analysis: Software Requirements –The Requirements Engineering Process, Requirements Elicitation Process and Analysis.			**CO2**
UNIT-III	**SOFTWARE DESIGN**	**Periods: 09**	
Design Process and Design Quality– Coupling and Cohesion – Software Design approaches: Object Oriented Design – UML – Use case model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams. Function Oriented Design: Data Flow Diagrams. User Interface Design - Principles and Activities.			**CO3**
UNIT-IV	**SOFTWARE TESTING STRATEGIES**	**Periods: 09**	
Introduction to software testing - Testing objectives, strategies, and techniques - Types of software testing: Unit testing, Black Box testing – White Box testing, Integration testing, System testing. Test planning process- Test execution process - Automated testing tools and frameworks.			**CO4**
UNIT-V	**SOFTWARE METRICS AND MANAGEMENT**	**Periods: 09**	
Software Metrics: Types of metrics, Product Metrics - Process Metrics - Object oriented Metrics. Quality management: Overview of Quality concepts, Software Quality Assurance, Software Quality Standards and Models: ISO 9000,CMMI - Quality assurance processes and techniques, Software Maintenance and Evolution.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Roger S. Pressman, Software Engineering a Practitioner's Approach, 9th Edition, TMH, 2014.
2. Ian Sommerville, Software Engineering, 10th Edition, Pearson Education,2015.
3. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill International Edition,8th edition, 2019.

Reference Books

1. S. L. Pfleeger and J.M. Atlee, "Software Engineering Theory and Practice", Pearson Education, 4th edition, 2010.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", 2nd edition, PHI Learning Pvt. Ltd., 2010.
3. K.K Aggarwal and Yogesh Singh, "Software Engineering", 3rd edition, New Age international Publishers, 2007
4. Waman S jawadekar, "Software Engineering Principles and Practices", McGraw-Hill. Companies, 2007.
5. PankajJalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2011.

Web References

1. https://nptel.ac.in/courses/Software Engineering
2. https://www.coursera.org/courses?query=software engineering
3. https://www.tutorialspoint.com/software_engineering/index.htm
4. https://www.udemy.com/course/the-complete-software-engineering-from-basics-to-advanced/
5. http://philip.greenspun.com/teaching/teaching-software-engineering

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	1	1	-	-	-	-	1	-	1	1	-	-
2	3	1	2	1	1	-	-	-	-	1	-	1	1	-	-
3	3	1	2	1	1	-	-	-	-	1	-	1	1	-	-
4	3	1	2	1	1	-	-	-	-	1	-	1	1	-	-
5	3	1	2	1	1	-	-	-	-	1	-	1	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CSBC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Design and Analysis of Algorithms**	**2**	**0**	**2**	**3**	**50**	**50**	**100**

(Common to CSE & CCE)

Prerequisite	Programming (C or C++), Data Structures and Problem Solving Approaches.	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze and improve the efficiency of algorithms and estimate the performance of algorithm and Divide and Conquer.	**K2**
	CO2 Determine the Greedy paradigms, Dynamic Programming and explain when an algorithmic design situation calls for it.	**K3**
	CO3 Interpret the Backtracking paradigms , Branch and Bound , NP-Hard paradigms and explain when an algorithmic design situation calls for it.	**K3**
	CO4 Demonstrate programs using Divide and Conquer , Greedy paradigms.	**K3**
	CO5 Build the programs using Dynamic Programming, Backtracking and Branch and Bound.	**K2**

UNIT - I	**Introduction To Algorithm and Divide and Conquer**	**Periods:10**	
Introduction – Algorithm – Pseudo code for expressing algorithms – Performance Analysis – Time complexity – Space complexity – Asymptotic Notation – Big oh notation – Omega notation – Theta notation and Little oh notation. Divide and Conquer method: Binary search – Merge sort – Quick sort			**CO1**
UNIT - II	**Greedy Method and Dynamic Programming**	**Periods:10**	
Greedy method: General method – applications– Knapsack problem – Minimum cost spanning trees –Single source shortest path problem. Dynamic Programming: Applications – Multistage graphs – 0/1 knapsack problem, All pairs shortest path problem – Traveling sales person problem			**CO2**
UNIT - III	**Backtracking and Branch and Bound**	**Periods:10**	
Backtracking: General method. Applications – N – queen problem – Sum of subsets problem – Graph coloring – Hamiltonian cycle – 0/1 Knapsack Problem. Branch and Bound: General method – Applications – Traveling sales person problem – 0/1 knapsack problem – LC Branch and Bound solution –FIFO Branch and Bound solution			**CO3**
UNIT - IV	**Laboratory Exercises**	**Periods:15**	
1. Implementation of binary search using Divide-and-Conquer technique 2. Implementation of Finding Maximum and Minimum using Divide-and-Conquer technique. 3. Implementation of Knapsack using Greedy technique. 4. Implementation of Minimum Spanning Tree using Prim's and Kruskal's Algorithm using Greedy technique. 5. Implementation of Single-Source Shortest Paths algorithms using Greedy technique.			**CO4**
UNIT - V	**Laboratory Exercises**	**Periods:15**	
6. Implementation of All Pairs Shortest Paths using Dynamic Programming technique. 7. Implementation of Traveling Salesman algorithms using Dynamic Programming technique. 8. Implementation of 8 Queens with the design of Backtracking. 9. Implementation of sum of subsets with the design of Backtracking. 10. Implementation of Traveling Salesman problems with Branch-and-Bound technique.			**CO5**

Lecture Periods:30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods:60**

Text Books

1. Levitin Anany," Introduction to the Design and Analysis of Algorithms", Pearson Education India,1st Edition,2019.
2. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", Galgotia Publications, 2nd Edition, 2010.
3. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms",PHI/Pearson Education, 3rd Edition,2009.

Reference Books

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012.
2. Aho Alfred V.,"Design & Analysis of Computer Algorithms", Pearson Education India,2nd Edition,2018
3. Basu S. K.," Design Methods and Analysis of Algorithms", PHI Learning,3rd Edition, 2018.
4. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", 2nd Edition, Galgotia Publications, 2010.
5. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms, 3rd Edition, PHI/Pearson Education, 2009.

Web References

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
2. https://www.javatpoint.com/daa-tutorial
3. https://www.guru99.com/design-analysis-algorithms-tutorial.html
4. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
5. https://swayam.gov.in/nd1_noc20_cs71/preview

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	2	1	-	-	-	-	-	2	1	2
2	3	3	3	3	2	2	1	-	-	-	-	-	2	1	3
3	3	3	3	3	2	2	2	-	-	-	-	-	2	1	3
4	3	3	3	3	2	2	2	-	-	-	-	-	2	1	3
5	3	3	3	3	2	2	2	-	-	-	-	-	2	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)									End Semester Examination (ESE) Marks (Practical – Internal Evaluation)	End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous assessment (Theory)					Continuous assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **BS**			*End Semester Exam Type: **LE**			
Course Code	**U23MAPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to all Branches Except CSBS)

Prerequisite	Matrices, Fourier Transforms, Laplace Transforms	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Perform and evaluate Matrix Operations	**K3**
	CO2 Solve Differential and Integral Equations	**K3**
	CO3 Construct Fourier series and Fourier Transforms of the given function	**K3**
	CO4 Find the Measures of Central tendency	**K3**
	CO5 Analyze Correlation and Regression lines	**K3**

List of Experiments:

1. Find the Inverse, Rank, Eigen values and Eigen Vectors of the matrix.
2. Solve the first order differential equation.
3. Find the integration of $\int_a^b f(x)dx$.
4. Find the Fourier series of f(x).
5. Find the Fourier Transform of f(x).
6. Find the Laplace Transform of f(x).
7. Find the Mean, Median and Mode.
8. Construct the Pie and Bar Diagram.
9. Find the Correlation coefficient.
10. Find the Regression lines.

Lecture Periods:- Nil	**Tutorial Periods:- Nil**	**Practical Periods: 3 0**	**Total Periods :30**

Reference Books

1. T. Veerarajan, “Engineering Mathematics, Tata McGraw Hill Education (India) Private Limited Chennai 2nd Edition Paperback – 1 January 2018.
2. M.K. Venkataraman, “Engineering Mathematics, The National Publishing Company, Madras, 2016.
3. Dr. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, Paperback – 1, 2019.

Web References

1. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf
2. https://www.nrigroupindia.com/niist/wp-content/uploads/sites/6/2022/02/lab-manual-it406matlab.pdf
3. https://www.studocu.com/row/document/comsats-university-islamabad/signals-and-systems/lab-lab-manual/38332410

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	-	-	-	-	-	1	1	-	-
2	3	2	1	1	-	1	-	-	-	-	-	1	1	-	-
3	2	1	-	-	-	1	-	-	-	-	-	1	1	-	1
4	2	1	-	-	-	1	-	-	-	-	-	1	1	-	-
5	3	2	1	1	-	1	-	-	-	-	-	1	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**English**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **HS**			*End Semester Exam Type: **LE**			
Course Code	**U23ENPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**General Proficiency- I**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret meaning and apply reading strategies in technical and non-technical context	**K3**
	CO2 Develop interpersonal communication skills professionally	**K4**
	CO3 Demonstrate various forms of formal writing	**K3**
	CO4 Decode graphical data coherently	**K2**
	CO5 Apply the techniques of verbal aptitude in competitive exams	**K3**

UNIT- I	**COMPREHENSION ANALYSIS**	**Periods:6**	
Listening: Dialogue based on social contexts (IELTS based) - Speaking: Break the iceberg (IELTS based) Submitting Video Recording - Reading: Reading technical passage (IELTS based) - Writing: Writing Task: 2 (IELTS Academic) - Vocabulary: Synonyms (IELTS)			**CO1**
UNIT- II	**PERSONALITY DEVELOPMENT**	**Periods:6**	
Listening: Monologue about the everyday social issues (IELTS based) - Interview Videos - Speaking: Speak about the topic in the Flash Card (IELTS based) - Reading: British & American Vocabulary - Writing: SWOT Analysis - Vocabulary: Idioms and Phrases (IELTS)			**CO2**
UNIT- III	**INFERENTIAL LEARNING**	**Periods:6**	
Listening: Conversation between 4 people regarding education (IELTS based), Anecdotes - Speaking: Structure Discussion (IELTS based) - Reading: Distinguish between facts & opinions (IELTS based), - Writing: Writing Conversation to different context - Vocabulary: Phrasal Verbs (IELTS)			**CO3**
UNIT- IV	**INTERPRETATION AND FUNCTIONAL WRITING**	**Periods:6**	
Listening: Monologue on an academic subject (IELTS based), Group Discussion videos - Speaking: Group Discussion Practice - Reading: Read and review (Books, Magazines) - Writing: Writing Task 1: (IELTS Academic: Graph/ chart/tables description) - Vocabulary: Collocations (IELTS)			**CO4**
UNIT-V	**VERBAL APTITUDE - I**	**Periods:6**	
Language Enhancement: Articles, Preposition, Conjunction **Verbal Ability Enhancement:** Ordering of sentences, Blood Relation, Completing Statements- Cloze test, Spotting Errors - Sentence Improvement, Word Analogy, Word Groups **(GATE)**			**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1.Lewis, Norman, "Word Power Made Easy".Goyal Publishers and Distributors Pvt.Ltd., Latest Edition, 2020.

2.Patterson,Kerry, Joseph Grenny,Ron McMillan, Al Switzler, "Crucial Conversation Tools for talking when Stakes are High", Kindle Publication, 2nd Edition, 2011.

3.Comfort, Jeremy,et.al. "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge: Reprint 2011.

4.Agarwal, R. S. "A Modern Approach to Verbal & Non Verbal Reasoning". S. Chand, 2010.

5.Wren, Percival Christopher, and Wren Martin. "High School English Grammar and Composition". S Chand, 2005.

Web References

1.https://www.ielts-exam.net/grammar/
2.https://ieltsfocus.com/2017/08/02/collocations-ielts/
3.https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4.https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5.https://www.examsbook.com/word-analogy-test-questions-with-answers

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
5	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-

Correlation Level: 1-Low, 2-Medium, 3-High

Evaluation Methods

Practical				
Continuous Assessment Internal Evaluation		**End Semester External Evaluation**		**Total Marks**
50 marks		**50 marks**		100
Conduction of Practical (Assignment 1&2 -10 Marks Performance in practical classes - 5 Marks)	15	Listening (L)	20	
Record	5	Speaking(S)	10	
Viva	5	Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will be converted to 15 Marks)	15	Writing(W)	10	
Attendance	10			

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23CCP302**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Principles of Communication Engineering Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Demonstrate the effects of sampling and TDM.	**K3**
	CO2 Implement AM & FM modulation and demodulation.	**K3**
	CO3 Implement PCM & DM.	**K3**
	CO4 Simulate and validate the various of digital modulation techniques.	**K3**
	CO5 Simulate and validate line coding and error control coding.	**K3**

List of Exercises

1. Study of line coding and decoding techniques
2. Study of sampling
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pre-emphasis and de-emphasis
6. Pulse Code Modulation and Demodulation
7. Pulse Amplitude Modulation and Demodulation.
8. Pulse Position Modulation and Demodulation and Pulse Width Modulation and Demodulation.
9. Delta Modulation and Demodulation
10. QAM modulation and demodulation using MATLAB.
11. To simulate ASK, FSK, DPSK Generation and Detection Schemes using MATLAB.
12. To Simulation of Linear Block and Cyclic Error Control Coding Schemes.
13. To simulate Pre-emphasis and De-emphasis and to trace their characteristics.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems”, 3/e, TMH 2007
2. S. Haykin, “Digital Communications”, John Wiley 2005
3. B.P.Lathi,” Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007
4. H P Hsu, Schaum Outline Series, “Analog and Digital Communications”, TMH 2006
5. B.Sklar,” Digital Communications Fundamentals and Applications”, 2/e Pearson Education 2007.

Web References

1. www.allaboutcircuits.com
2. www.circuitstoday.com
3. http://www.electronics-tutorials.ws
4. www.tutorialspoint.com
5. https://nptel.ac.in/courses/108/104/108104091/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	1	1	-	-	-	-	-	1	2	2	-	-
2	3	3	3	1	1	-	-	-	-	-	1	2	2	-	-
3	3	3	3	1	1	-	-	-	-	-	1	2	2	-	-
4	3	3	3	1	1	-	-	-	-	-	1	2	2	-	-
5	3	3	3	1	1	-	-	-	-	-	1	2	2	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **AEC**			*End Semester Exam Type:			
Course Code	**U23CCS301**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- I** **1. Computer on Office Automation**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
(CCE)								
Prerequisite	Basic knowledge in computer							

Microsoft Access

- Build custom applications to track any type of information your company needs: Contacts, Appointments, Sales, Employees, Expenses, Telemarketing, Service, Human Resources, Ordering, Inventory, Engineering, etc
- Create Word documents on the fly to populate letters, envelopes and custom reports based ondata in a database
- Create functionality that can open up a Word template, fill the document with data, print the document and save the document with 1 click of a button
- Create functionality that can open up an Excel spreadsheet and populate it with data
- Create functionality that can open up an Excel spreadsheet and populate it with information aswell as determine where to insert/delete rows if needed to keep the integrity of formulas in tact

Microsoft Excel

- Create worksheets that have to be validated before the system lets the user save the spreadsheet
- Create worksheets that can read information from another system (i.e. database) to populate dropdown boxes, etc
- Create company expense report that saves the information into a database for summary/analysis purposes
- Combine data from multiple Excels spreadsheets/worksheets to create a new formatted Excel spreadsheet
- Create automations that can open a master spreadsheet with many tabs and determine whichof the tabs (single or multiple) need to be populated with data and which tabs need to be removed from the spreadsheet if they aren't needed
- Create automations to eliminate people having to re-key/massage/format data

Microsoft Word

- Create documents that can read information from another system (i.e. database) to populate dropdown boxes, etc
- Create documents that have to be validated before the system lets the user save the document
- Create documents that upon saving can save the information on the document into a database
- Create documents that can popup and format an Outlook email with data from the document tobe sent out upon saving a document.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

1. Remya Chandran, "A Text Book of Introduction to Computers & Office Automation", Independently published, 2019
2. James W Driscoll, "Office Automation: The Dynamics of a Technological Boondoggle", Palala Press, 2018

Web References

1. https://www.referenceforbusiness.com/encyclopedia/Mor-Off/Office-Automation.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
2	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
3	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
4	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
5	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**III**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23CCS301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- I 2. Animation Practices**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Implement algorithm for drawing	**K3**
	CO2	Use 2D Geometric Transformation	**K3**
	CO3	Implement image manipulation and enhancement	**K3**
	CO4	Implement 2D animations using tools	**K3**
	CO5	Implement 3D graphical scenes using open graphics library suits	**K3**

List of Exercises

Implement the Exercises Using C / OPENGL / JAVA

1. Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes Circle (Midpoint)
2. 2D Geometric transformations:
   Translation
   Rotation
   Scaling
   Reflection
   Shear
   Window-Viewport
3. Composite 2D Transformations
4. Line Clipping
5. 3D Transformations – Translation, Rotation, Scaling.
6. 3D Projections – Parallel, Perspective.
7. Creating 3D Scenes.
8. Image Editing and Manipulation – Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
9. 2D Animation – To create Interactive animation using any authoring tool.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. J. D. Foley, A. Van Dam, S. K. Feiner, J. F. Hughes, “Computer Graphics: Principles and Practicein C”, 3rd ed, Addison-Wesley, 2013
2. Eric Lengyel , “Mathematics for 3D Game Programming and Computer Graphics”, CourseTechnology PTR, 2012

Web References

1. https://www.cs.brandeis.edu/~cs155/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
2	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
3	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
4	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-
5	1	-	-	-	1	-	-	-	-	-	1	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**III**	Course Category: **AEC**			End Semester Exam Type:-			
Course Code	**U23CCS301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- I 3. PCB and Circuit Design**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Infer the fundamental of circuit design	**K2**
	CO2 Describes PCB design and its types	**K2**
	CO3 Demonstrate the Proteus PCB schematic	**K3**
	CO4 Examines the design synchronization	**K4**
	CO5 Tests the various routing guidelines	**K4**

List of Exercises

1. **Introduction to Circuit Designing:** Fundamental of circuit design - Creating New Components - Introduction to Analog Circuit Design - Introduction to Digital Circuit Design - Placing Symbols and Ports - Labeling components - Circuit optimization

2. **Introduction to PCB Design -** Definition and Evolution of PCB - Purposes of a PCB - Types of PCBs Creating the Blank PCB - Defining a sheet template - Printed Circuit Technology - PCB Construction (Power and Ground Plane) - PCB Printing & Etching process

3. **Proteus PCB Schematic -** Defining the Board Shape & Placement Boundary - Creating a board outline & placement / routing boundary - Basic concepts of PCB Designing - Schematic capture - From schematic to PCB - Placing, editing, and connecting parts and electrical symbols - Adding and editing graphics and text

4. **Proteus PCB Editor -** Creating and editing parts - Preparing to create a net list - Creating a net list- Exporting and importing schematic data - PCB Material. - Board Layers, Colors and Grids. - Defining the Electrical/Mechanical Layer - Defining PWR/GND layers.

5. **Design Transfer to the PCB and Design Rule Check -** Design synchronization with schematic tool. - Design transfer using a Net list. - Design rules concepts. - Design Rule Checking

6. **Component Placement & Shielding -** Placing components. - Finding components for placement. Moving components. - Shielding Practices. - Copper Pour

7. **Routing PCB Layout Routing and Grounding** - Routing guidelines

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Bruce R. Archambeault , James Drewniak “PCB Design for Real-World EMI Control”, Springer- Verlag New York Inc., United States, 2002.
2. Kraig Mitzner, “Complete PCB Design Using OrCAD Capture and PCB Editor”, ElsevierScience & Technology, Oxford, United Kingdom, 2009.
3. Keng Tiong Ng , “PCB-RE: Real-World Examples”, Independently Published, 2019.
4. Roger Hu, “PCB Design and Layout Fundamentals for EMC”, Independently Published, 2019.
5. Matthew Scarpino, “Designing Circuit Boards with EAGLE: Make High-Quality PCBs at Low cost Pearson Education, United States, 2014

Web References

1. https://engineering.eckovation.com/learn-design-pcb/
2. https://www.tronicszone.com/blog/steps-pcb-design-manufacturing/
3. https://www.elprocus.com/what-is-printed-circuit-board-and-designing-process-of-pcb/
4. https://www.electronics-notes.com/articles/analogue_circuits/pcb-design/how-to- design-pcb-board-basics.php
5. https://resources.pcb.cadence.com/blog/2019-what-is-the-pcb-fabrication-process-an-introduction

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	1	2	1	1	-	-
2	1	-	-	-	-	-	-	-	-	1	2	1	1	-	-
3	1	-	-	-	-	-	-	-	-	1	2	1	1	-	-
4	1	-	-	-	-	-	-	-	-	1	2	1	1	-	-
5	1	-	-	-	-	-	-	-	-	1	2	1	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **AEC**				*End Semester Exam Type:		
Course Code	**U23CCC3XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course- III**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

(Common to all Branches)

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered throughCentre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years.Pass in this course is mandatory for the award of degree.

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category Code: **MC**			*End Semester Exam Type: -			
Course Code	**U23CCM303**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CLIMATE CHANGE**	**0**	**0**	**2**	**-**	**100**	**-**	**100**

(Common to all Branches)

UNIT – I	**ATMOSPHERE AND ITS COMPONENTS**	**Periods:6**	
Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere Composition of the atmosphere -Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.			**CO1**
UNIT – II	**GLOBAL CLIMATE**	**Periods:6**	
Account of past climate Environmental indicators and instrumental records Human Footprints on global warming-Predicting future climates- Temperature regime - Extreme climate events			**CO2**
UNIT – III	**IMPACTS OF CLIMATE CHANGE**	**Periods:6**	
Causes of Climate change: Change of Temperature in the environment- Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors Agriculture, Forestry and Ecosystem - Water Resources Human Health Industry, Settlement and Society Methods and Scenarios - Projected Impacts for Different Regions- Uncertainties in the Projected Impacts of Climate Change - Risk of Irreversible Changes.			**CO3**
UNIT – IV	**OBSERVED CHANGES AND ITS CAUSES**	**Periods:6**	
Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change-Climate Sensitivity and Feedbacks-The Montreal Protocol UNFCCC - IPCC Evidences of Changes in Climate and Environment on a Global Scale and in India.			**CO4**
UNIT – V	**CLIMATE CHANGE AND MITIGATION MEASURES**	**Periods:6**	
Clean Development Mechanism -Carbon Trading- examples of future Clean Technology - Biodiesel Natural Compost Eco Friendly Plastic Alternate Energy Hydrogen Bio-fuels-Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices-Carbon sequestration - Carbon capture and storage (CCS) - International and Regional cooperation- Remedial measures.			**CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:**	**Total Periods:45**

Text Books

1. Joan Fitzgerald "Greenovation: Urban Leadership on Climate Change, Oxford University Press 2020.
2. J. David Neelin" Climate change and climate modelling" Cambridge University press (2011).
3. Robin Moilveen "Fundamentals of weather and climate" Oxford University Press (2nd Edition) (2010),
4. Andrew Dessler and Edward A. Parson "The Science and Politics of Global Climate Change" 2009

Reference Books

1. Bill McKibben (2012), The Global Warming Reader: A Century of Writing About Climate Change,Penguin.
2. JasonSmerdon(2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University
3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.
4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.
5. Jan C. van Dam, (2003) Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press,.

Web References

1. https://nptel.ac.in/courses/105102089/
2. https://www.warmheartworldwide
3. https://nptel.ac.in/content/storage

Department	**Mathematics**	Programme : **B.Tech.**						
Semester	**IV**	Course Category Code:**BS**			*End Semester Exam Type: **TE**			
Course Code	**U23MATC05**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Discrete Mathematics and Graph Theory**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to CSE, IT, AI&DS and CCE)

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Construct Mathematical arguments using logical connectives and truth tables.	**K3**
	CO2 Verify the correctness of an argument predicate logic and quantifiers.	**K3**
	CO3 Solve problems using counting techniques in Lattices.	**K3**
	CO4 Familiarize the different types of Graphs.	**K3**
	CO5 Understand the Applications of Shortest path algorithms.	**K3**

UNIT – I	**LOGICS AND PROOFS**	**Periods:12**
Introduction – Connectives – Statement formulae – Truth table – Tautologies – Equivalence of Statement formulae – NAND and NOR Connectives – Implications – Principal conjunctive and disjunctive normal forms.		**CO1**

UNIT – II	**PREDICATE AND QUANTIFIERS**	**Periods:12**
Predicate and Quantifiers – Rules of Inference theory – Conditional proof – Indirect method of proof.		**CO2**

UNIT – III	**LATTICES**	**Periods:12**
Partially Ordering – Posets – Hasse Diagram – Lattices as Posets – Properties of Lattices – Sub lattices – Complemented and Distributive lattices.		**CO3**

UNIT – IV	**GRAPH THEORY**	**Periods:12**
Graphs and types of Graphs – Matrix representation of graphs – Isomorphism – Connected graphs – Euler graphs – Hamilton paths and circuits.		**CO4**

UNIT – V	**TREES**	**Periods:12**
Trees – Properties of Trees – Algorithm – Kruskal's algorithm.		**CO5**

Lecture Periods:45	**Tutorial Periods:15**	**Practical Periods:-**	**Total Periods:60**

Text Books

1. P. Tremblay and R. Manohar, "Discrete Mathematical structures with Applications to computer Science", 13th reprint, Tata McGraw - Hill publishers, 2002.
2. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications New York, First Edition, 2016.
3. Dr G. Balaji "Discrete Mathematics", G. Balaji Publishers – 14th Edition 2021.

Reference Books

1. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw - Hill Education Pvt. Ltd., 3rd Edition, 2008.
2. F. Harary, "Graph theory", Narosa publishing house, New Delhi, 1988.
3. Douglas B. West, "Introduction to Graph theory", Pearson Education, second edition, 2002.
4. Oscar Levin, "Discrete Mathematics An Open Introduction", 3rd Edition, 4th Printing: 2019 ISBN: 978-1792901690
5. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw - Hill PublishingCompany, Pvt. Ltd., New Delhi, Fifth edition, 2003.

Web References

1. https://www.researchgate.net/publication/1922282_Discrete_Mathematics_for_Computer_Science_Some_Notes
2. https://nptel.ac.in/courses/111/107/111107058/
3. https://nptel.ac.in/courses/106/106/106106183/
4. https://www.pdfdrive.com/discrete-mathematics-for-computer-science-e17017833.html
5. https://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	-	-	-	-	-	-	-	1	1	-	1
2	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
3	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
4	3	3	2	1	-	1	-	-	-	1	1	1	1	-	-
5	3	3	2	1	-	1	-	-	-	1	1	1	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ITTC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN JAVA**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to All Branches)

Prerequisite	Programming Skills	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Articulate the concept of Java fundamentals, OOPs and Strings	**K2**
	CO2 Demonstrate the principles of inheritance, packages and interfaces with real time applications	**K2**
	CO3 Create real time applications using exception handling and thread programming.	**K3**
	CO4 Build distributed applications using Collections and IO streams	**K3**
	CO5 Design and build simple GUI programs using AWT, Swings and build database applications.	**K3**

Unit- I	**Introduction**	**Periods: 09**
Introduction: Java: History – Features – JVM - JRE – JDK – Java Compilation and Execution – Data Types- Variables, Types, Expressions, Assignment Statements, Input/Output Statements: Scanner/System class, Type Casting (Primitives to Primitives), Conditional and Iterative Control Structures - Arrays **OOPs with Java**: Introduction to OOPs Concepts - Class – Objects – Methods - Access Modifiers – Creating Class and Objects, Object Life-Cycle - Garbage Collection-Constructors - this – static – Array of Objects –Nested classes. **String**: String Class– Built-in Methods – StringBuilder - StringBuffer		**CO1**

Unit- II	**Inheritance, Interfaces and Packages**	**Periods: 09**
Inheritance: Types of Inheritance – is-a Relationship, has-a Relationship – super keyword – final keyword – Polymorphism - Method overloading and Method overriding – Abstract Class **Interfaces:** Define – Extend – Implement – Access - Interfaces vs Abstract classes, Type Conversions (Primitives to Objects vice-versa): Autoboxing and Auto unboxing. **Packages:** Define – Create – Access – Import.		**CO2**

Unit- III	**Exception Handling and Multithreading**	**Periods: 09**
Exception Handling: Exception Hierarchy – Checked and Unchecked Exceptions – try, catch, throws, throw and finally – User Defined Exceptions. **Multithreading:** Thread – Life cycle – Defining and Running – Implementation Types – Thread Priorities – Thread Synchronization - Inter-Thread Communication.		**CO3**

Unit- IV	**Collections and I/O Streams**	**Periods: 09**
Collections: List: ArrayList and LinkedList. Set: HashSet and TreeSet. Map: HashMap – Stack – Queue. Lambda Expressions. **I/O Streams:** Streams – Byte Streams and Character Streams – FileInputStream and FileOutputStream – FileReader and FileWriter. Object Serialization : ObjectInputStream and ObjectOutputStream		**CO4**

Unit- V	**GUI and JDBC**	**Periods: 09**
AWT: Components – Controls – Event Handling **SWING**: Swing Components – Layout Management. **JDBC:** JDBC Architecture – JDBC Driver Types – Implementation of JDBC.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45**

Text Books

1. Allen B. Downey and Chris Mayeld, “Think Java - How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2020
2. Herbert Schildt, “Java: The Complete Reference”, TMH Publishing Company Ltd, 11th Edition, 2018.
3. H.M.Dietel and P.J.Dietel, “Java How to Program”, 11th Edition, Pearson Education/PHI, 2017
4. Cay S. Horstmann, Gary Cornell, “Core Java Volume - I Fundamentals”, 9th Edition, Prentice Hall, 2013.

Reference Books

1. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018.
2. Poaul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
3. P.J. Dietel and H.M Dietel, “Java for Programmers”, Pearson Education, 9th Edition, 2011.
4. Steven Holzner, “Java 2 Black book”, Dreamtech Press, 2011.

Web References

1. https://www.javatpoint.com/java-tutorial
2. https://docs.oracle.com/en/java/
3. https://www.studytonight.com/java/
4. https://onlinecourses.nptel.ac.in/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	2	3	2	1
2	3	3	3	-	3	-	-	-	-	-	-	2	3	2	1
3	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
4	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
5	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech**						
Semester	**II/ IV**	Course Category: **ES**				End Semester Exam Type: **TE**		
Course Code	**U23CSTC06**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**DATABASE MANAGEMENT SYSTEMS**	3	-	-	3	25	75	100
(Common to CSE, IT and CCE)								
Prerequisite	Computer Programming and Data Structures							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application	**K2**
	CO2 Manipulate and build database queries using Structured Query Language and relational algebra	**K3**
	CO3 Use data normalization principles to develop a normalized database for a given application	**K3**
	CO4 Illustrate various transactions and recovery techniques	**K2**
	CO5 Apply tools like NoSQL, MongoDB, Cassandra on real time applications	**K3**

UNIT - I	**INTRODUCTION**	**Periods:09**	
Database Systems - Data Models – System Structure-Database System Architecture - Entity-Relationship Model - ER Diagram - Extended ER Model - ER into Relational Model - Relational Model: Structure of Relational Databases, Database Schema, Keys, Tables.			**CO1**
UNIT - II	**DATABASE LANGUAGES**	**Periods:09**	
Relational Algebra - Extended-Relational Algebra - Relational Calculus - SQL: Introduction - DDL - DML - Integrity Constraints - Set Operations - Joins - Nested Queries - View- Trigger - Stored Procedures.			**CO2**
UNIT - III	**RELATIONAL DATABASE DESIGN AND DATA STORAGE**	**Periods:09**	
Relational Database Design: Domain and Data Dependency - Lossless Design - Armstrong's axioms - Functional Dependencies - Normal Forms - 1NF, 2NF, 3NF, BCNF and 4NF. **Data Storage:** RAID - File Organization - Indexing: Types of Indexing.			**CO3**
UNIT - IV	**TRANSACTIONS**	**Periods:09**	
Transaction concepts and states- Concurrent Execution - Serializability -Query Processing- Concurrency Control: Lock based Protocol - Timestamp based Protocol - Recovery System: - Log-Based Recovery - Shadow Paging.			**CO4**
UNIT - V	**NoSQL DATABASES**	**Periods:09**	
NoSQL - Document Database: MongoDB - Multi-dimensional: Cassandra.			**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition - McGraw-Hill Higher Education, International Edition, 2019.
2. Ramez Elmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition),
3. Publisher: Pearson,2016.
4. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015

Reference Books

1. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, McGraw-Hill College Publications, 2015.
2. Date C J, Kannan A and Swamynathan S, “An Introduction to Database Systems”, 8th Edition, Pearson Education, New Delhi, 2006.
3. Alan Beaulieu, “Mastering SQL Fundamentals”, Second Edition, O’Reilly,2009
4. Kristina Chodorow; Shannon Bradshaw, “MongoDB: The Definitive Guide”, 3rd Edition, O'Reilly Media, Inc., 2018.
5. Pramod J. Sadalage (Author), Martin Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, 1stEdition, Kindle Edition.

Web References

1. http://www.database.com/
2. http://cassandra.apache.org/
3. https://www.mongodb.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	-	3	3	2
2	2	1	1	3	-	-	-	-	-	-	-	-	3	3	2
3	2	1	1	-	-	-	-	-	-	-	-	-	3	3	2
4	1	-	-	-	-	-	-	-	-	-	-	-	3	3	2
5	2	1	1	3	-	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**IV**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CCT406**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Computer and Communication Networks**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the basic layers and its functions in computer networks.	**K2**
	CO2 Evaluate the functions of the layer 1 and layer 2 networks	**K3**
	CO3 Describe the basics of how data flows from layer 3 and layer 4.	**K3**
	CO4 Analyze and design network security.	**K3**
	CO5 Interpret wireless and mobile networks.	**K3**

UNIT-I	**Introduction to Computer Networks**	**Periods: 09**
Overview of computer networks- Definition and importance of computer networks, Historical perspective Types of networks, Network topologies and protocols - Common network topologies (Bus, Star, Ring, Mesh), Introduction to networking protocols (TCP/IP, OSI), OSI and TCP/IP models- Overview of OSI model layers and functions TCP/IP model and its correspondence with OSI layers.		**CO1**
UNIT-II	**Physical and Data Link Layers**	**Periods: 09**
Basics of data transmission- Analog and digital signals, Data transmission modes (Simplex, Half-Duplex, Full-Duplex) Transmission media (guided and unguided)- Guided media (Twisted Pair, Coaxial Cable, Optical Fiber), Unguided media (Radio waves, Microwaves, Infrared) Signal encoding and modulation- Multiplexing techniques		**CO2**
UNIT-III	**Network and Transport Layers**	**Periods: 09**
Routing algorithms- Routing basics and algorithms (Shortest Path, Dijkstra's algorithm) , Routing protocols (RIP, OSPF) IP addressing and subnets - Subnetting and super netting , Transport layer protocols (TCP, UDP) - TCP and UDP characteristics and differences, Connection-oriented vs. connectionless communication, Congestion control- Causes and effects of network congestion, Congestion control mechanisms		**CO3**
UNIT-IV	**Application Layer and Network Security**	**Periods: 09**
Session establishment and termination - Session initiation and termination protocols, Presentation layer functions- Data compression and encryption, Application layer protocols (HTTP, FTP, SMTP)- Detailed study of HTTP, FTP, and SMTP protocols, Network security basics and protocols (SSL/TLS, IPsec)- Overview of cryptography, Secure Socket Layer (SSL), Transport Layer Security (TLS), IPsec		**CO4**
UNIT-V	**Wireless Mobile Networks and Emerging Technologies**	**Periods: 09**
Wireless communication fundamentals - Modulation schemes in wireless communication, Mobile network architecture (2G, 3G, 4G, 5G) - Evolution of mobile networks, Key features and technologies in each generation Emerging technologies (SDN, NFV, IoT, Edge Computing) Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT), Edge Computing		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. James Kurose and Keith Ross "Computer Networking: A Top-Down Approach " 8thth edition Pearson © 2021
2. Behrouz A. Forouzan, Data Communications and Networking, sixth EditionTMH, 2022
3. Larry L. Peterson, Bruce S. Davie, Computer Networks: A SystemsApproach, sixth Edition, Morgan Kaufmann Publishers Inc., 2021

Reference Books

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: AnOpen Source Approach, McGraw Hill Publisher, 2011.
4. Mark Lutz, Laura Lewin, Frank Willison, "Programming Python", O'Reilly Media, 3rd Edition, 2006.
5. Gowrishankar S, Veena A, "Introduction to Python Programming", CRC Press, 2018.

Web References

1. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html
2. https://www.geeksforgeeks.org/basics-computer-networking/
3. https://owasp.org/www-pdf-archive/Owasp_wireshark.pdf

4. https://datatracker.ietf.org/meeting/106/materials/slides-106-edu-sesse-ietf-106-newcomers-overview-01.pdf
5. https://www-sop.inria.fr/members/Vincenzo.Mancuso/ReteInternet/10_subnet.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	1	-	-	-	-	-	1	-	1	2	3	-
2	3	1	2	1	-	-	-	-	-	1	-	1	2	3	-
3	3	1	2	2	-	-	-	-	1	1	1	1	2	3	-
4	3	1	2	1	-	-	-	-	1	1	1	1	2	3	-
5	3	1	2	2	-	-	-	-	1	1	1	1	2	3	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

ProfessionalElective–I (Offered inSemester IV)		
Sl.No.	**Course Code**	**CourseTitle**
1	U23CCE401	Mobile Communication and Networks
2	U23CCE402	Network Analysis and Management
3	U23CCE403	Information and Image coding Theory
4	U23CCE404	Compiler Design
5	U23CCE405	Azure Development and Operations

Department	**Computer and Communication Engineering**	Programme:**B.Tech.**						
Semester	**IV**	CourseCategoryCode:**PE**			*End SemesterExamType:**TE**			
CourseCode	**U23CCE401**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Mobile Communication and Networks**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective-I)								
Prerequisite	Principles of Communication							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Understand cellular concepts and signal propagation in mobile communication.	**K2**
	CO2	Understand the fundamental principles of signal propagation in wireless communication.	**K2**
	CO3	Compare and contrast various multiple access techniques and their suitability for different applications.	**K3**
	CO4	Illustrate the architecture of mobile communication networks, including GSM, CDMA, 3G, 4G LTE, and 5G.	**K3**
	CO5	Discuss the performance requirements of various Antennas for wireless communication.	**K3**

Unit- I	**Basics of Cellular Concepts**	**Periods:09**	
Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction. techniques and methods to improve cell coverage, Frequency management and channel assignment.			**CO1**
Unit- II	**Signal Propagation**	**Periods:09**	
Propagation mechanism, reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small-scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.			**CO2**
Unit- III	**Multiple Access and Modulation Techniques**	**Periods:09**	
FDMA, TDMA, CDMA, SDMA, OFDM. Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE.			**CO3**
Unit- IV	**Cellular Wireless Standards**	**Periods:09**	
Wireless Standards: Overview of 2G 3G, 4G and 5G cellular mobile standards. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.			**CO4**
Unit- V	**Antennas for wireless communications**	**Periods:09**	
Mobile terminal Antennas: Performance requirements -Dipoles- Helical- inverted F, patches- MEGSAR-Mobile satellite Antennas.Base station antennas: Performance requirements in macro cellCO4 antenna design and diversity-micro/pico cell antennas, WLAN antennas. Adaptive antennas: Adaptive antenna applications.			**CO5**

LecturePeriods:45	**TutorialPeriods:**	**PracticalPeriods:-**	**TotalPeriods:45**

TextBooks

1. William Lee ,"Mobile Cellular Telecommunications: Analog and Digital Systems", McGraw Hill Education, 2nd Edition, July 2017.
2. AfifOsseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
3. Andreas F. Molisch, "Wireless Communications", Publisher: Wiley, 2nd edition, 2011.
4. T.S.Rappaport, "Wireless Communications Principles and Practice", PHI, 2nd Edition, 2006.

ReferenceBooks

1. Vijay K. Garg, "Wireless Communication and Networking", Elsevier, Morgan Kaufmann, Reprinted 2012.
2. Erik Dahlman ," 4G, LTE-Advanced Pro and The Road to 5G", 3rd Edition, 2016.
3. Sassan Ahmadi, "5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards "Hardcover – 1, June 2019.
4. Antennas for all applications, 3rd edition, by J.D. Krauss, TMH.
5. C.A.Balanis - Antenna Theory and Design, 3rd Ed., John Wiley & Sons., 2005

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1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://archive.nptel.ac.in/courses/108/101/108101092/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
2	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
3	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
4	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
5	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme:**B.Tech**						
Semester	**IV**	CourseCategoryCode: **PE**			End SemesterExamType: **TE**			
CourseCode	**U23CCE402**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Network Analysis and Management**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective- I)								
Prerequisite	Computer and Communication Networks							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the key concepts of networks and analysis	**K2**
	CO2 Apply the principles of flow models to analyze data within network systems, establishing connections between data sources and sinks.	**K3**
	CO3 Discuss the foundational concepts of network design, establishing design goals that align with organizational objectives.	**K3**
	CO4 Demonstrate knowledge of network performance issues, including bottlenecks and congestion	**K3**
	CO5 Discuss advanced networking concepts such as SNMP all the versions	**K3**

UNIT-I	**Introduction to Network Analysis**	**Periods:09**
Overview of computer networks -Types of networks (LAN, WAN, MAN) - Characteristics and applications of Local Area Networks (LAN), Wide Area Networks (WAN) and their use cases , Metropolitan Area Networks (MAN) and their significance Network topologies and architectures, Introduction to network protocols (TCP/IP, OSI model)- TCP/IP protocol suite, OSI model and its layers , Basics of network analysis tools and methodologies,- Overview of network analyzers, Packet capturing and analysis.		**CO1**
UNIT-II	**Flow Analysis**	**Periods:09**
Background- Flows- Data sources and sinks- Flow models- Flow boundaries- Flow distributions - Flow specifications- Applying the flow model - Establishing flow boundaries - Applying flow distributions- Combining flow models, boundaries and distributions- Developing flow specifications - Prioritizing flow, simplifying flow analysis process - examples of applying flow specs.		**CO2**
UNIT-III	**Logical Design**	**Periods:09**
Background- Establishing design goals - Shared Medium - Switching - Routing- Hybrid Routing/Switching Mechanisms – Applying Interconnection Mechanism to Design – Integrating Network management and security into the Design- Defining Network Management- Designing with manageable resources- Network Management Architecture- Security and Security mechanism- Network Management and security.		**CO3**
UNIT-IV	**Performance Optimization and Troubleshooting**	**Periods:09**
Performance metrics and monitoring tools- Bandwidth, latency, and throughput, Performance monitoring tools - Identifying and resolving network performance issues, Analyzing bottlenecks and congestion QoS (Quality of Service) considerations - Using diagnostic tools (ping, traceroute) - Resolving common connectivity issues, Diagnosing and resolving common network errors - Error detection and correction mechanisms, Performance optimization techniques, Load balancing, caching, and compression, Network optimization best practices.		**CO4**
UNIT-V	**Network Management and SNMP Protocol Model**	**Periods:09**
Network and System management, Network management system platform; Current SNMP Broadband and TMN management, Network management standards. SNMPV1, SNMPV2 system architecture, SNMPV2 structure of management information. SNMPV2 MIB – SNMPV2 protocol, SNMPV3-Architecture, Application, Security user based security model, Access control RMON.		**CO5**

LecturePeriods:45	**TutorialPeriods:**	**PracticalPeriods:-**	**TotalPeriods:45**

TextBooks

1. James. D. McCabe, Practical Computer Network Analysis and Design, 3rdEdition, Morgan Kaufaman, 2007.
2. Mani Subramanian, Network Management – Principles and Practice – 2nd Edition Prentice Hall, 2012.

ReferenceBooks

1. J.Radz, Fundamentals of Computer Network Analysis and Engineering: Basic Approaches for Solving Problems in the Networked Computing Environment, Universe, 2005.
2. Mark Newman, Networks: An Introduction, Kindle Edition, 2010.
3. Laura Chappel and Gerald Combs, Wireshark 101: Essential Skills for Network Analysis, Kindle Edition, 2013.
4. William Stallings., SNMP, SNMP2, SNMP3 and RMON1 and 2, Pearson Education, 2004.
5. Daw Sudira, Network Management, Sonali Publications, 2004.

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1. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html
2. https://www.geeksforgeeks.org/basics-computer-networking/
3. https://datatracker.ietf.org/meeting/106/materials/slides-106-edu-sesse-ietf-106-newcomers-overview-01.pdf
4. https://www.researchgate.net/publication/338220481_Network_requirement_analysis
5. https://nptel.ac.in/courses/106/106/106106091/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	-	-	-	-	-	-	-	3	2	-
2	3	2	2	1	1	-	-	-	-	-	-	-	3	2	-
3	3	2	2	1	1	-	-	-	-	-	-	-	3	2	-
4	3	2	2	1	1	-	-	-	-	-	-	-	3	2	-
5	2	2	2	1	1	-	-	-	-	-	-	-	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme:**B.Tech**						
Semester	**IV**	CourseCategoryCode: **PE**			End SemesterExamType:**TE**			
CourseCode	**U23CCE403**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Information and Image Coding Theory**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective-I)								
Prerequisite	NIL							

Course Outcomes			
	On completion of the course, the students will be able to		BT Mapping (Highest Level)
	CO1	Describe the channel performance using Information theory.	**K2**
	CO2	Apply source coding techniques of Audio and speech coding algorithms.	**K3**
	CO3	Impart knowledge on source coding techniques of image coding algorithms.	**K3**
	CO4	Illustrate source coding techniques of video coding algorithms.	**K3**
	CO5	Apply error control codes in Communication systems.	**K3**

UNIT-I	**Information Theory**	**Periods:09**	
Information entropy fundamentals: Information – entropy - properties of information and entropy - relation between information and probability - mutual and self-information - coding theory- code efficiency and redundancy - Shannon's theorem - construction of basic codes-Shannon and Fanon coding, Huffman coding – arithmetic coding.			**CO1**
UNIT-II	**Voice Coding**	**Periods:09**	
Adaptive Differential Pulse Code Modulation, Adaptive delta modulation, Adaptive sub band coding, Adaptive transform coding, Linear predictive vocoder and comparison of various voice coding techniques.			**CO2**
UNIT-III	**Image Coding**	**Periods:09**	
CODING Image compression and its need, Shift codes, Arithmetic Coding, run length coding, Transform coding and JPEG standard.			**CO3**
UNIT-IV	**Video Coding**	**Periods:09**	
Video Compression: Principles-I, B, P frames, Motion estimation, Motion compensation, Introduction to H.261, MPEG Video compression standard.			**CO4**
UNIT-V	**Error Control Coding**	**Periods:09**	
Error Control Coding: Convolutional codes, Cyclic codes, Cyclic Redundancy Check codes, Reed Solomon codes, BCH Codes, Repetition codes and Principle of Turbo coding.			**CO5**

LecturePeriods:45	**TutorialPeriods:**	**PracticalPeriods:-**	**TotalPeriods:45**

TextBooks

1. Simon Haykin, "Digital Communications", John Wiley and Sons, 2013.
2. Ranjan Bose, Information Theory, Coding and Cryptography, 1st Edition, McGraw Hill Education (India) Pvt. Ltd., 2015.
3. K Sayood, "Introduction to Data Compression" 5/e, Elsevier 2017.
4. Khalid Sayood, Introduction to Data Compression, 4th Edition, Elsevier, Reprint: 2015.

ReferenceBooks

1. R Bose, "Information Theory, Coding and Cryptography", TMH 2007
2. S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007
3. Mark Nelson, "Data Compression Book", BPB Publication 1992.
4. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.
5. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, 2nd Edition, 2004
6. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002

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1. https://onlinelibrary.wiley.com/doi/full/10.1002/inf2.12016
2. https://nptel.ac.in/courses/117/101/117101053/
3. https://en.wikipedia.org/wiki/Information_theory
4. htps://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=18
5. https://www.codeandtheory.com/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	-
2	3	2	2	-	-	-	-	-	-	-	-	-	3	2	-
3	3	2	2	-	-	-	-	-	-	-	-	-	3	2	-
4	3	2	2	-	-	-	-	-	-	-	-	-	3	2	-
5	3	2	2	-	-	-	-	-	-	-	-	-	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme:**B.Tech.**						
Semester	**IV**	CourseCategoryCode:**PE**			*End SemesterExamType:**TE**			
CourseCode	**U23CCE404**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Compiler Design**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
CCE (Professional Elective -I)								
Prerequisite	Nil							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Explain lexical analyzer from a specification of a language's lexical rules.	**K2**
	CO2	Understand context-free grammar, top down and bottom up parsing techniques	**K2**
	CO3	Applydifferentparsingalgorithmstodeveloptheparsers for agivengrammar.	**K3**
	CO4	Implement asyntax-directedtranslationand run-timeenvironment.	**K3**
	CO5	Apply optimization techniques to intermediate code and generate machine code	**K3**

UNIT-I	**Introduction to Compilers**	**Periods:09**	
Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.			**CO1**
UNIT-II	**Syntax Analysis**	**Periods:09**	
Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC			**CO2**
UNIT-III	**IntermediateCode Generation**	**Periods:09**	
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.			**CO3**
UNIT-IV	**Run-Time Environment And Code Generation**	**Periods:09**	
Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.			**CO4**
UNIT-V	**Code Optimization**	**Periods:09**	
Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks-Global Data Flow Analysis - Efficient Data Flow Algorithm.			**CO5**

LecturePeriods:45	**TutorialPeriods:**	**PracticalPeriods:-**	**TotalPeriods:45**

TextBooks

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools‖, 2nd Edition, Pearson Education, 2009.
2. Kenneth C. Louden (1997), Compiler Construction– Principles and Practice, 1stedition, PWS Publishing.
3. K. L. P Mishra, N. Chandrashekaran (2003), Theory of computer science- Automata Languages and computation, 2nd edition, Prentice Hall of India, New Delhi, India.

ReferenceBooks.

1. Des Watson,A Practical Approach to Compiler Construction- 2017
2. Allen I. Holub, Compiler Design in C‖, Prentice-Hall Software Series, 2014.
3. Randy Allen, Ken Kennedy, and Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
4. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003
5. Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Morgan Kaufmann Publishers Elsevier Science, 2004.

Web References

1. https://www.tutorialspoint.com/compiler_design/
2. https://www.javatpoint.com/compiler-tutorial
3. https://www.geeksforgeeks.org/introduction-of-compiler-design/
4. https://nptel.ac.in/courses/106/105/106105190/
5. https://www.guru99.com/compiler-design-tutorial.html

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	-	-	-	-	-	-	-	-	3	3	1
2	3	3	2	2	-	-	-	-	-	-	-	-	3	3	1
3	3	3	2	2	-	-	-	-	-	-	-	-	3	3	1
4	3	3	2	2	-	-	-	-	-	-	-	-	3	3	1
5	3	3	2	2	-	-	-	-	-	-	-	-	3	3	1

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme:**B.Tech.**						
Semester	**IV**	CourseCategoryCode:**PE**			*End SemesterExamType:T**E**			
CourseCode	**U23CCE405**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Azure Development and Operations**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
CCE (Professional Elective - I)								
Prerequisite	Software Engineering							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Explain traditional software development methodologies like waterfall.	**K2**
	CO2	Apply the Agile Methodology and comparing various other software development models with agile.	**K3**
	CO3	Explain implementing Continuous Integration and Continuous Delivery.	**K2**
	CO4	Create quick MVP prototypes for modules and functionalities.	**K3**
	CO5	Explain CAMS for DevOps (Culture, Automation, Measurement and Sharing).	**K2**

UNIT-I	**Traditional Software Development**	**Periods:09**	
The Advent of Software Engineering - Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation - Developers vs IT Operations conflict.			**CO1**
UNIT-II	**Rise of Agile Methodologies**	**Periods:09**	
Agile movement in 2000 - Agile Vs Waterfall Method - Iterative Agile Software Development - Individual and team interactions over processes and tools - Working software over comprehensive documentation - Customer collaboration over contract negotiation - Responding to change over following a plan			**CO2**
UNIT-III	**Introduction Devops**	**Periods:09**	
Introduction to DevOps - Version control - Automated testing - Continuous integration - Continuous delivery - Deployment pipeline - Infrastructure management – Databases			**CO3**
UNIT-IV	**Purpose Of Devops**	**Periods:09**	
Minimum Viable Product- Application Deployment- Continuous Integration- Continuous Delivery.			**CO4**
UNIT-V	**Cams (Culture, Automation, Measurement and Sharing)**	**Periods:09**	
CAMS – Culture, CAMS – Automation, CAMS – Measurement, CAMS – Sharing, Test-Driven Development, Configuration Management-Infrastructure Automation- Root Cause Analysis- Blamelessness- Organizational Learning			**CO5**

LecturePeriods:45	**TutorialPeriods:**	**PracticalPeriods:-**	**TotalPeriods:45**

TextBooks

1. GrigGheorghiu, Alfredo Deza, Kennedy Behrman, Noah Gift, “Python for DevOps”, .
2. Len Bass, Ingo Weber, Liming Zhu, “DevOps - A Software Architect’s Perspective”, Pearson Education.

ReferenceBooks.

1. Deepak Gaikwad, Viral Thakkar, DevOps Tools: from practioner’s point of view, Wiley, 1st Edition, 2019.
2. Gene Kim, Jez Humble, Patrick Debois, and Willis,” The DevOps Handbook”, IT Revolution Press, 2016.
3. JoakimVerona, “Practical DevOps”, O'Reilly, 2016.

Web References

1. https://azure.microsoft.com/en-in/overview/devops-tutorial/
2. https://www.javatpoint.com/devops

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	1	-	-	-	-	-	-	-	3	3	2
2	3	3	2	2	1	-	-	-	-	-	-	-	3	3	2
3	3	3	2	2	1	-	-	-	-	-	-	-	3	3	2
4	3	3	2	2	1	-	-	-	-	-	-	-	3	3	2
5	3	3	2	2	1	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category : **PC**			End Semester Exam Type:**TE**			
Course Code	**U23CCB401**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Operating Systems Principles and Practices**	**2**	**0**	**2**	**3**	**50**	**50**	**100**
CCE (Theory Cum Practical course)								
Prerequisite	NIL							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Understand the core functionalities and structure of operating systems	**K2**
	CO2	Apply the OS concepts to ensure system security and efficient resource management	**K3**
	CO3	Analyse the modern OS trends in diverse computing environments	**K3**
	CO4	Explore the commands to advanced processes	**K4**
	CO5	Simulatethe integrated OS algorithms	**K4**

UNIT- I	**Operating Systems Fundamentals**	**Periods:10**	
Introduction to Operating Systems-Types of Operating Systems-System Architecture-Storage Management-Operating System services-System calls -Types of System Calls-Process Scheduling-Operations on Processes-Inter-Process Communication			**CO1**
UNIT- II	**System Internals and Management**	**Periods:10**	
Process Synchronization-The Critical Section Problem- Semaphores-Deadlocks-Prevention-Detection- Memory Management-Swapping-Contiguous Memory Allocation-Paging-Page Replacement-Thrashing			**CO2**
UNIT- III	**Specialization and Diverse Environments**	**Periods:10**	
Operating Systems for Specific Platforms-Cloud Computing and Distributed Systems-Mobile Operating Systems-Real Time Operating Systems-Security Concerns and Emerging Threats			**CO3**
UNIT- IV	**Exploring Commands to Advanced Processes**	**Periods:15**	
List of Exercises 1. Experiment to explore and practice basic commands 2. Experiment to implement the following CPU scheduling algorithms a) FCFS b) SJF c) Round Robin d) Priority 3. Program to implement Producer – Consumer problem using Semaphores 4. Program to implement Dining-Philosophers Problem 5. Program to implement Inter-Process Communication 6. Program to implement the following Contiguous memory allocation Techniques a) Worst fit b) Best fit c) First fit			**CO4**
UNIT-V	**Integrated OS Algorithms and Simulations**	**Periods:15**	
List of Exercises 1. Program to implement Bankers Algorithm for Dead Lock Avoidance 2. Program to implement Bankers Algorithm for Dead Lock Prevention 3. Simulate all Page replacement algorithms a) FIFO b) LRU c) OPTIMAL 4. Simulate all File organization techniques a) Single level directory b) Two level directory 5. Simulate all File allocation strategies a) Sequential b) Indexed c) Linked 6. Program to Simulate disk scheduling algorithms. a) FCFS b) SCAN c) C-SCAN			**CO5**

Lecture Periods:30	**Tutorial Periods:-**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. AviSilberschatz, Peter Baer Galvin and Greg Gagne:Operating System Concepts, 9th edition, John Wiley and Sons, 2012.
2. William Stallings, “Operating System”, Prentice Hall of India, 6th Edition, 2015.
3. Andrew S. Tanenbaum, Albert S.WoodHull: Operating Systems, Design and Implementation,4th Edition, Prentice Hall, 2008.
4. Gary Nutt, “Operating Systems”, 3rd Edition, Addison Wesley, 2004

Reference Books

1. Thomas Anderson and Michael Dahlin, “Operating Systems principles and practice”, Wiley, 2nd Edition, 2014.
2. Harvey M. Deitel, “Operating Systems”, Pearson Education, Third Edition, 2013.
3. Silberschatz, Galvin, “Operating System Concepts”, Wiley, Student Edition, 2006.
4. William Stallings, “Operating System: Internals and design Principles”, Old Edition (7), Pearson Education India.

Web References

1. https://nptel.ac.in/courses/106108101/
2. http://www.tcyonline.com/tests/operating-system-concepts
3. http://www.galvin.info/history-of-operating-system-concepts-textbook
4. https://www.cse.iitb.ac.in/~mythili/teaching/cs347_autumn2016/index.html
5. https://www.cse.iitk.ac.in/pages/CS330.html

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	1	-	1	1	1	1	-	-	-	-	-	2	1	2
2	-	2	-	2	2	2	2	-	-	-	-	2	2	1	2
3	3	2	2	1	2	2	2	3	-	-	-	2	2	1	2
4	3	2	-	1	3	3	3	3	-	-	-	3	2	1	2
5	3	3	3	3	3	3	3	3	-	-	-	3	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High Evaluation

Evaluation method

Assessment	Continuous Assessment Marks (CAM)									End Semester Examination (ESE) Marks (Practical – Internal Evaluation)	End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous ssessment(Theory)					Continuous assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: **HS**				*End Semester Exam Type: **LE**		
Course Code	**U23ENPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**General Proficiency- II**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to ALL Branches except CSBS)								
Prerequisite	Basics of English Language							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Infer ideas to attend international standardized test by broadening receptive and productive skills	**K2**
	CO2	Interpret the types of writing in different state of affairs	**K3**
	CO3	Acquire meticulous exposure in speaking and get rid of performance anxiety	**K2**
	CO4	Articulate the ideas and opinions effectively and coherently	**K2**
	CO5	Progress the skills to compete in various competitive exams like GATE, GRE, UPSC, etc.	**K4**

UNIT- I	**CAREER SKILLS**	**Periods:6**	
Listening: Listening at specific contexts - Speaking: Demonstrative speaking practice using visual aids (charts, graphs, maps) - Reading: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) - Writing: Integrated Writing Task (TOEFL) - Vocabulary: Synonyms and Antonyms (IELTS)			**CO1**
UNIT- II	**CORPORATE SKILLS**	**Periods:6**	
Listening: Listening English news and reproducing in own words - Speaking: Team Presentation - Reading: Short texts and Longer Passages (cloze reading) - Writing: Analytical Writing: Analyzing an issue and Argument task (GRE based) - Vocabulary: Prefix and Suffix			**CO2**
UNIT- III	**FUNCTIONAL SKILLS**	**Periods:6**	
Listening: Listening TED Talks - Speaking: Brainstorming & Individual Presentation - Reading: Text Completion (GRE Based) - Writing: Picture Inference - Vocabulary: Word Formation			**CO3**
UNIT- IV	**TRANSFERRABLE SKILLS**	**Periods:6**	
Listening: Listening Documentaries and making notes - Speaking: Mock Interview - Reading: Read texts on emerging trends - Writing: Agreeing & Disagreeing Essay (IELTS) - Vocabulary: Euphemism, Redundancy, Clichés and Intensifiers			**CO4**
UNIT-V	**VERBAL APTITUDE - II**	**Periods:6**	
Transformational Grammar: Tenses, Change of Voice, Concord **Verbal Ability Enhancement:** Letter Series, Coding &Decoding, Sentence Equivalence (GRE)Analytical Reasoning and Logical Reasoning (GATE), Syllogism, One-word Substitution, Jumbled Sentences			**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Cullen, Pauline, Amanda French, and Vanessa Jakeman**.** “The official Cambridge guide to IELTS for academic & general training”.Cambridge, 2014.
2. Prasad, Hari Mohan, Sinha, Uma Rani, “Objective English for Competitive Examinations”, Tata Mc Graw Hill: Noida,2010.
3. Lougheed, Lin. “Barron's Writing for the TOEFL IBT: With Audio CD”. Barron's Educational series, 2008.
4. Grussendorf, Marion, “English for Presentations”, Oxford University Press, Oxford, 2007.
5. Murphy, Raymond English Grammar in Use with answers: Reference and Practice for Intermediate students, Cambridge: CUP,2004.

Web References

1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
5	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Practical				
Continuous Assessment Internal Evaluation		**End Semester External Evaluation**		**Total Marks**
50 marks		**50 marks**		
Conduction of Practical (Assignment 1&2 -10 Marks Performance in practical classes - 5 Marks)	15	Listening (L)	20	100
Record	5	Speaking(S)	10	
Viva	5	Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will be converted to 15 Marks)	15	Writing(W)	10	
Attendance	10			

Department	**Information Technology**	Programme: **B.Tech**						
Semester	**IV**	Course Category Code: **ES**			*End Semester Exam Type: **LE**			
Course Code	**U23ITPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Java Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to All Branches)								
Prerequisite	Basic concepts of Object-Oriented Programming Principles							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply and practice logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2 Demonstrate the use of inheritance, interface and package in relevant applications	**K3**
	CO3 Implement robust application programs in Java using exception handling and multithreading.	**K3**
	CO4 Build java distributed applications using Collections and IO streams.	**K3**
	CO5 Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java.	**K3**

List of Exercises

1. Develop simple programs using java
2. Develop a java program that implements class and object.
3. Write a java program to find the frequency of a given character in a string
4. Write a java program to demonstrate inheritance and interfaces.
5. Develop a java program that implements the Packages.
6. Create java applications using Exception Handling for error handling.
7. Develop a simple real life application program to illustrate the use of Multi-Threads.
8. Implement simple applications using Collections.
9. Develop application using the concept of I/O Streams
10. Write a Java Program to demonstrate AWT and Swing Components
11. Develop a simple application and use JDBC to connect to a back-end database.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Allen B. Downey and Chris Mayeld, “Think Java - How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2020
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018
3. Cay.S.Horstmann and Gary Cornell, “Core Java 2”, Vol 2, Advanced Features, Pearson Education, 7th Edition, 2010

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog.
5. https://www.geeksforgeeks.org.

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23CSPC04**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATABASE MANAGEMENT SYSTEMS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to CSE, IT and CCE)								
Prerequisite	Data Structures and Algorithms							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Implement relational database systems using SQL statements.	**K3**
	CO2	Use typical data definitions and manipulation commands in various applications.	**K3**
	CO3	Demonstrate applications using Nested and Join Queries	**K3**
	CO4	Execute various advance SQL queries related to Transaction Processing.	**K3**
	CO5	Build commercial relational database systems using trigger and cursor concept.	**K3**

List of Exercises

Structured Query Language:

1. Data Definition Language
2. Data Manipulation Language
3. Data Selection and Projection statements
4. Aggregate Functions
5. Joins
6. Built in Functions
7. Nested Queries
8. Set Operations
9. View
10. Transaction Control Language
11. Data Control Language

PL/SQL:

12. Simple Pl/SQL Programs
13. Trigger
14. Cursor : Implicit Cursor and Explicit Cursor

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Oracle Developer Handbook.
2. SQL/PL/SQL for Oracle by P.S. Deshpande, IIT Madras, Dream Tech Press.
3. Alan Beaulieu, Mastering SQL Fundamentals, 2nd Edition, O"Reilly,2009
4. Silberschatz, Korth, Sudarshan, Database System Concepts, 7thEdition - McGraw-Hill Higher Education, 2019

Web References

1. www.oracle-developer.net
2. www.oracle.com/DBA

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	2	1	-	2	1	-	2	2	3	2
2	3	2	3	3	2	2	1	-	2	1	-	-	3	3	3
3	3	3	3	3	2	2	2	-	2	1	-	-	3	2	3
4	3	2	3	3	2	2	1	-	2	1	-	-	3	3	3
5	3	3	3	3	2	2	2	-	2	1	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: **PC**			*End Semester Exam Type:**LE**			
Course Code	**U23CCP403**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Computer and Communication Networks Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(CCE)

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Effectively use of network commands	**K3**
	CO2 Compare the performance of different transport layer protocols	**K3**
	CO3 Implement various protocols using TCP and UDP	**K4**
	CO4 Demonstrate a Congestion control algorithm	**K4**
	CO5 Use simulation for transfer of files from PC to PC using Socket programming	**K4**

List of Experiments

1. Learn to use commands tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDU 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:
   (i) Echo client and echo server
   (ii) File transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP/RARP protocols.
6. Study of Network Simulator (NS) and Simulation of Congestion Control Algorithms using NS
7. Study of TCP/UDP performance using simulation tool.
8. Simulation of Distance Vector / Link state Routing algorithm
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC)
11. Implementation of Data encryption and decryption.
12. Transfer of files from PC to PC using Windows / Unix socket processing.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Douglas E. Comer, “Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture”, 6th Edition, Pearson Education, 2013.
2. Nader F. Mir, “Computer and Communication Networks”, 2nd 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. Behrouz A. Forouzan and FirouzMosharraf, “Computer Networks a Top Down Approach”,6e, Tata McGraw-Hill, 2021.

Web References

1. https://tinyurl.com/ycy6x454
2. https://tinyurl.com/yapn9ac7
3. https://tinyurl.com/ydf33ye6
4. https://nptel.ac.in/courses/106/105/106105081/
5. https://nptel.ac.in/courses/106/105/106105183/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	3	2
2	3	2	1	1	3	-	-	-	-	-	-	-	2	3	2
3	3	2	1	1	3	-	-	-	-	-	-	-	2	3	2
4	3	2	1	1	3	-	-	-	-	-	-	-	2	3	2
5	3	2	1	1	3	-	-	-	-	-	-	-	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**IV**	Course Category: **AEC**			End Semester Exam Type:-			
Course Code	U23CCS402	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- II 1. Computer Hardware and Troubleshooting**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Infer the fundamental of standard desktop personal computer components.	**K2**
	CO2 Ability to analyze and troubleshooting system related problems.	**K3**
	CO3 Ability to Installation and configure computer drivers	**K3**
	CO4 Design and analyze sequential logic circuits along with its applications.	**K3**
	CO5 Design and analyze ability to Install of various operating systems, peripherals with antivirus and configure it.	**K3**

List of Experiments

1. Study and identification of standard desktop personal computer.
2. Understanding of Motherboard and its interfacing component
3. Install and configure computer drivers and system components.
4. Disk formatting, partitioning and Disk operating system commands
5. Install, upgrade and configure Windows operating systems.
6. Remote desktop connections and file sharing.
7. Identify, install and manage network connections Configuring IP address and Domain name system.
8. Install, upgrade and configure Linux operating systems.
9. Installation Antivirus and configure the antivirus.
10. Installation of printer and scanner software.
11. Disassembly and Reassembly of hardware.
12. Troubleshooting and Managing Systems.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

1. Craig Zacker& John Rourke, “The complete reference :PC hardware”, Tata McGrawHill, New Delhi, 2001.
2. Mike Meyers, “Introduction to PC Hardware and Troubleshooting”, Tata McGrawHill, New Delhi, 2003.
3. B.Govindarajulu, “IBM PC and Clones hardware trouble shooting and maintenance”, Tata McGraw-Hill, New Delhi, 2002

Web References

1. https://nptel.ac.in/courses/117101055/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	2	1	1	-	-
2	1	-	-	-	-	-	-	-	-	-	2	1	1	-	-
3	1	-	-	-	-	-	-	-	-	-	2	1	1	-	-
4	1	-	-	-	-	-	-	-	-	-	2	1	1	-	-
5	1	-	-	-	-	-	-	-	-	-	2	1	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**IV**	Course Category: **AEC**			End Semester Exam Type:-			
Course Code	**U23CCS402**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- II 2. Mobile Servicing**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
(CCE)								
Prerequisite	NIL							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Infer the fundamental of standard mobile components.	**K2**
	CO2	Examine and troubleshoot mobile hardware and software related problems	**K4**
	CO3	Inspect about various faults arising due to corrupt software	**K4**
	CO4	Identify different flasher boxes and Flashing software for various brands	**K4**
	CO5	Identify and troubleshooting faults using advanced techniques	**K4**

List of Experiments

MODULE I: HARDWARE BASED EXPERIMENTS

1. Study of various tools and equipment used for mobile phone repairs.
2. Introduction of various Circuit of the Motherboard and Various Components used in mobile phone
3. Assembling and disassembling of various models of mobile phones.
4. Identifying the fault and troubleshooting for repairing of various fault
5. Common repair procedure for hardware and software related faults.

MODULE II: SOFTWARE BASED EXPERIMENTS

6. Detailed study of various faults arising due to corrupt software
7. Introduction of various flasher boxes and Flashing software of various brands of hands.
8. Removing virus from infected phones and Unlocking of handsets through codes and/or software.
9. Common repair procedure for Water damaged repair techniques.
10. Use of internet for troubleshooting faults using advanced troubleshooting techniques.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

1. ChukkyOparandu , “Mobile Phones and Tablets Repairs: A Complete Guide for Beginners and Professionals”, Mondraim Nig. Ltd, May 2016..
2. SanjibPandit , “Advance Mobile Repairing: Multicolour Circuits, Service Diagrams & Repairing”, Mondraim Nig. Ltd, December 2010.

Web References

1. https://www.youtube.com/watch?v=OjxCelVySi8
2. https://www.youtube.com/watch?v=jd8zBgwMfU0
3. https://in.pinterest.com/pin/862017184895958528/
4. https://fliphtml5.com/fgms/skao/basic
5. https://www.pinterest.com/smartphonesrepair/phone-repairing-manual-pdf-free-download/

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	1	2	-	-	-	1	-	-	-	1	3	-
2	3	2	2	1	2	-	-	-	1	-	-	-	1	3	-
3	3	2	2	1	2	-	-	-	1	-	-	-	1	3	-
4	3	2	2	1	2	-	-	-	1	-	-	-	1	3	-
5	3	2	2	1	2	-	-	-	1	-	-	-	1	3	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**IV**	Course Category: **AEC**			End Semester Exam Type:-			
Course Code	**U23CCS402**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- II 3. Android App Development**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
	(CCE)							

Prerequisite	Basic Programming Skills	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Infer the fundamentals of Android development.	**K2**
	CO2 Demonstrate proficiency in using Android Studio.	**K3**
	CO3 Design user interfaces (UI) for Android applications.	**K3**
	CO4 Utilize various UI components provided by the Android framework.	**K3**
	CO5 Test and debug Android applications effectively using various debugging tools and techniques.	**K3**

List of Experiments

1. Introduction to Android OS and its architecture
2. Setting up Android development environment (Android Studio, SDK, and AVD)
3. Creating an android app project
4. Deploying the app to an emulator and a device
5. Deploying UI components - Layouts ,views and widgets
6. Text and Scrolling views (Working with TextView Elements)
7. Implement navigation within Android applications using intents, fragments, and the navigation component.
8. Debugging Your App
9. Testing Your App
10. Delightful User Experience

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 3 0**	**Total Periods: 30**

Reference Books

1. Bill Phillips and Chris Stewart,"Android Programming: The Big Nerd Ranch Guide", 4th edition, 2020.

Web References

1. https://developer.android.com
2. http://androidweekly.net
3. http://android-arsenal.com
4. http://androidauthority.com

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: **AEC**				*End Semester Exam Type:		
Course Code	**U23CCC4XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course - IV**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
(Common to all Branches)								

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as pass on satisfactory completion. A letter grade P is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23CCM404**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Right to Information and Good Governance**	**0**	**0**	**2**	**-**	**100**	**-**	**100**

Common to all Branches

Prerequisite -

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe and analyze concept and legislative provisions related to RTI	**K2**
	CO2 Develop critical thinking skills to identify instances where public authorities have failed to meet their obligations	**K3**
	CO3 Critically assess the challenges and limitations faced by Central and State Information Commissions	**K2**
	CO4 Analyze the structure and functioning of the judiciary at different levels - local, regional, national.	**K2**
	CO5 Analyze the impact of the RTI Act on promoting transparency, accountability, and citizen empowerment in India	**K2**

UNIT- I	**Introduction**	**Periods:06**
Conceptual background – Right to know – Open Government – Transparency in governance and accountability – Right to information under the Indian Constitution – Article 19(1)(a) and Article 21 of the Constitution – Role of NGOs and movement for right to information – Right to Information Act, 2005- Scope and objectives.		**CO1**
UNIT- II	**Obligation of Public Authorities**	**Periods:06**
Obligations of public authorities: Section 4 - Designation of Public Information Officers: Section 5 - Disposal of request: Section 7 -Exemption from disclosure of information: Section 8 - Grounds for rejection to access in certain cases: Section 9 - Severability: Section 10 - Third party information: Section 11		**CO2**
UNIT- III	**Central and State Information Commission**	**Periods:06**
Constitution of Central and State Information Commissions - Terms of office and conditions of service - Removal of Chief Information Commissioner or Information Commissioner - Powers and functions of Information Commissions.		**CO3**
UNIT- IV	**Judiciary and Right to Information Act**	**Periods:06**
Protection of right to access the information- Role of the Supreme Court and High Courts – Recent attempts of dilution of the right to information Law		**CO4**
UNIT- V	**Right to Information Act, 2005 and its relevance to other laws**	**Periods:06**
Public Records Act, 1993 - Whistle Blowers Protection Act, 2014 - Official Secrets Act, 1923		**CO5**

Lecture Periods:30	**Tutorial Periods: -**	**Practical Periods:**	**Total Periods:30**

Text Books

1. Virender Negi, Monika Negi," Right to Information: Key to Good Governance", Indu Book Services Pvt. Limited, 2019
2. R. M. Pal, Somen Chakraborty "Human Rights Education in India" Indian Social Institute, 2000
3. Sairam Bhat," Right to Information and Good Governance - Volume 3 of NLSIU book series" National Law School of India University, 2016

Reference Books

1. Sairam Bhat [ed], Right to Information and Good Governance, NLSIU Book Series-3, 2016. [ISBN-9789383363452]
2. Sairam Bhat, Right to Information, Eastern Book House, 2012. [ISBN-978838021553]
3. Praveen Dala; Consumer Protection and Right to Information; Central Information Commission, 2007.

Web References

1. https://archive.nptel.ac.in/courses/129/106/129106001/
2. https://onlinecourses.nptel.ac.in/noc20_lw01/preview
3. https://www.classcentral.com/course/swayam-right-to-information-and-good-governance-19988

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Department	**Management Studies**	Programme : **B.Tech**						
Semester	**V**	Course Category Code: **HS**			*End Semester Exam Type: **TE**			
Course Code	**U23HSTC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Research Methodology**	**2**	**0**	**0**	**2**	**25**	**75**	**100**

Prerequisite	**Nil**	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Students will be able to explain the differences between various types of research and describe how different research methods are used to address engineering problems.	**K2**
	CO2 Students will develop the ability to identify research problems, perform comprehensive literature reviews, and use various tools and services for effective information retrieval.	**K2**
	CO3 Students will gain proficiency in designing experiments, analyzing data, and interpreting results using both numerical and graphical methods.	**K4**
	CO4 Students will be able to apply ethical guidelines to structure and write research papers and dissertations, avoiding plagiarism.	**K3**
	CO5 Students will understand the fundamentals of intellectual property rights, including how to protect and enforce them, which is crucial for innovation and entrepreneurship in engineering.	**K3**

UNIT-I	**Introduction to Research**	**Periods: 6**
Meaning and Importance of Research, Types of Research: Overview of Basic, Applied, and Developmental Research, Overview of the Research Process, Defining a Research Problem: Key Considerations, Setting Research Objectives and Research Questions, Introduction to Research Design: Basic Concepts, Approaches to Research: Quantitative vs. Qualitative.		**CO1**
UNIT-II	**Problem Formulation and Literature Review**	**Periods: 6**
Identifying and Formulating Research Problems, conducting a Literature Review: Essential Steps, Referencing and Citation Methods: Basic Techniques. Sources of Information: Overview of Libraries and Online Databases.		**CO2**
UNIT-III	**Research Methods and Data Analysis**	**Periods: 6**
Introduction to Experimental Research, Developing Hypotheses: Basic Approach. Data Collection Methods:Sampling and Surveys, Basics of Data Analysis: Numerical and Graphical Analysis, Introduction to Inferential Statistics.		**CO3**
UNIT-IV	**Writing and Presenting Research**	**Periods: 6**
Preparing a Research Report: Key Sections (Abstract, Introduction, Methodology, Results, Discussion, Conclusion). Referencing and Citation: Brief Overview.		**CO4**
UNIT-V	**Ethics and Legal aspects in research**	**Periods: 6**
Ethical Considerations in Research: Introduction to Scientific Misconduct. Basics of Intellectual Property Rights Introduction to Patents, Copyrights, and Trademarks – Case studies on ethical dilemmas in research.		**CO5**

Lecture Periods:	**Tutorial Periods:**	**Practical Periods:**	**Total Periods:**

Text Books

1. Kumar, R. Research Methodology: A Step-by-Step Guide for Beginners, 5th Edition, SAGE Publications, 2019.
2. Ram Ahuja, (2022). Research methods (2nd ed.). Rawat Publications.
3. Creswell, J. W., and Creswell, J. D. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, SAGE Publications, 2018.
4. Kothari, C. R. (2023). Research methodology – Methods and Techniques (5th ed.). New Age International Publishers.
5. T. Ramappa (2008). Intellectual Property Rights under WTO, S. Chand Publishers

Reference Books

1. Thiel, D. V. (2014). Research methods for engineers. Cambridge University Press.
2. Ganesan, R. (2024). Research methodology for engineers. MJP Publishers.
3. Agarwal, C., & Sharma, V. (2012). Research methodology in sociology. Commonwealth Publishers.
4. Thody, A. (2006). Writing and presenting research (SAGE Study Skills Series). SAGE Publications.
5. Bordens, K. S. and Abbott, B. B.(2011), Research Design and Methods – A Process Approach (8th ed.). McGraw Hill.

Web References

1. https://conjointly.com/kb/
2. https://owl.purdue.edu/owl/research_and_citation/conducting_research/writing_a_literature_review.html

3. https://files.eric.ed.gov/fulltext/ED536788.pdf
4. https://researcheracademy.elsevier.com/
5. https://www.wipo.int/
6. https://www.scholastic.com/parents/school-success/homework-help/homework-project-tips/7-steps-to-successfulresearch-report.html
7. https://www.futurelearn.com/info/courses/business-research-methods- investigation.
8. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India
9. https://researchgate.net/
10. https://journals.sagepub.com/home/jmx

COs/POs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	1	1	1	1	3
CO2	2	3	2	2	2	1	1	1	2	2	1	3
CO3	3	3	3	3	2	1	1	1	1	1	2	2
CO4	2	2	1	2	1	1	1	3	2	3	1	2
CO5	2	2	2	2	1	2	2	3	2	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**		Programme: **B.Tech**				
Semester	**V**		Course Category: **PC**		End Semester Exam Type: **TE**		
Course Code	**U23CSTC06**		Periods/Week			Credit	Maximum Marks
			L	T	P	C	CAM	ESE	TM
Course Name	**Artificial Intelligence**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to CSE, IT and CCE)									
Prerequisite	Basics of Algorithms and Probability								
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)		
	CO1	Understand AI fundamentals and apply search strategies to solve complex problems					**K2**		
	CO2	Understand the fundamentals of knowledge representation					**K3**		
	CO3	Understand and Apply Fuzzy logic and Predicate logic.					**K3**		
	CO4	Design model and manage uncertainty using probabilistic reasoning techniques.					**K3**		
	CO5	Explore the benefits of AI in different fields					**K3**		
UNIT - I	**Introduction to AI and Problem Solving**					**Periods:09**			
Overview of AI - Foundations of AI - History of AI - Agents Structure and its types. Problem Solving by Searching: Uninformed search - BFS - DFS - Informed search - Greedy Best First Search - A* Search - AO* Search - Constraint Satisfaction Problem(CSP) - Backtracking search for CSP.									**CO1**
UNIT - II	**Knowledge Representation**					**Periods:09**			
Introduction to Knowledge Representation: Types - Approaches - Knowledge representation using Semantic Network – Extended semantic networks - Frames – Conceptual dependencies – Scripts.									**CO2**
UNIT - III	**Fuzzy and Predicate Logic**					**Periods:09**			
Basic Concepts of Fuzzy Set Theory – Operations of Fuzzy Sets – Properties of Fuzzy Sets – Crisp Relations – Fuzzy Relational Equations – Operations on Fuzzy Relations – Fuzzy Systems – Logical Agents, Predicate Logic – First-Order Logic, Inference in First-Order Logic, Forward and Backward Chaining.									**CO3**
UNIT - IV	**Probabilistic Reasoning**					**Periods:09**			
Probabilistic Notations - Bayes rule - Bayesian Network - Probabilistic reasoning over time: Time and Uncertainty - Understanding Partially Observable Environments - Inference in Temporal Models - Hidden Markov Models - Kalman Filters - Dempster and Shafer Theory.									**CO4**
UNIT - V	**Applications of AI**					**Periods:09**			
AI in healthcare: Disease Diagnosis and Prediction.AI In Finance: Automated trading and Portfolio Management – AI in Education: Adaptive Learning and Assessment – AI in Customer service: Chatbot and Virtual Assistance.									**CO5**
Lecture Periods:45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods:45**			

Text Books

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th Edition, Pearson, 2020.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, “Artificial Intelligence”, 3rd Edition, McGraw Hill, 2017.
3. S. Rajasekaran,G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms synthesis and applications”,15th Edition, PHI Learning Private Limited,2011

Reference Books

1. Cherry Bhargava,”Artificial Intelligence Fundamentals and Applications”, First Edition,CRC Press,2021.
2. S. Kanimozhi Suguna, M.Dhivya,Sra Paiva,”Artificial Intelligence Recent Trends and Applications, First Edition, ”CRC Press,2021.
3. Wolfgang Ertel,”Introduction to Artificial Intelligence,”2nd Edition,Springer,2018.
4. David Poole and Alan Mackworth,” Artificial Intelligence: Foundations of Computational Agents”, 2nd Edition, Cambridge University Press, 2017.
5. Chris Thornton, Benedict Du Boulay, ”Artificial Intelligence through Search”,4th Edition, Springer Netherlands,2012.

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1. https://www.tutorialspoint.com/artificial_intelligence/index.htm
2. https://www.javatpoint.com/artificial-intelligence-ai
3. https://www.geeksforgeeks.org/artificial-intelligence/
4. https://towardsdatascience.com/
5. https://www.coursera.org/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	2	2	2	3	3	2	3
2	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3
3	3	2	3	3	3	-	-	-	2	3	3	3	3	3	3
4	3	3	3	3	3	-	-	-	2	3	3	3	3	3	3
5	3	3	2	3	3	-	-	-	2	2	3	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme : **B.Tech**						
Semester	**V**	Course Category Code:**PC**			*End Semester Exam Type:**TE**			
Course Code	**U23CCT507**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Signal Processing**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(CCE)

Prerequisite	Basics of Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Classify different type of signals and systems	**K2**
	CO2 Understand Discrete time signal in frequency domain	**K3**
	CO3 Realize discrete time systems in various methods	**K3**
	CO4 Estimate Discrete Fourier Transform through FFT algorithm	**K3**
	CO5 Describe basic functions in digital signal processing and its application	**K3**

UNIT – I	**Classification of Signals and Systems**	**Periods:9**

Continuous time signals - Discrete time signals – Representation of signals – Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential signals, Classification of continuous and discrete time signals-Operations on the signals. Continuous time and discrete time systems: Classification of systems – Properties of systems. **CO1**

UNIT – II	**Discrete Time Signals and Systems**	**Periods:9**

Analyzing Discrete Time signal in frequency domain using Fourier Transform: Properties of Fourier transform; Z Transformation- Properties-ROC-Inverse z-transform. Discrete time system analysis using convolution sumdifference equation-System function and Block diagram representation,correlation **CO2**

UNIT – III	**Discrete Fourier Transform**	**Periods:9**

The Discrete Fourier Transform- Need for DFT, DFT as a linear transformation. Properties of DFT- Periodicity, Linearity, Symmetry, Multiplication-Circular Convolution, Efficient Computation of DFT-FFT algorithm Implementation of Radix 2 FFT algorithm (DIT and DIF)-Applications of FFT algorithm. **CO3**

UNIT – IV	**Multirate Signal Processing**	**Periods:9**

Basic block diagram of digital signal Processing-Sampling theorem-Multi rate digital signal processing: Concepts, design of practical sampling rate converters, Decimators, interpolators. Polyphase decompositions. **CO4**

UNIT – V	**DSP Algorithms**	**Periods:9**

FIR/IIR filters Computational characteristics of DSP algorithms and applications, Numerical representation of signals-word length effect and its impact, Applications of Distributed Arithmetic to Digital Signal Processing, Model of Speech Wave Form – Vocoder. **CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:**	**Lecture Periods:45**

Text Books

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, Second Edition, John Wiley and Sons, 2002
2. Allan V. Oppenheim, Allan S.Willsky and S.Hamid Nawab, “Signals and Systems”, 2nd Edition, PHI Learning, New Delhi, 2007.
3. John G. Proakis and Dimitris K. Manolakis , “Digital Signal Processing” , 4th edition, Pearson, 2007

Reference Books

1. B. P. Lathi, “Principles of Linear Systems and Signals”, 2nd Edition, Oxford, 2009
2. P.Ramesh Babu, “Digital Signal Processing”, Scitech Publications, 7th Edition, 2017
3. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems – Continuous and Discrete”, Pearson, 2007.
4. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.
5. M.J.Roberts, “Signals & Systems Analysis using Transform Methods & MATLAB”, Tata McGraw Hill, 2007.

Web References

1. https://engineering.purdue.edu/~bouman/ece438/lecture/module
2. http://freevideolectures.com/Course/2339/Digital-Signal-Processing-IITKharagpur
3. http://www.analog.com/en/content/beginners_guide_to_dsp/fca.html
4. http://www.nptelvideos.in/2012/12/signals-and-system.html
5. https://nptel.ac.in/courses/117/101/117101055/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	-	-	-	-	3	2	1
2	3	3	3	2	1	-	-	-	-	-	-	-	3	2	1
3	3	3	3	2	1	-	-	-	-	-	-	-	3	2	1
4	3	3	3	2	1	-	-	-	-	-	-	-	3	2	1
5	3	3	3	2	1	-	-	-	-	-	-	-	3	2	1
6	3	3	3	2	1	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**		Programme: **B.Tech.**					
Semester	**V**		Course Category: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23CCT508**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Cyber Physical System Design**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Communication Networks and Programming Skills							
Course Outcomes	On completion of the course, the students will be able to						BT Mapping (Highest Level)	
	CO1	Analyse and understand the various platform aspects of cyber physical systems					**K2**	
	CO2	Determine the various modeling formalisms for CPS					**K2**	
	CO3	Interpret and analyse CPS security and safety aspects					**K3**	
	CO4	Demonstrate programs using real time control and automation in CPS					**K3**	
	CO5	Simulate the basics of Intelligent and Secure CPS					**K3**	
UNIT - I	**Overview of Cyber-Physical Systems**					**Periods:09**		
Cyber-Physical Systems Overview – 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. CPS – Platform- CPS HW platforms – Processors, Sensors, Actuators – CPS Network – Wireless Hart, CAN, Automotive Ethernet.								**CO1**
UNIT - II	**Automated Control Systems**					**Periods:09**		
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.CPS implementation issues – From features to automotive software components.								**CO2**
UNIT - III	**Intelligent and Secure Cyber-Physical Systems**					**Periods:09**		
Intelligent CPS – Safe Reinforcement Learning – Robot motion control – Autonomous Vehicle control – Gaussian Process Learning – Smart Grid Demand Response – Building Automation. Secure Deployment of CPS -Secure Task mapping and Partitioning – Automotive Case study : Vehicle ABS hacking – Power Distribution Case study : Attacks on Smart Grids.								**CO3**
UNIT - IV	**Real-Time Networks and Communication in Cyber physical Systems**					**Periods:09**		
Real-Time Networks for CPS - Real-Time Wireless Networks - Quality of Service (QoS) in CPS Networks - Bandwidth, Latency, Jitter – Performance trade-offs in CPS networks.- Fault Tolerance and Recovery in CPS - Case Studies in Real-Time CPS Networks.								**CO4**
UNIT - V	**Trends and Applications in Cyber-Physical Systems**					**Periods:09**		
Edge Computing and CPS: Role of Edge Computing in CPS – Advantages of Edge and Fog Computing for CPS – Latency Reduction, Data Offloading, and Privacy Preservation. Blockchain in CPS: Leveraging Blockchain for Security in CPS – Decentralized and Trustless Systems – Applications of Blockchain in Autonomous Systems and Smart Grids.								**CO5**
Lecture Periods:45		**Tutorial Periods: -**		**Practical Periods: -**		**Total Periods:45**		

Text Books

1. Rajeev Alur, "Principles of Cyber-Physical Systems", 2015.
2. Edward A. Lee and Sanjit A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", 2nd Edition, 2017.

Reference Books

1. Hermann Kopetz, "Real-Time Systems: Design Principles for Distributed Embedded Applications", 2022.
2. E. A. Lee, Sanjit Seshia “Introduction to Embedded Systems – A Cyber–Physical Systems Approach”, MIT Press, 2013. Houbing Song, Danda B. Rawat, Sabina Jeschke, and Christian Brecher, "Cyber-Physical Systems: Foundations, Principles and Applications", 2016.
3. Claudius Ptolemaeus, "Modeling and Simulation of Cyber-Physical Systems using Ptolemy II", 2018.
4. Jonathan Valvano, "Embedded Systems: Real-Time Interfacing to the ARM Cortex-M Microcontrollers", Volume 2, Fourth edition, 2014.

Web References

1. https://www.udacity.com/course/cyber-physical-systems-design-analysis--ud9876
2. https://www.geeksforgeeks.org/introduction-to-cyber-physical-system/
3. https://omscs.gatech.edu/cs-7639-cyber-physical-design-and-analysis

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1
2	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1
3	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1
4	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1
5	3	2	2	-	-	-	-	-	-	-	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23CCE506	Wireless Adhoc and Sensor Networks
2	U23CCE507	Data Mining and Information Warehousing
3	U23CCE508	Multimedia Graphics Design
4	U23CCE509	Theory of Computation
5	U23ITEC01	Software Defined Networks

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE506**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Wireless Adhoc and Sensor Networks**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

CCE (Professional Elective-II)

Prerequisite	**NIL**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the basics of Ad hoc networks and routing protocols.	**K2**
	CO2 Apply the knowledge to identify appropriate physical and MAC layer protocols.	**K3**
	CO3 Interpret the basics of Sensor networks and routing protocols.	**K3**
	CO4 Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement.	**K3**
	CO5 Analyze the security issues possible in Ad hoc and sensor networks.	**K4**

UNIT - I	**Introduction to Ad-Hoc Networks and Routing Protocols**	**Periods:09**
Ad-Hoc Networks: Fundamentals of Wireless Communication Technology- Characteristics of the Wireless Channel - mobile ad hoc networks (MANETs) - concepts and architectures. **Ad-Hoc Networks Routing Protocols**: Issues in designing a routing protocol for Ad hoc networksproactive routing, reactive routing (on-demand), hybrid routing- Classification of routing protocols. Transport Layer solutions-TCP over Ad hoc wireless Networks		**CO1**
UNIT - II	**MAC Protocols for Ad-Hoc Wireless Networks**	**Periods:09**
Protocol- Design goal of MAC Protocol-Classification of MAC Protocols- Contention based protocols Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms.MAC Protocols that use directional Antennas and Multichannel MAC Protocols.		**CO2**
UNIT - III	**Sensor Networks and its Architecture**	**Periods:09**
Introduction to Sensor Networks: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes. **Sensor Networks Architecture**: Sensor Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.		**CO3**
UNIT - IV	**WSN Networking Concepts and Routing Protocols**	**Periods:09**
WSN Networking concepts: 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. **WSN Routing Protocols:** Routing Protocols- Energy Efficient Routing, Geographic routing Challenges and Issues in Transport layer protocol.		**CO4**
UNIT - V	**Sensor Network Security**	**Periods:09**
Network Security Requirements, Issues and 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.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. C. Siva Ram Murthy and B. S. Manoj," Ad Hoc Wireless Networks Architectures and Protocols", 2nd Edition, Pearson Publication, Reprinted in 2015.
2. Holger Karl and Andreas Willig," Protocol and Architecture for Wireless Sensor Networks", 1st Edition, John Wiley publication, Reprinted in 2011.
3. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd,2nd Edition2003.

Reference Books

1. Raheem Beyah, Janise McNair and Cherita Corbett." Security in Ad hoc and Sensor Networks" World Scientific Publications / Cambridge University Press,Volume 3, 2010
2. Jagannathan Sarangapani," Wireless Ad hoc and Sensor Networks — Protocols", Performance and Control, CRC Press, Taylor & Francis Group, 2010.
3. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.

4. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey , computer networks", Elsevier, 2002, 394 - 422.
5. Fei Hu, Xiaojun Cao and Auerbach," Wireless Sensor Networks — Principles and Practice," CRC Press, Taylor &Francis Group, 1St Edition, 2010.

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1. https://www.tutorialspoint.com
2. https://nptel.ac.in/wireless Ad Hoc and Sensor Networks.pdf 3.
3. https://www.techtarget.com/searchmobilecomputing/definition/ad-hoc-network
4. https://www.geeksforgeeks.org
5. https://archive.nptel.ac.in/courses/106/105/106105160/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
2	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
3	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
4	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
5	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE507**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Mining and Information Warehousing**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective-II)								
Prerequisite	Basic knowledge of databases, statistics, and programming							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic concepts and scope of data mining and warehousing	**K2**
	CO2 Master the techniques for preprocessing data to enhance quality	**K3**
	CO3 Apply OLAP techniques to analyze and visualize data stored in a warehouse	**K3**
	CO4 Implement various classification algorithms to classify data	**K3**
	CO5 Analyze and apply data mining techniques through real-world case studies	**K3**

UNIT-I	**Introduction to Data Mining and Data Warehousing**	**Periods: 09**
Introduction to Data Mining: Data Mining vs. Machine Learning vs. Data Science, Data Mining Applications and Challenges, Data Mining Process: Data Cleaning, Data Integration, Data Selection, and Transformation. Introduction to Data Warehousing: Overview of Data Warehousing Concepts, Data Warehousing Architecture, Differences between OLAP and OLTP, Data Marts and Metadata.		**CO1**
UNIT-II	**Data Preprocessing and ETL Processes**	**Periods: 09**
Data Preprocessing- Data Quality and Cleaning- Handling Missing Data- Dealing with Noisy Data, Data Integration and Transformation Techniques, Data Reduction: Dimensionality Reduction -Data Discretization and Concept Hierarchy Generation ETL Process: Importance of ETL in Data Warehousing, Steps Involved in ETL, Tools and Technologies for ETL		**CO2**
UNIT-III	**Data Warehousing Design and OLAP**	**Periods: 09**
Data Warehouse Design: Designing Star Schema, Snowflake Schema, and Fact Constellations, Implementing Data Marts, Data Warehouse Implementation Considerations. OLAP (Online Analytical Processing): OLAP Operations: Roll-up, Drill-down, Slice, Dice, Pivot, Types of OLAP: ROLAP, MOLAP, HOLAP, Implementing OLAP Cubes		**CO3**
UNIT-IV	**Data Mining Techniques: Association, Classification, and Clustering**	**Periods: 09**
Association Rule Mining: Introduction, Apriori Algorithm and FP-Growth Algorithm, Mining Multilevel and Multidimensional Association Rules, Applications of Association Rule Mining. Classification: Introduction to Classification Techniques, Decision Trees: ID3, C4.5, CART, Bayesian Classification, k-Nearest Neighbor (k-NN), Support Vector Machines (SVM), Model Evaluation: Cross-Validation, Confusion Matrix, Precision, Recall, Clustering Techniques		**CO4**
UNIT-V	**Advanced Topics in Data Mining and Case Studies**	**Periods: 09**
Advanced Data Mining Techniques: Web Mining: Web Content Mining, Web Structure Mining, Web Usage Mining, Temporal and Spatial Data Mining, Big Data Mining: Challenges and Techniques. Case Studies and Applications: Real-World Case Studies on Data Mining and Warehousing, Application of Data Mining in Business, Future Trends in Data Mining and Warehousing		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Han, J., Kamber, M., & Pei, J. Data Mining: Concepts and Techniques. Elsevier 2011.
2. Inmon, W. H.. Building the Data Warehouse. Wiley. 2005
3. Matthew A, Russell, Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites. by O'Reilly Media 2011.

Reference Books

1. Tan, P.-N., Steinbach, M., & Kumar, V.. Introduction to Data Mining. Pearson 2006
2. Ponniah, P.. Data Warehousing Fundamentals. Wiley 2004
3. JiaweiHan,Micheline-Kamber,Jian-Pei,Data-Mining.-Concepts-and-Techniques-3rd Edition, Morgan Kaufmann 2012
4. Daniel T. Larose , Data Mining and Predictive Analytics (Wiley Series on Methods and Applications in Data Mining) 2nd Edition 2012
5. Michael J.A. Berry , Gordon S. Linoff, Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management by Wiley 2004

Web References

1. https://www.geeksforgeeks.org/difference-between-data-warehousing-and-data-mining/
2. https://www.vssut.ac.in/lecture_notes/lecture1428550844.pdf
3. https://www.geeksforgeeks.org/data-warehousing/
4. https://www.snowflake.com/trending/data-warehousing-and-data-mining-for-bi/
5. https://www.egyankosh.ac.in/bitstream/123456789/89128/3/Block-1.pdf

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
3	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
4	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
5	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**V**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE508**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Multimedia Graphics Design**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective- II)								
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain graphics systems and its software	**K2**
	CO2 Apply two dimensional transformations graphics design	**K3**
	CO3 Apply three dimensional transformations graphics design	**K3**
	CO4 Apply Illumination and color models	**K3**
	CO5 Implementing animation graphics sequences and realism	**K3**

UNIT-I	**Introduction Computer Graphics**	**Periods:09**	
Introduction to Image and Objects, Image Representation, Basic Graphics Pipeline, Bitmap and Vector-Based Graphics, Applications of Computer Graphics, Display Devices, Cathode Ray Tubes, Raster-Scan Display, Random-Scan Display, Flat Panel Display, Input Technology, Coordinate System Overview.			**CO1**
UNIT-II	**Two Dimensional Transformation**	**Periods:09**	
Introduction to transformations, Transformation Matrix, Types of Transformations in Two-Dimensional Graphics: Identity Transformation, Scaling, Reflection, Shear Transformations, Rotation, Translation, Rotation about an Arbitrary Point, Combined Transformation, Homogeneous Coordinates, 2D Transformations using Homogeneous Coordinates			**CO2**
UNIT-III	**Three Dimensional Transformation**	**Periods:09**	
Three-dimensional transformations, Objects in Homogeneous Coordinates; Three-Dimensional Transformations: Scaling, Translation, Rotation, Shear Transformations, Reflection, World Coordinates and Viewing Coordinates, Projection, Parallel Projection, Perspective Projection.			**CO3**
UNIT-IV	**Illumination and Colour Models**	**Periods:09**	
Light sources - Basic Illumination Models – Halftone Patterns and Dithering Techniques; Properties of light - Standard Primaries and Chromaticity Diagram; Intuitive Colour Concepts - RGB Colour Model - YIQ Colour Model - CMY Colour Model - HSV Colour Model - HLS Colour Model; Colour Selection.			**CO4**
UNIT-V	**Animations & Realism**	**Periods:09**	
Animation Graphics: Design of Animation Sequences – Animation Function – Raster Animation – Key Frame Systems – Motion Specification –Morphing – Tweening. **Computer Graphics Realism:** Tiling the Plane – Recursively defined curves – Koch curves – C curves – Dragons – Space Filling Curves – Fractals – Grammar based Models – Fractals – Turtle Graphics – Ray Tracing.			**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. Computer Graphics, R. K. Maurya, John Wiley.
2. Mathematical elements of Computer Graphics, David F. Rogers, J. Alan Adams, Tata McGraw-Hill.
3. Procedural elements of Computer Graphics, David F. Rogers, Tata McGraw-Hill.

Reference Books

1. Computer Graphics, Donald Hearn and M. Pauline Baker, Prentice Hall of India.
2. Computer Graphics, Steven Harrington, McGraw-Hill.
3. Computer Graphics Principles and Practice, J.D. Foley, A Van Dam, S. K. Feiner and R. L. Phillips, Addision Wesley.
4. Principles of Interactive Computer Graphics, William M. Newman, Robert F. Sproull, Tata McGraw-Hill.
5. Introduction to Computer Graphics, J.D. Foley, A. Van Dam, S. K. Feiner, J.F. Hughes and R.L. Phillips, Addision Wesley.

Web References

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102065/
3. https://nptel.ac.in/courses/106/102/106102063/
4. https://en.wikipedia.org/wiki/Hyperlink 5. http://www.weblinkcomputers.com/diploma-in-computer-application-graphics

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	1	-	2
2	3	2	2	1	-	-	-	-	-	-	-	1	1	-	2
3	3	2	2	1	-	-	-	-	-	-	-	1	1	-	2
4	3	2	2	1	-	-	-	-	-	-	-	1	1	-	2
5	2	2	2	1	-	-	-	-	-	-	-	1	1	-	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**V**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Theory of Computation**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

CCE (Professional Elective -II)

Prerequisite	Discrete Mathematics, Digital Electronics and System, Design and Analysis of Algorithms	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand models and abstractions: automata as a basic model of computation	**K2**
	CO2 Understand link between languages, automata, and decision problems.	**K3**
	CO3 Understand layering as a means of tackling complexity, layering applied to the Internet.	**K2**
	CO4 Understand algebraic formalisms of languages such as regular expressions, context-free grammar.	**K3**
	CO5 Understand algorithms and computability through the lens of Turing machines.	**K2**

UNIT - I	**Finite Automaton**	**Periods:09**	
Alphabets, formal languages and problems. Regular languages and automata models- Deterministic Finite automaton, Formal argument of correctness, Regular languages -Properties of regular languages, Closure, properties, product construction, Limitations of Automata Nonregularity, Pumping Lemma, Non-Deterministic Finite Automaton, Subset construction, Equivalence with DFAs.			**CO1**
UNIT - II	**Regular Expressions**	**Periods:09**	
Equivalence with regular languages- Algorithms for regular languages, Minimization and its algorithm. Myhill- Nerode relations, Characterization of regular languages.			**CO2**
UNIT - III	**Grammars, Context-Free Languages And Machine Models**	**Periods:09**	
Grammars and the motivation from language theory- Context-free grammars, closure properties- Chomsky Normal Form for CFGs. PDAs - Empty- stack vs Final state acceptance conditions - Equivalence of PDAs and CFGs. Limitations of PDA computation, non- context-free language - Pumping Lemma for CFLs.			**CO3**
UNIT - IV	**Turing Machines and Computability**	**Periods:09**	
Modeling computation using Turing Machines - Equivalent mod- els - Church Turing Hypothesis - Decidability **CO4** and Turing recognizability (i.e., recursive and recursively enumerable)- Closure properties - Undecidability by diagonalization.			**CO4**
UNIT - V	**Resource Bounded Turing Machines & Intro To Complexity**	**Periods:09**	
Basic complexity classes- Time bounded classes Post's correspondence problem, undecidable problems, Polytime reductions, NP -completeness, Cook- Levin Theorem without proof.			**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. Michael Sipser, "Introduction to the Theory of Computation", Cengage Publications, 3rd Edition 2012.
2. John Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann, "Introduction to Automata, Theory, Languages and Com- putation".Pearson Publications, 3rd Edition, 2008.
3. Elaine Rich "Automata, Computability and Complexity: Theory and Applications", 1st edition, Pearson education, 2007.

Reference Books

1. R.B. Patel, "Theory of Computation", Khanna Book Publishing, 2020.
2. Harry Lewis, Christos Papadimitriou, "Elements of the Theory of Computation", Prentice Hall, Pearson Pub- lisher, 2nd Edition, 1997.
3. Sanjeev Arora and Boaz Barak**,**"Computational Complexity: A Modern Approach"**,** Cambridge University Press, 2009.
4. Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett Learning, 6th edition, 2016.

Web References

1. What is theory of computation? Set membership problem, basic notions like alphabet, strings, formal languages:
2. https://nptel.ac.in/courses/106104028
3. Introduction- Theory of Computation: https://nptel.ac.in/courses/106104148

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	3	2	3
2	3	2	2	2	-	-	-	-	-	-	-	-	3	2	3
3	3	2	2	2	-	-	-	-	-	-	-	-	3	2	3
4	3	2	2	2	-	-	-	-	-	-	-	-	3	2	3
5	3	2	2	2	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PE**				*End Semester Exam Type:**TE**		
Course Code	**U23ITEC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Software Defined Networks**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective-II)								
Prerequisite	Computer Networks							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Express the basics of networking and working of SDN	**K2**
	CO2	Articulate SDN controllers	**K2**
	CO3	Describe the protocol, controller and application models	**K2**
	CO4	Explain the use of SDN in data centers	**K2**
	CO5	Expound the exploration of SDN in other environments	**K2**

UNIT-I	**Introduction**	**Periods:9**	
History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture-Evolution of Switches and Control Planes, Data Center Needs, The Evolution of Networking Technology, Evolution of SDN – How SDN Works- Centralized and Distributed Control and Data Planes			**CO1**
UNIT-II	**Open Flow & SDN Controllers**	**Periods:9**	
OpenFlow Overview, Potential Drawbacks of Open SDN, Opendaylight, Floodlight controllers, SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Alternatives Overlap and Ranking			**CO2**
UNIT-III	**Emerging Protocol, Controller, and Application Models**	**Periods:9**	
Expanded Definitions of SDN, SDN Protocol Models, SDN Controller Models, Application Models, New Approaches to SDN Security, The P4 Programming Language, SDN programming interfaces			**CO3**
UNIT-IV	**SDN in the Data Center**	**Periods:9**	
Data Center Definition, Data Center Demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations			**CO4**
UNIT-V	**SDN in Other Environments**	**Periods:9**	
Wide Area Networks- Service Provider and Carrier Networks- Campus Networks-Hospitality Networks-Mobile Networks-Optical Networks-SDN vs P2P/Overlay Networks-Network Function Virtualization, SDN Platforms-Juniper, IETF			**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods:-**	**Total Periods:45**

Text Books

1. P. Goransson, C. Black, T. Culver, “Software Defined Networks – A Comprehensive Approach”, 2nd Edition, Elsevier, 2016,
2. Siamak Azodolmolky, “Software Defined Networking with OpenFlow”, Packt, 2013

Reference Books

1. Anand Nayyar, Bhawna Singla, Preeti Nagrath, “Software Defined Networks: Architecture and Applications”, Wiley, 2022
2. Doug Marschke, Jeff Doyle, Pete Moyer, “Software Defined Networking (SDN): Anatomy of OpenFlow”, Lulu Publishing Services, 2015

Web References

1. https://sdn.systemsapproach.org/
2. https://www.ciscopress.com/articles/article.asp?p=3145761&seqNum=4

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
2	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
3	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
4	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
5	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Code Category: **PC**				End Semester Exam Type: **LE**		
Course Code	**U23CSPC05**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Artificial Intelligence Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to CSE, IT and CCE)

Prerequisite	Basics of Algorithms and Probability		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Apply Search Algorithms to implement and compare heuristic-based search algorithms like Greedy Best First Search, A*, and AO* to solve pathfinding and graph-based problems.	**K3**
	CO2	Solve CSPs with Backtracking to model and solve complex Constraint Satisfaction Problems (CSPs) such as N-Queens or Sudoku using backtracking techniques.	**K3**
	CO3	Design Inference Engines: Students will develop forward and backward chaining inference engines, leveraging First-Order Logic for AI decision-making tasks.	**K3**
	CO4	Perform Probabilistic Reasoning: to construct and use Bayesian Networks, Hidden Markov Models, and Kalman Filters for probabilistic reasoning and sequence prediction tasks.	**K3**
	CO5	Explore the benefits of AI in different applications.	**K3**

List of Exercises

1. Implement Greedy Best First Search and A* Search for pathfinding problems (e.g., solving a grid-based puzzle).
2. Model a classic Constraint Satisfaction Problem (e.g., N-Queens problem or Sudoku) and solve using backtracking.
3. Implement AO* search for a graph-based problem.
4. Develop an inference engine using forward chaining and backward chaining to deduce conclusions from a given set of facts and rules.
5. Implement basic inference techniques in First-Order Logic using forward and backward chaining for an AI-based decision-making task.
6. Construct a Bayesian Network for a real-world problem (e.g., medical diagnosis) and perform inference using conditional probabilities.
7. Implement a Hidden Markov Model for sequence prediction (e.g., weather prediction or speech recognition).
8. Simulate a Kalman Filter for a tracking or navigation problem (e.g., predicting object positions over time).
9. Implement basic belief functions and apply Dempster-Shafer theory for uncertainty modeling in a decision-making problem.
10. Develop a model to predict stock price movements using historical data.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Cherry Bhargava,"Artificial Intelligence Fundamentals and Applications", First Edition,CRC Press,2021.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2020.
3. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill, 2017.
4. Chris Thornton, Benedict Du Boulay, "Artificial Intelligence through Search",4th Edition, Springer Netherlands,2012.
5. S.Rajasekaran,G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms synthesis and applications",15th Edition, PHI Learning Private Limited,2011

Web References

1. https://www.tutorialspoint.com/artificial_intelligence/index.html
2. https://www.javatpoint.com/artificial-intelligence-ai
3. https://www.geeksforgeeks.org/artificial-intelligence/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

Co's	Program Outcomes (POs)												Program Outcomes Specific (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	2	2	2	3	3	3
2	3	3	3	3	2	-	-	-	-	2	2	2	2	2	3
3	3	3	3	3	3	-	-	-	-	3	3	3	3	3	3
4	3	3	3	3	3	3	3	-	-	3	3	3	3	3	3
5	3	3	3	3	3	3	3	-	-	3	3	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer And Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category : **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23CCP504**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Signal Processing Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(CCE)

Prerequisite	Basics of mathematics		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Analyze various signals in time and frequency domain representation	**K2**
	CO2	Develop and implement digital systems using the DFT and the Fast Fourier Transform (FFT)	**K2**
	CO3	Perform and verify convolution using Simulink	**K2**
	CO4	Implement digital filters using windowing techniques	**K3**
	CO5	Implement algorithms using DSP processors for basic signal processing applications.	**K3**

List of Exercises

PART- A

1. Generate the following standard discrete-time signals. i) Unit Impulse ii) Unit Step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response using DFT and FFT (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross-correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence using MATLAB's FFT function.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
9. Implement and verify N-point IFFT of a given sequence.
10. Design and Simulation of IIR and FIR filters using Filter Design Toolbox
11. Linear Convolution using Simulink
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.

PART B - List of Experiments using DSP Processor

1. Study of Code composer studio
2. Perform Generation of Signals using DSP trainer Kit
3. Implement and verify linear and circular convolution between two given signals.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Alan V. Oppenheim and Ronald W. Schafer, “Discrete-Time Signal Processing,” 3rd edition, Prentice Hall,2010.
2. Vinay K. Ingle and John G. Proakis, Digital Signal Processing using MATLAB, Cengage learning, 3rd Edition, 2011.
3. Ashok Ambardar, Digital Signal Processing: A modern introduction, Cengage Learning, 1st Edition, 2006.
4. Alan V. Oppenheim, Wilsky S. and Nawab S. H, Signals and Systems, Pearson, 2015
5. P.Ramesh Babu,”Digital Signal processing”, Scitech Publications, 7th Edition, 2017

Web References

1. https://www.mathworks.com/matlabcentral/fileexchange/100591-generation-and-plotting-of-all-basic-signals
2. https://www.mathworks.com/help/signal/ug/linear-and-circular-convolution.html
3. https://www.mathworks.com/help/matlab/ref/fft.html
4. https://software-dl.ti.com/ccs/esd/documents/users_guide/index.html
5. https://www.ti.com/tool/TMDSLCDK6748

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	3	2	1
2	3	3	3	2	3	-	-	-	-	-	-	-	3	2	1
3	3	3	3	2	3	-	-	-	-	-	-	-	3	2	1
4	3	3	3	2	3	-	-	-	-	-	-	-	3	2	1
5	3	3	3	2	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of Practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PC**				*End Semester Exam Type: **LE**		
Course Code	**U23CCP505**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cyber Physical System Design Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(CCE)								

Prerequisite	Basic Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Model and simulate cyber-physical systems using tools such as Ptolemy II	**K2**
	CO2 Design and implement real-time scheduling, control mechanisms, and performance analysis in CPS	**K2**
	CO3 Design and simulate intelligent automation systems such as building automation and smart grids	**K3**
	CO4 Understand security challenges in CPS, with the ability to simulate cybersecurity attacks, and implement secure task mapping and defense mechanisms.	**K3**
	CO5 Simulate and design autonomous systems, including autonomous vehicle path planning, and intelligent, secure automation solutions.	**K3**

List of Experiments:

1. Program to model and simulate CPS using Ptolemy II.
2. Program to implement Real-Time Scheduling and Control.
3. Program to design a Building Automation System.
4. Program to perform Performance Analysis in Real-Time Networks.
5. Program to implement Fault Tolerance in CPS.
6. Program to simulate Autonomous Vehicle Path Planning.
7. Program to simulate Smart Grid with Demand Response.
8. Program to simulate Cybersecurity Attacks on CPS.
9. Program to simulate Secure Task Mapping.
10. Program to simulate Intelligent Building Automation.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Hermann Kopetz, "Real-Time Systems: Design Principles for Distributed Embedded Applications", 2022
2. E. A. Lee, Sanjit Seshia “Introduction to Embedded Systems – A Cyber–Physical Systems Approach”, MIT Press, 2013
3. Houbing Song, Danda B. Rawat, Sabina Jeschke, and Christian Brecher, "Cyber-Physical Systems: Foundations, Principles and Applications", 2016.
4. Claudius Ptolemaeus, "Modeling and Simulation of Cyber-Physical Systems using Ptolemy II", 2018.
5. Jonathan Valvano, "Embedded Systems: Real-Time Interfacing to the ARM Cortex-M Microcontrollers", Volume 2, 4th edition, 2014.

Web References

1. https://www.udacity.com/course/cyber-physical-systems-design-analysis--ud9876
2. https://www.geeksforgeeks.org/introduction-to-cyber-physical-system/
3. https://omscs.gatech.edu/cs-7639-cyber-physical-design-and-analysis

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2
2	3	3	3	3	2	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	2	3	2
4	3	3	3	2	2	-	-	-	-	-	-	-	2	3	2
5	3	3	3	3	3	-	-	-	-	-	-	-	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category Code: **PA**				*End Semester Exam Type: -		
Course Code	**U23CCW501**	Periods / Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**Micro Project**	0	0	2	1	100	-	100
(CCE)								
Prerequisite	Computer and Communication Engineering							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify the problem statement for the micro project work through the literature survey	**K2**
	CO2 Choose the proper components as per the requirements of the design/ system.	**K2**
	CO3 Apply the acquainted skills to develop final model/system	**K3**

There shall be a Micro Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the micro project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Micro-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Micro Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Micro Project work with weightage as indicated evaluation Methods.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	2	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3- High

Evaluation Method

Assessment	**Review 1**			**Review 2**				**Total Marks**
	Novelty	**Presentation**	**Viva**	**Presentation**	**Demonstration**	**Viva**	**Report**	
Marks	10	20	10	20	20	10	10	100

Department	**Computer and Communication Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23CCC5XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course- V**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	Nil							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as ↑pass↓ on satisfactory completion. A letter grade ↑P↓ is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Computer and Communication Engineering**		Programme: **B.Tech.**					
Semester	**V**		Course Category Code: **MC**			*End Semester Exam Type: **-**		
Course Code	**U23CCM505**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Essence of Indian Traditional Knowledge**		**2**	**0**	**0**	**-**	**100**	**-**	**100**
Common to all Branches								
Prerequisite	**-**							
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Familiarize with the philosophy of Indian culture						**K2**
	CO2	Distinguish the Indian languages and literature						**K2**
	CO3	Describe the philosophy of ancient, medieval and modern India						**K2**
	CO4	Illustrate the information about the fine arts in India						**K2**
	CO5	Describe the contribution of scientists of different eras						**K2**
UNIT- I	**Introduction to Culture**						**Periods:06**	
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India								**CO1**
UNIT- II	**Indian Languages, Culture and Literature**						**Periods:06**	
Indian Languages and Literature - I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature								**CO2**
UNIT- III	**Religion and Philosophy**						**Periods:06**	
Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)								**CO3**
UNIT- IV	**Fine Arts in India (Art, Technology and Engineering)**						**Periods:06**	
Indian Painting, Indian handicrafts, Music, divisions of Indian classical music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India								**CO4**
UNIT-V	**Education System in India**						**Periods:06**	
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India								**CO5**
Lecture Periods:30	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods:30**		

Reference Books

1. Kapil Kapoor, Text and Interpretation: The India Tradition, ISBN: 81246033375, 2005
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, Position paper on Arts, Music, Dance and Theatre, ISBN 81-7450 494-X, 200
4. S. Narain, Examinations in ancient India, Arya Book Depot, 1993
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN 13: 978 - 8120810990, 2014

Web References

1. https://nptel.ac.in/courses/109/104/109104102/
2. https://nptel.ac.in/courses/101/104/101104065/
3. https://nptel.ac.in/courses/109/108/109108158/
4. https://nptel.ac.in/courses/109/106/109106059/
5. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ae01/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Department	**Information Technology**		Programme: **B.Tech.**					
Semester	**VI**		Course Category Code: **PC**			*End Semester Exam Type:**TE**		
Course Code	**U23ITTC03**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Machine Learning**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Common to CSE, IT and CCE								
Prerequisite	Mathematics							
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)	
	CO1	Explain the basic concepts of machine learning					**K2**	
	CO2	Apply supervised algorithms for different classification problems					**K3**	
	CO3	Explain the need for ensemble methods					**K2**	
	CO4	Apply unsupervised and reinforcement learning techniques to various problems					**K3**	
	CO5	Apply dimensionality reduction and optimization techniques					**K3**	

Unit- I	**Introduction**	**Periods: 09**	
Introduction: Machine learning; Examples of Machine Learning Applications: Learning associations – Classification – Regression – Unsupervised learning – Reinforcement learning; Preliminaries: Weight space – Curse of dimensionality – Testing machine learning algorithms – Turning data into probabilities – Basic statistics – Bias-variance tradeoff.			**CO1**
Unit- II	**Supervised Learning**	**Periods: 09**	
Neural Networks and Linear Discriminants: Brain and the Neuron – Neural networks – Perceptron – Linear separability – Linear regression; Multi-layer Perceptron: Forward and Backward propagation; Support Vector Machines.			**CO2**
Unit- III	**Probabilistic Learning, Learning with Trees**	**Periods: 09**	
Probabilistic Learning: Gaussian mixture models – Nearest neighbor methods; Learning with Trees: Constructing decision trees – Classification and Regression trees – Classification example; Ensemble Learning: Boosting – Bagging – Random forests.			**CO3**
Unit- IV	**Unsupervised Learning, Reinforcement Learning**	**Periods: 09**	
Unsupervised: K-means algorithm; Reinforcement learning: State and action space – Reward function – Discounting – Action selection – Policy – Markov decision process – Values – SARSA and Q-learning.			**CO4**
Unit- V	**Dimensionality Reduction, Optimization Techniques**	**Periods: 09**	
Dimensionality Reduction Techniques: Linear Discriminant analysis, Principal Component Analysis; Optimization and Search: Least-squares optimization – Conjugate gradients – Search approaches – Exploitation and exploration.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2015.
2. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Edition, The MIT Press, 2014.

Reference Books

1. Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, 1st Edition, Wiley, 2014.
2. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, 1st Edition, Cambridge University Press, 2012.
3. Richert, Willi, “Building machine learning systems with Python”, Packt Publishing, 2013.
4. Tom M Mitchell, “Machine Learning”, McGraw-Hill Education (India), 2013.
5. Y S Abu-Mostafa, M Magdon-Ismail, H T Lin, “Learning from Data”, AML Book Publishers, 2012

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
2	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
3	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
4	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
5	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23CCT609**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**Microprocessor and Embedded Systems**	**3**	0	0	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Basic Electronics, Digital Electronics and Basic Programming Knowledge							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the architecture, addressing modes, and instruction sets of the 8086 microprocessor.	**K3**
	CO2 Describe the interfacing of peripheral devices with 8086 microprocessor.	**K3**
	CO3 Demonstrate the 8051 microcontroller architecture and its components	**K3**
	CO4 Understand the basic embedded systems concepts using Embedded C	**K3**
	CO5 Implement interactive projects using Arduino and Raspberry Pi	**K3**

UNIT – I	**8086 Microprocessor**	**Periods:9**
8086 Architecture- Pin configuration and function of pins- Minimum and maximum mode operations- Instruction queue and pipelining, Bus Organization-Memory Segmentation- Memory Addressing-Physical and logical address calculation Machine Cycles and Bus Timings- Instruction fetch, memory read/write, and I/O read/write cycles,		**CO1**
UNIT – II	**8086 Instruction Set and Peripheral Interfacing**	**Periods:9**
Addressing Modes Overview: immediate, register, direct, indirect, based, indexed, relative, Instruction Set- Data transfer, arithmetic, logical, and control transfer instructions, Peripheral Interfacing- Overview of interfacing with 8255 (PPI)- 8251 (USART)- 8253 (Timer)		**CO2**
UNIT – III	**8051 Microcontroller Architecture**	**Periods:9**
8051 Architecture- CPU, registers, I/O ports, and memory organization, 8051 Instruction Set- Data transfer, arithmetic, logical, and control instructions, Interrupts and Timers, Interrupt structure and timer/counter operation		**CO3**
UNIT – IV	**Embedded Systems Concepts**	**Periods:9**
Introduction to Embedded Systems- Definition, characteristics, and real-time systems, Embedded System Design, Hardware and software components, Basic architecture and memory models, Embedded C Programming- Basics I/O port programming, delay generation		**CO4**
UNIT – V	**Embedded System Interfacing and Applications**	**Periods:9**
Arduino Overview- Setting up the Arduino IDE, Writing and uploading programs, using libraries, Interfacing with Arduino, Analog and digital interfacing with sensors and actuators, Raspberry Pi Basics -Overview, setup, and basic Python programming, GPIO pin usage and simple interfacing projects		**CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:**	**Total Periods:45**

Text Books

1. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications " by Walter A. Triebel and Avtar Singh : United States 3rd Edition 2011
2. The 8086/8088 Family: Design, Programming, and Interfacing" by John Uffenbeck Pearson edition 2013
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C for ATMEL" by Muhammad Ali Mazidi, Janice Mazidi, and Rolin McKinlay Pearson edition 2011

Reference Books

1. Embedded Systems Design: An Introduction to Processes, Tools, and Techniques" by Peter Marwedel Texas Instruments 2017
2. Arduino: A Technical Reference" by J. M. Smith Springer 2017
3. Getting Started with Raspberry Pi" by Matt Richardson and Shawn Wallace O'Reilly Media 2013
4. Arduino: A Technical Reference" by J. M. Smith 2018
5. Microprocessors and Interfacing - SIE, 3rd Edn" by Douglas V. Hall and SSSP Rao 3rd edition 2005

Web References

1. https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm
2. https://www.javatpoint.com/8086-microprocessor
3. https://www.geeksforgeeks.org/pin-diagram-8086-microprocessor/
4. https://www.geeksforgeeks.org/introduction-of-embedded-systems-set-1/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-
2	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-
3	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-
4	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-
5	3	2	2	2	2	-	-	-	-	-	-	-	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme:**B.Tech.**						
Semester	**VI**	CourseCategoryCode:**PC**				*End SemesterExamType:**TE**		
CourseCode	**U23CCT610**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internet and Web Programming**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Computer Networks							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Construct a basicwebsiteusing HTMLand CSS.	**K2**
	CO2 Build dynamic web page with validation using Java Script and JQuery	**K3**
	CO3 Create simple PHP scripts	**K3**
	CO4 Develop a web Application using Angular JS.	**K3**
	CO5 Use Node.js for application development.	**K3**

UNIT-I	**Introduction**	**Periods:09**
Web Essentials: Clients, Servers and Communication- Basic Internet protocols – World Wide Web – HTTP Request and Response – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Cascading and Inheritance – Box Model - Positioning - Introduction to responsive design - Bootstrap: Containers, Grids, Typography, Flex, and Forms.		**CO1**
UNIT-II	**Client Side Programming**	**Periods:09**
Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, Regular Expressions-Exception Handling-Form validation-Built-in objects-Event Handling DHTML with JavaScript- JQuery.		**CO2**
UNIT-III	**Server Side Processing and Scripting – PHP**	**Periods:09**
PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading – Email Basics - Email with attachments - PHP and HTML - Simple PHP scripts - Database connectivity using MySQL.		**CO3**
UNIT-IV	**Web Application and Angular JS**	**Periods:09**
Web applications- Web application frameworks: MVC framework-Angular JS: Introduction, Data binding, Directives, Modules, Scopes, Controllers, Expressions, Filters, Events, FormSingle Page Application-Multiple Views and Routing – Service.		**CO4**
UNIT-V	**Node JS**	**Periods:09**
Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js		**CO5**

LecturePeriods:45	**TutorialPeriods:**	**PracticalPeriods:-**	**TotalPeriods:45**

Text Books

1. Deitel and Deitel and Nieto, “Internet and World Wide Web How to Program”, Pearson Education, 5th Edition, 2011.
2. Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”, Pearson Education, 2011.
3. Brad Dayley, Brendan Dayley, Caleb Dayley, ‘Node.js, MongoDB and Angular Web Development’, Addison-Wesley, Second Edition, 2018.

Reference Books

1. Stephen Wynkoop and John Burke, “Running a Perfect Website”, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming, “Building Intranet Applications”, Wiley Publications, 3rd Edition, 2009.
3. Steven Holzener , “PHP – The Complete Reference”, 1st Edition, Mc-Graw Hill, 2017.
4. Vasan Subramanian, ‘Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node’, Second Edition, Apress, 2019.
5. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly publishers, 2014.

Web References

1. www. w3schools.com
2. https://www.javatpoint.com
3. https://www.tutorialspoint.com

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	2	3	-
2	3	2	1	1	-	-	-	-	-	-	-	-	2	3	-
3	3	2	1	1	-	-	-	-	-	-	-	-	2	3	-
4	3	2	1	1	-	-	-	-	-	-	-	-	2	3	-
5	3	2	1	1	-	-	-	-	-	-	-	-	2	3	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Professional Elective–III (Offered in Semester VI)		
Sl.No.	**Course Code**	**Course Title**
1	U23CCE610	Advanced Communication Techniques
2	U23ECEC01	Digital Image Processing
3	U23CCE611	Computational Intelligence
4	U23CCE612	Artificial Neural Networks
5	U23ITEC02	Natural Language Processing

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE610**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Communication Techniques**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

CCE (Professional Elective III)

Prerequisite	Basic knowledge of Communication Systems	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Recall the requirements and key functionalities of 4G LTEA/5G NR technology.	**K2**
	CO2 Understand the principles of advanced Modulation and channel coding	**K2**
	CO3 Compare various channel access technologies used in 5G wireless systems.	**K3**
	CO4 Explore the principles of 5G Architecture	**K2**
	CO5 Understand the different 6G technologies	**K2**

UNIT-I	**Overview of 5G Wireless Communications**	**Periods: 09**
Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases.		**CO1**
UNIT-II	**Introduction to Advanced Modulation and channel coding**	**Periods: 09**
Review of Basic Modulation Schemes (ASK, FSK, PSK, QPSK), Wideband modulation techniques (QAM, OFDM). Error correction codes (ECCs), Forward error correction (FEC), Polar codes, Low-density parity-check (LDPC) codes, and Turbo codes.		**CO2**
UNIT-III	**Waveform Design for 5G & Beyond**	**Periods: 09**
Introduction - 5G Waveform Design and Waveform Requirements – Flexible OFDM comparison with CP-OFDM, generalized frequency division multiplexing (GFDM), filter bank multi carriers (FBMC) and universal filtered multicarrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods.		**CO3**
UNIT-IV	**5G Architecture**	**Periods: 09**
Introduction, 5G Architecture framework, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN **CO4** architecture, Functional Split Between NG-RAN and 5G Core Network. 5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture, Network Slicing concepts & requirements.		**CO4**
UNIT-V	**6G Communications**	**Periods: 09**
6G Use Cases Requirements and Metrics, 6G Enabling Technologies, Physical Layer Design Challenges for 6G Wireless, PHY Layer Design Challenges in Reconfigurable Intelligent Surface Aided 6G Wireless Networks, Millimeter Wave and Terahertz Spectrum for 6G Wireless, Challenges in Transport Layer.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Saad Z. Asif, “5G Mobile Communications Concepts and Technologies” CRC Press, 2019.
2. William Stallings “5G Wireless: A Comprehensive Introduction”, Pearson Education, 2021
3. Suvra Sekhar Das and Ramjee Prasad, “Evolution of Air Interface Towards 5G: Radio Access Technology and Performance Analysis”, Gistrup, Denmark: River Publishers series in Communication, 2018.

Reference Books

1. Tao Jiang, Lingyang Song, and Yan Zhang, “Orthogonal Frequency Division Multiple Access (OFDMA) Fundamentals and Applications”, Auberbach Publications, Taylor & Francis Group, 2010.
2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology” Cambridge University Press-2016.
3. Yulei Wu, Sukhdeep Singh, Tarik Taleb, Abhishek Roy, Harpreet S. Dhillon, Madhan Raj Kanagarathinam, Aloknath De , 6G Mobile Wireless Networks, Springer Nature, 24-Aug-2021
4. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks” first edition, John Wiley & Sons, 2015.

Web References

1. https://onlinecourses.nptel.ac.in/noc24_ee152/preview
2. https://onlinecourses.nptel.ac.in/noc22_ee56/preview
3. https://archive.nptel.ac.in/courses/108/106/106106167/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	2	2	2	-	-	-	-	-	-	-	-			-
2	3	2	2	2	-	-	-	-	-	-	-	-			-
3	3	2	2	2	-	-	-	-	-	-	-	-			-
4	3	2	2	2	-	-	-	-	-	-	-	-			-
5	3	2	2	2	-	-	-	-	-	-	-	-			-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks(CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Applicationoriented/Problemsolving/Design/Analyticalincontentbeyondthesyllabus

Department	**Electronics and Communication Engineering**		Programme: **B.Tech.**					
Semester	**VI**		Course Category: **PE**			*End Semester Exam: **TE**		
Course Code	**U23ECEC01**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Digital Image Processing**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE(Professional Elective III)									
Prerequisite	**Signal processing**								
Course Outcomes	On completion of the course, the students will be able to							BT Mapping (Highest Level)	
	CO1	Understand fundamentals, visual perception, and pixel relationships.						**K2**	
	CO2	Correlate the various image processing technique with the help of mathematical preliminaries						**K3**	
	CO3	Apply different types of image enhancement and restoration techniques in various applications						**K3**	
	CO4	Illustrate the significance of Colour Image Processing and Image Segmentation techniques						**K4**	
	CO5	explore image compression techniques, coding methods, and pattern recognition based on matching.						**K4**	

UNIT-I	**Digital Image Fundamentals**	**Periods:09**
Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels., simple image formation model, Brightness, contrast, hue, saturation, Mach band effect		**CO1**
UNIT-II	**Image Transform**	**Periods:09**
Two-dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT- Image transforms – 1D DFT, 2D DFT, Discrete Cosine transform, Discrete Sine transform, Hadamard transform, Haar transform, Slant transform, KL transform, SVD transform, Wavelet transform.		CO2
UNIT-III	**Image Enhancement and Image Restoration**	**Periods:09**
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters. Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.		CO3
UNIT-IV	**Colour Image Processing And Image Segmentation**	**Periods:09**
Colour fundamentals – Colour models – HIS to RGB and RGB to HIS. Detection of Discontinuities– Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation. Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm		**CO4**
UNIT-V	**Image Compression and Recognition**	**Periods:09**
Need for compression – Coding Redundancy - Interpixel Redundancy - Psycho visual Redundancy - Bit plane coding - Variable length coding – Adaptive coding – Arithmetic coding – LZW coding – Hybrid coding – Wavelet – JPEG – MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Textbooks

1. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing, 2017, 4th edition, Pearson Education, USA
2. Anil K. Jain, Fundamentals of Digital Image Processing, 2015, 1st edition, Pearson India, India
3. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.

Reference Books

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
3. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.
4. John C. Russ, F. Brent Neal-The Image Processing Handbook, Seventh Edition, The Kindle edition (2016), CRC Press,Taylor & Francis Group.
5. P.Ramesh Babu, Digital Image Processing, Scitech Publications., 2003

Web References

1. http://eeweb.poly.edu/~onur/lectures/lectures.html
2. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html
3. https://nptel.ac.in/courses/117/105/117105079/
4. https://nptel.ac.in/courses/117/105/117105135/
5. https://www.csie.nuk.edu.tw/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO’s	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
2	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-
3	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-
4	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-
5	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* **Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus**

Department	**Computer and Communication Engineering**			Programme: **B.Tech.**				
Semester	**VI**			Course Category Code: **PE**		*End Semester Exam Type: **TE**		
Course Code	**U23CCE611**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**Computational Intelligence**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE(Professional Elective III)										
Prerequisite	Artificial Intelligence									
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)		
	CO1	Understand the fundaments of Computational Intelligence and Fuzzy Logic.						**K2**		
	CO2	Explain the types of Artificial Neural Networks and its applications						**K3**		
	CO3	Describe Evolutionary Computation Intelligence and its applications.						**K3**		
	CO4	Analyze hybrid Computational intelligence systems.						**K3**		
	CO5	Apply Computational Intelligence in real time applications.						**K3**		
Unit- I	**Introduction to Computational Intelligence and Fuzzy Logic**						**Periods: 09**			
Overview of Computational Intelligence(CI) - Comparison with traditional Artificial Intelligence -Computational Intelligence techniques - Expert Systems: Rule-based expert systems – Uncertainty management - Fuzzy expert systems: Fuzzy sets and operations of fuzzy sets - Fuzzy rules and fuzzy inference - Fuzzy expert systems.								**CO1**		
Unit- II	**Artificial Neural Networks**						**Periods: 09**			
Introduction to Artificial Neural Networks(ANN), Neural Networks Architecture, Types of ANN: Feedforward Neural network, Recurrent Neural network, Convolutional Neural network and Deep Networks, Applications of ANN.								**CO2**		
Unit- III	**Evolutionary Computation**						**Periods: 09**			
Introduction to Evolutionary Computation, Genetic Algorithms (GA): Representation, Selection, Crossover, and Mutation, Genetic Programming (GP), Differential Evolution (DE) and Evolution Strategies. Applications of Evolutionary Computation in Optimization and Search Problems.								**CO3**		
Unit- IV	**Hybrid Computational Intelligence Systems**						**Periods: 09**			
Hybrid Intelligent Systems: Combining Neural Networks, Fuzzy Logic, and Evolutionary Computation, Neural expert systems -Neuro fuzzy systems -Evolutionary neural networks, Applications of Hybrid CI Systems in Complex Problem Solving.								**CO4**		
Unit- V	**Recent Advances and Applications in CI**						**Periods: 09**			
Deep Reinforcement Learning (DRL), Explainable AI (XAI), CI in Healthcare: Medical Diagnosis, Bioinformatics, and Personalized Medicine - CI in Finance: Algorithmic Trading, Risk Management, and Fraud Detection - CI in Robotics and Autonomous Systems.								**CO5**		
Lecture Periods: 45	**Tutorial Periods:**			**Practical Periods: -**			**Total Periods: 45**			

Text Books

1. Andries P. Engelbrecht, Computational Intelligence: An Introduction, 2nd Edition, John Wiley & Sons, 2012.
2. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing", 2nd Edition, John Wiley & Sons, 2011.

Reference Books

1. S.Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy logic and Genetic Algorithms-Synthesis and Applications, PHI Learning, 2003.
2. Marsland S, Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. S. Russell and P. Norvig, Artificial Intelligence – A Modern Approach, Prentice Hall, 2010.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, Pearson Education,2004.

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
2	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
3	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
4	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
5	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**			Programme: **B.Tech.**				
Semester	**VI**			Course Category: **PE**		End Semester ExamType:**TE**		
Course Code	**U23CCE612**			Periods/Week		Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Artificial Neural Networks**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE(Professional Elective III)										
Prerequisite	Engineering Mathematics, signals and systems									
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)			
	CO1	Understand the principles of Neural Networks					**K2**			
	CO2	Identify different types of models of artificial neural networks					**K3**			
	CO3	Analyze the feed-forward neural networks					**K3**			
	CO4	Analyze the feedback neural networks					**K3**			
	CO5	Implementing different applications of artificial neural networks					**K3**			
UNIT-I	**Basics of Artificial Neural Networks**					**Periods:09**				
Characteristics of Neural Networks, Historical Development of Neural Network , Artificial Neural Networks-Terminology, Models of Neuron, Topology, Basic Learning Laws.										**CO1**
UNIT-II	**Activation and Synaptic Dynamics**:					**Periods:09**				
Introduction, Common Activation functions ,Activation Dynamics Models, Synaptic Dynamics Models, Learning Methods.										**CO2**
UNIT-III	**Feed forward Neural Network**:					**Periods:09**				
Introduction, Analysis of Pattern Association Networks, Analysis of Pattern Classification Networks. Training Algorithm for Pattern Association-Hetero associative memory neural network										**CO3**
UNIT-IV	**Feedback Neural Networks**					**Periods:09**				
Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks. Auto associative net-Iterative Auto associative net-Bidirectional Associative Memory.										**CO4**
UNIT-V	**Architecture, Memory and Applications**					**Periods:09**				
Neural Architecture for complex pattern recognition task — Associative memory — Data and Image compression — Pattern Classification —Spatio temporal patterns (Avalanche) — Pattern variability (Neocognitron) — Other Applications.										**CO5**
Lecture Periods:45		**Tutorial Periods:-**		**Practical Periods:-**			**TotalPeriods:45**			

Text Books:

1. B.Yegnanarayana-Artificial neural network, PHI Publication, 2005
2. Laurene Fausett, “Fundamentals of Neural Networks-Architectures, Algorithms and Applications”, Pearson Education, 2004
3. S.Raj sekaran,Vijayalakshmi Pari- Neural networks, Fuzzy logic and Genetic Algorithms

Reference Books:

1. Kevin L.Priddy, Paul E.Keller – Artificial neural networks: An Introduction-SPIE Press, 2005
2. Mohammad H.Hassoun–Fundamentals of artificial neural networks -MITPress,1995
3. James.A. Freeman and David. M.Skapura,"Neural Networks Algorithms, Applications and Programming Techniques " Pearson Education, 2002.
4. Simon Haykin, "Neural Networks- A Comprehensive Foundation’, Pearson Education – 2001

Web References

1. https://ocw.mit.edu/courses/9-641j-introduction-to-neural-networks-spring-2005/
2. https://nptel.ac.in/courses/117105084/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	1	-	-	-	-	-	-	-	2	2	-
2	3	2	2	2	1	-	-	-	-	-	-	-	2	2	-
3	3	2	2	2	1	-	-	-	-	-	-	-	2	2	-
4	3	2	2	2	1	-	-	-	-	-	-	-	2	2	-
5	3	2	2	2	1	-	-	-	-	-	-	-	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks(CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Applicationoriented/Problemsolving/Design/Analyticalincontentbeyondthesyllabus

Department	**Information Technology**	Programme :**B.Tech.**						
Semester	**VI**	Course Category Code: **PE**			*End Semester Exam Type:**TE**			
Course Code	**U23ITEC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Natural Language Processing**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Common to IT and CCE (Professional Elective III)

Prerequisite	Basic mathematics, Fundamentals of Machine Learning

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the Fundamental Models in NLP.	**K2**
	CO2 Describe various Language Models in NLP.	**K2**
	CO3 Perform POS tagging for a given natural language and Select a suitable language modelling technique based on the structure of the language.	**K3**
	CO4 Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology.	**K2**
	CO5 Apply learning algorithms for various NLP applications	**K3**

Unit-I	**Introduction to NLP**	**Periods:09**	
Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult. Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language, Cross entropy			**CO1**
Unit-II	**Language Modelling**	**Periods:09**	
Words: Collocations - Frequency-Mean and Variance – Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios. Statistical Inference: n - gram Models over Sparse Data: Bins: Forming Equivalence Classes- N gram model - Statistical Estimators- Combining Estimators			**CO2**
Unit-III	**Markov Model and POS Tagging**	**Periods:09**	
Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging			**CO3**
Unit-IV	**Probabilistic Context Free Grammars and Probabilistic**	**Periods:09**	
The Probability of a String, Problems with the Inside-Outside Algorithm, Parsing for disambiguation, Tree banks, Parsing models vs. language models, Phrase structure grammars and dependency, Lexicalized models using derivational histories, Dependency-based models.			**CO4**
Unit-V	**NLP Applications**	**Periods:09**	
Text Alignment - Word Alignment - Clustering - Vector Space Model - Term Distribution Model – Latent Semantic Indexing –Discourse Segmentation - Decision Trees – Maximum Entropy Modeling – k- Neighbor Classification			**CO5**

LecturePeriods:45	**TutorialPeriods:-**	**PracticalPeriods:-**	**LecturePeriods:45**

TextBooks

1. Christopher D. Manning and Hinrich Schutze, "Foundations of Natural Language Processing" , 6th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2024.
3. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012.

ReferenceBooks

1. Nitin Indurkhya, Fred J. Damerau "Handbook of Natural Language Processing", 2nd Edition, CRC Press, 2010.
2. Chris Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", 2nd edition, MIT Press Cambridge, 2003.
3. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action", MANNING Publications, 2019.
4. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012

Web References

1. https://machinelearningmastery.com/natural-language-processing/
2. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1
3. https://www.nlp.com/what-is-nlp/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	-	1	-	-	-	-	1	-	-	3	1	-
2	2	2	2	-	1	-	-	-	-	1	-	-	3	1	-
3	2	2	2	-	1	-	-	-	-	1	-	-	3	1	-
4	1	2	2	2	1	-	-	-	-	1	-	-	3	1	-
5	3	1	2	2	1	-	-	-	-	1	-	-	3	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CCB602**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Science for Networking**	**2**	**0**	**2**	**3**	**50**	**50**	**100**
CCE(Theory cum Practical)								
Prerequisite	Networking Basics, Programming Skills							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Analyze data science techniques for network data collection, preprocessing, and statistical analysis.	**K2**
	CO2 Implement machine learning algorithms to classify, cluster, and predict network traffic.	**K2**
	CO3 Evaluate deep learning, security analytics, and big data processing for network challenges.	**K3**
	CO4 Demonstrate skills in network data collection, preprocessing, and basic machine learning models.	**K3**
	CO5 Apply advanced techniques like time series analysis and real-time analytics for network security and visualization.	**K3**

UNIT – I	**Introduction to Data Science in Networking**	**Periods:10**
Introduction to Data Science-Networking Fundamentals-Data Collection in Networks-Data Preprocessing-Statistical Methods-Case Studies		**CO1**
UNIT – II	**Machine Learning and Data Analytics for Networking**	**Periods:10**
Introduction to Machine Learning-Classification Techniques-Clustering Methods-Dimensionality Reduction-Time Series Analysis-Real-time Analytics		**CO2**
UNIT – III	**Advanced Topics in Network Data Science**	**Periods:10**
Deep Learning for Networking-Network Security Analytics-Big Data in Networking-Visualization of Network Data-Network Traffic Engineering-Ethical and Privacy Concerns		**CO3**
UNIT – IV	**Laboratory Exercises: Network Data Analysis and Machine Learning Techniques**	**Periods:15**
1. Capture and preprocess network data using tools like Wireshark and Python libraries. 2. Perform Exploratory Data Analysis (EDA) on captured network data to identify patterns and anomalies. 3. Implement and compare machine learning models (e.g., Decision Trees, SVM) for classifying network traffic. 4. Apply clustering algorithms (e.g., K-means) to network traffic data to identify anomalies or similar traffic patterns. 5. Analyze and forecast network traffic using time series techniques. 6. Implement Support Vector Machine(SVM) model for classifying network traffic and compare its performance with the Decision tree model.		**CO4**
UNIT – V	**Laboratory Exercises: Advanced Network Analytics and Security Techniques**	**Periods:15**
7. Perform PCA on network traffic data to reduce dimensionality and improve model performance. 8. Develop and evaluate models for detecting network intrusions using historical network data. 9. Implement a basic real-time analytics pipeline using Apache Kafka and Spark Streaming tools. 10. Create visualizations of network traffic and analysis results using tools lik Matplotlib,Seaborn, or Tableau. 11. Analyze network traffic for potential security threats and implement basic mitigation techniques. 12. Use Clustering techniques(eg. DBSCAN) to detect anomalies in network traffic and evaluate their potential security impact.		**CO5**

Lecture Periods:30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods:60**

Text Books

1. "Data Science for Network Security" by Kurt R. Riedel, 2nd edition, 2023
2. "Machine Learning for Networking and Security" by Shashi Shekhar, springer, 2022.
3. “Data Science for the Internet of Things: Leveraging Data and Algorithms for IoT” by S.K.Singh, Wiley publication, 2021.

Reference Books

1. "Computer Networking: Principles, Protocols, and Practice" by Olivier Bonaventure
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller and Sarah Guido
4. "Big Data: Principles and Paradigms" by Rajkumar Buyya, et al.
5. "Network Security Through Data Analysis: Building Situational Awareness" by Michael Collins

Web References

1. https://www.geeksforgeeks.org/basics-computer-networking/
2. https://www.w3schools.com/datascience/default.asp
3. https://www.guru99.com/data-communication-computer-network-tutorial.html

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-
2	3	2	2	2	-	-	-	-	-	-	-	-	2	2	-
3	3	2	2	2	-	-	-	-	-	-	-	-	2	3	-
4	3	2	2	2	-	-	-	-	-	-	-	-	2	3	-
5	3	2	2	2	-	-	-	-	-	-	-	-	2	3	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	ContinuousAssessmentMarks(CAM)									EndSemesterExamination(ESE) Marks (Practical –Internal Evaluation)	EndSemesterExamination(ESE) Marks (Theory)	Total Marks
	Continuous ssessment(Theory)					Continuous assessment(Practical)						
	CAT1	CAT 2	Model	Attendance	Total	ConductionofPractical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*Tobeweightedfor10Marks					10	*Tobeweightedfor10 Marks			10		*To beweighted for 50Marks	100

Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23ITPC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Machine Learning Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Common to CSE, IT and CCE

Prerequisite	Mathematics		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Apply python packages and libraries for various problems	**K3**
	CO2	Apply supervised learning techniques for various problems	**K3**
	CO3	Develop an open-ended solution with data privacy and ethical concerns, for a given realworld problem.	**K3**
	CO4	Apply unsupervised and reinforcement learning techniques for various problems	**K3**
	CO5	Apply ensemble techniques to solve the problems and demonstrate the working of dimensionality reduction methods	**K3**

List of Exercises

1. Working with Python packages - Numpy, Scipy, Scikit-learn, Matplotlib
2. Loan amount prediction using linear regression and visualize the interpretation
3. Handwritten character recognition using neural networks
4. Classification of Email spam and MNIST data using Support Vector Machines.
5. Predicting Diabetes using decision tree
6. Applications of Random Forest and AdaBoost ensemble techniques
7. K-means clustering for Euclidean distance metric
8. k-Nearest Neighbor algorithm
9. Applications of dimensionality reduction techniques on any dataset
10. Analyze any two supervised / unsupervised machine learning algorithms for any of the following real-time applications: (a) Text processing (b) Image processing (c) IoT systems

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, 1st Edition, Wiley, 2014.
2. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, 1st Edition, Cambridge University Press, 2012.
3. Richert, Willi, “Building machine learning systems with Python”, Packt Publishing, 2013.
4. Tom M Mitchell, “Machine Learning”, McGraw-Hill Education (India), 2013.
5. Y S Abu-Mostafa, M Magdon-Ismail, H T Lin, “Learning from Data”, AML Book Publishers, 2012

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	-	-	-	1	-	-	2	3	1	2
2	3	2	2	-	2	-	-	-	1	-	-	2	3	1	2
3	3	3	3	-	2	-	-	-	1	-	-	2	3	1	2
4	3	2	3	-	2	-	-	-	1	-	-	2	3	1	2
5	3	2	3	3	2	-	-	-	2	3	-	2	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**		Programme: **B.Tech.**					
Semester	**VI**		Course Category : **PC**			*End Semester Exam Type: **LE**		
Course Code	**U23CCP606**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Microprocessor and Embedded Systems Laboratory**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
(CCE)								
Prerequisite	Knowledge of digital electronics and Programming in C							
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)	
	CO1	Understand 8086 architecture					**K2**	
	CO2	Apply assembly and C programming for embedded systems					**K3**	
	CO3	Analyze timer, UART, and I/O interfacing					**K3**	
	CO4	Implement embedded systems applications with Arduino / Raspberry Pi					**K3**	
	CO5	Evaluate embedded system performance and data handling					**K3**	

List of Exercises

1. Write an Embedded C program to interface a 7-segment display with the 8051 microcontroller and display numbers from 0 to 9.
2. Develop a program to interface a 4x4 matrix keypad with the 8051 and display the key pressed on an LCD or serial terminal.
3. Write a program to control the speed of a DC motor using Pulse Width Modulation (PWM) on the 8051 microcontroller.
4. Write an Embedded C program to interface a stepper motor with the 8051 microcontroller and control its direction and steps (clockwise and counterclockwise rotation).
5. Interface a temperature sensor (e.g., LM35) with the 8051 and write a program to display the temperature on an LCD or serial monitor.
6. Write an Embedded C program to interface a switch with the Arduino board and control an LED.
7. Interface a temperature sensor (e.g., LM35) with Arduino and display the temperature readings on the serial monitor.
8. Set up a temperature sensor with the Raspberry Pi and use Python to send data to a cloud platform for monitoring.
9. Control GPIO pins of Raspberry Pi using Python to turn an LED on and off
10. Interface an ultrasonic sensor with the Raspberry Pi and measure the distance to an object using Python programming.
11. Generate a PWM signal using Arduino and vary the brightness of an LED or control the speed of a DC motor.
12. Write an Embedded C program to simulate a buzzer control system. The buzzer should be activated when a certain condition is met, such as pressing a simulated button.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. The 8051 Microcontroller and Embedded Systems: Using Assembly and C Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay Pearson 2011
2. 8051 Microcontroller: Internals, Instructions, Programming & Interfacing, Subrata Ghoshal, Pearson 2013.
3. Programming and Customizing the 8051 Microcontroller, Ajit Pal, PHI Learning, 2009

Web References

1. https://www.esacademy.com/en/library/8051/
2. https://www.keil.com/dd/chip/3499.htm
3. https://computersciencejunction.in/2020/02/10/8051-microcontroller-projects-in-c/
4. https://circuitdigest.com/microcontroller-projects/8051-microcontroller
5. https://www.keil.com/support/man/docs/gsac/gsac_intro.htm

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-
2	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-
3	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-
4	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-
5	3	2	2	2	1	-	-	-	-	-	-	-	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer and Communication Engineering**				Programme:**B.Tech.**			
Semester	**VI**				CourseCategoryCode: **PC**		*End SemesterExamType:**LE**	
CourseCode	**U23CCP607**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internet and Web Programming Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(CCE)								
Prerequisite	Nil							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Construct Web pages using HTML and style sheets.	**K3**
	CO2 Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.	**K3**
	CO3 Use PHP programming to develop web applications.	**K3**
	CO4 Develop Angular JS programs using basic features	**K3**
	CO5 Deploy server side applications using NodeJS.	**K3**

List of Experiments

1. Create a web page with the following using HTML
   a. To embed a map in a web page
   b. To fix the hot spots in that map
   c. Show all the related information when the hot spots are clicked.
2. Create a web page with the following.
   a. Cascading style sheets.
   b. Embedded style sheets.
   c. Inline style sheets. Use our college information for the web pages.
3. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
4. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
5. Write a program to create and Build a star rating system using Jquery.
6. Write programs in PHP
   a. Validate the form using PHP regular expression.
   b. PHP stores a form data into database.
7. Write a web service for finding what people think by asking 500 people‘s opinion for any consumer product.
8. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
9. Develop an Angular JS application that displays a list of shopping items. Allow users to add and remove items from the list using directives and controllers.
10. Write an Angular JS application that can calculate factorial and compute square based on given user input.
11. Create a NodeJS server that serves static HTML and CSS files to the user.
12. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.

LecturePeriods:	**TutorialPeriods:**	**PracticalPeriods: 30**	**TotalPeriods:30**

ReferenceBooks

1. Stephen Wynkoop and John Burke, “Running a Perfect Website”, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming, “Building Intranet Applications”, Wiley Publications, 3rd Edition, 2009.
3. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'Reilly publishers, 2014.
4. Vasan Subramanian,‘Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node’, Second Edition, Apress, 2019.
5. AgusKurniawan–“AngularJS Programming by Example”, First Edition, PE Press, 2014

Web References

1. www. w3schools.com
2. https://www.javatpoint.com
3. https://www.tutorialspoint.com

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
2	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
3	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
4	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
5	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in Practical classes			Model Practical Examination	Attendance		
	Conduction of Practical	Record work	viva				
Marks	15	5	5	15	10	50	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23CCW602**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Mini Project**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
(CCE)								
Prerequisite	Computer and Communication Engineering							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Identify the problem statement for the mini project work through the literature survey	**K2**
	CO2	Choose the proper components as per the requirements of the design/ system.	**K2**
	CO3	Apply the acquainted skills to develop final model/system	**K3**

There shall be a Mini Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the mini project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Mini-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Mini Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Mini Project work with weightage as indicated evaluation Methods.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	2	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 →High

Evaluation Method

Assessment	**Review 1**			**Review 2**				**Total Marks**
	Novelty	**Presentation**	**Viva**	**Presentation**	**Demonstration**	**Viva**	**Report**	
Marks	10	20	10	20	20	10	10	100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **AEC**			*End Semester Exam Type:			
Course Code	**U23CCC6XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course- VI**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

(Common to all Branches)

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as “pass” on satisfactory completion. A letter grade “P” is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Department	**Computer and Communication Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **MC**			End Semester Exam Type :			
Course Code	**U23EEM606**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Gender Equality**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

Common to ALL Branches

Prerequisite	**-**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the general identity, social construction of gender roles.	**K2**
	CO2 Illustrate the causes and issues of gender discrimination in Indian society.	**K2**
	CO3 Describe the workplace discrimination, media influences on gender and culture.	**K2**
	CO4 Familiarize with international and Indian frameworks on gender equality.	**K2**
	CO5 Illustrate the current challenges in gender equality, including the glass ceiling and the role of technology.	**K2**

UNIT - I	**Introduction to Gender Equality**	**Periods:06**
Gender equality - exploring gender identity and expression, Understanding the social construction of general roles and norms, historical perspectives on gender roles, Analyzing key milestones in the fight for gender equality.		**CO1**
UNIT - II	**Gender Inequality and Its Manifestations**	**Periods:06**
Gender discrimination in Indian society - causes of gender inequality - Illiteracy, patriarchal set up, lack of awareness, social beliefs, practice and custom - Issues of gender discrimination - Child marriage, child domestic work, poor education and health, violence and exploitation in workplace.		**CO2**
UNIT - III	**Gender and Culture**	**Periods:06**
Workplace discrimination, Media influences on gender and culture, Gender and power dynamics in society. Strategies for promoting gender equality and cultural understanding.		**CO3**
UNIT - IV	**Promoting Gender Equality**	**Periods:06**
Gender Equality and Human Rights - International frameworks and Conventions on Gender Equality - Equality under the Indian Constitution - Policies and initiatives for gender mainstreaming - Strategies for promoting Gender Equality in various contexts.		**CO4**
UNIT - V	**Contemporary Challenges and Future Directions**	**Periods:06**
Current challenges and emerging issues in gender equality - Glass ceiling - role of technology in continuing or challenging gender inequality - Exploring possibilities for transformative change and envisioning a gender-equal future.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. "Gender and Society" by Raewyn Connell- This book provides a comprehensive overview of gender roles, power dynamics, and the social construction of gender.
2. "The Second Sex" by Simone de Beauvoir- A historical and philosophical examination of women's oppression and gender inequality.
3. "Women and Gender in the Indian Society" by Neera Desai and Usha Thakkar- Focuses on the context of gender roles, inequality, and feminist movements in India.

Reference Books

1. Woman in early Indian societies, New Delhi: Manohar Publications. Sita A. Raman (2009).
2. A social and Cultural history, Volume1. Connecticut: Oxford: Praeger. Sita Raman (2009).
3. A social and Cultural history, Volume2. Connecticut: Oxford: Praeger Iftikhar R. (2016).
4. Indian Feminism: Class, Gender and Identity in Medieval Ages. Chennai: Notion Press. Iftikhar, R. (2012).

Web References

1. https://www.unwomen.org
2. https://ncw.nic.in

3. https://en.unesco.org/themes/gender-equality
4. https://www.weforum.org/reports
5. https://wcd.nic.in

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23ECTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internet of Things**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to ECE and CCE)

Prerequisite	Microcontroller		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Explain the fundamentals of IoT, its characteristics, protocols, and functional models.	**K2**
	CO2	Analyze different IoT reference architectures, functional, deployment, and operational views.	**K4**
	CO3	Apply IoT communication protocols (CoAP, MQTT, XMPP) for secure and efficient data communication.	**K3**
	CO4	Analyze different device data storage, authentication, and cloud-based solutions.	**K3**
	CO5	Evaluate and implement IoT-based solutions for smart cities, healthcare, agriculture, and industrial applications.	**K5**

UNIT - I	**INTRODUCTION**	**Periods:09**	
Introduction, Definition & Characteristics of IoT, Physical Design of IoT - Things in IoT - IoT Protocols, Logical Design of IoT - IoT Functional Blocks - IoT Communication Models - IoT Communication APIs, M2M, Difference between IoT and M2M.			**CO1**
UNIT - II	**ARCHITECTURE**	**Periods:09**	
IoT reference Model, IoT Reference Architecture, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints			**CO2**
UNIT - III	**COMMUNICATION PROTOCOLS**	**Periods:09**	
Communication Protocols; WEB - CoRE, CoAP; **SMS** - CoAP-SMS and CoAP-MQ, MQTT Protocol, XML, XMPP.			**CO3**
UNIT - IV	**DEVELOPMENT FRAMEWORK**	**Periods:09**	
Solution framework for IoT applications, Implementation of Device Integration, Data acquisition, and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices			**CO4**
UNIT - V	**APPLICATIONS**	**Periods:09**	
Home automations (Smart Lights), Smart Cities (Intelligent traffic management), Smart agricultures (Precision farming using IoT sensors), Industrial IoT (Smart factories and Industry 4.0, Industrial robotics and automation), Healthcare and Lifestyle – (Health & Fitness monitoring, Wearable Electronics)			**CO5**

Lecture Periods:	**Tutorial Periods: -**	**Practical Periods:**	**Total Periods:60**

Text Books

1. Arshadeep Bagha, Vijay Madisetti, “Internet of Things – A Hands-on Approach”, 2016, University Press
2. From Machine-to-Machine to the Internet of Things “Introduction to a New Age of Intelligence,” by Vlasios Tsiatsis, David Boyle, 2014
3. Raj Kamal, “INTERNET OF THINGS: Architecture and Design Principles”, 2017, McGraw Hill Education (India) Private Limited.

Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, and Rob Barton, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,” Cisco Press, 2017.
2. Converging Technologies for Smart Environments and Integrated Ecosystems, “Internet of Things,” by Ovldlu Vermesan, Editor Peter Frless, July 2013
3. Rajkumar Buyya, Selim Nehar, and Sanjay Ranka, “Internet of Things: Principles and Paradigms,” Morgan Kaufmann, 2014.
4. Shancang Li and Daoqiang Zhang, “Fog Computing: Concepts, Frameworks, and Technologies,” Springer, 2018.
5. Ian S. MacDonald, “Architecting the Internet of Things: A Practical Guide to IoT Solutions,” Apress, 2016.
6. Michael Miller, “The Internet of Things: How Smart TVs, Smart Cars, Home Appliances, and Even Your Toothbrush Can Change the World,” Que Publishing, 2015.

Web References

1. https://www.cisco.com/c/en/us/solutions/internet-of-things/overview.html
2. https://aka.ms/iot-beginners
3. https://www.ibm.com/internet-of-things
4. https://www.intel.com/content/www/us/en/internet-of-things/overview.html
5. https://zigbeealliance.org/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	2	3	1	-	-	1	-	1	-	3	2	1
2	3	2	2	3	3	1	-	-	1	-	1	-	2	3	2
3	2	3	2	3	3	1	-	-	1	-	1	-	3	3	2
4	3	2	3	2	2	1	-	-	1	-	1	-	3	2	2
5	3	2	3	2	3	1	-	-	1	-	1	-	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23CCT711**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud Computing and Distributed Systems**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Basic knowledge of computer networks and distributed systems							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the fundamental concepts of cloud computing and its evolution.	**K2**
	CO2 Analyze the various cloud enabling technologies such as virtualization, SOA, and web services.	**K2**
	CO3 Evaluate different cloud architectures, services, and storage mechanisms.	**K3**
	CO4 Apply resource management and security principles in cloud computing environments.	**K3**
	CO5 Investigate and explore emerging cloud computing technologies and their future applications.	**K4**

UNIT - I	**INTRODUCTION**	**Periods:09**	
Introduction to Cloud Computing - Definition and Characteristics of Cloud - Evolution of Cloud Computing - Underlying Principles of Parallel and Distributed Computing - Elasticity in Cloud - On-Demand Provisioning - Benefits and Challenges of Cloud Computing.			**CO1**
UNIT - II	**CLOUD ENABLING TECHNOLOGIES**	**Periods:09**	
Service-Oriented Architecture (SOA) - REST and Systems of Systems - Web Services and the Publish-Subscribe Model - Basics of Virtualization - Types and Implementation Levels of Virtualization - Virtualization Structures, Tools, and Mechanisms - Virtualization of CPU, Memory, and I/O Devices - Virtualization Support in Disaster Recovery.			**CO2**
UNIT - III	**CLOUD ARCHITECTURE, SERVICES, AND STORAGE**	**Periods:09**	
Layered Cloud Architecture Design - NIST Cloud Computing Reference Architecture - Public, Private, Hybrid, and Multi-Cloud Models - Infrastructure-as-a-Service (IaaS) - Platform-as-a-Service (PaaS) - Software-as-a-Service (SaaS) - Architectural Design Challenges in Cloud Computing - Cloud Storage and Storage-as-a-Service (STaaS) - Advantages of Cloud Storage - Cloud Storage Providers and Case Studies (e.g., Amazon S3, Google Cloud Storage)			**CO3**
UNIT - IV	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**Periods:09**	
Intercloud Resource Management - Resource Provisioning and Its Methods - Global Exchange of Cloud Resources - Security Overview in Cloud Computing - Cloud Security Challenges and Risk Management - Security in Software-as-a-Service (SaaS) - Security Governance in Cloud - Virtual Machine Security and Identity Access Management (IAM) - Security Standards and Compliance in Cloud Computing.			**CO4**
UNIT - V	**CLOUD TECHNOLOGIES AND MANAGEMENT**	**Periods:09**	
Hadoop Ecosystem and MapReduce Framework - Virtualization Tools (e.g., VirtualBox, Docker, Kubernetes) - Google App Engine: Architecture and Programming Environment - OpenStack and Its Components - Cloud Federation and Its Four Levels - Federated Services and Applications - Future Trends in Cloud Computing (Edge Computing, Serverless Computing, AI in Cloud)			**CO5**

Lecture Periods:	**Tutorial Periods: -**	**Practical Periods:**	**Total Periods:60**

Text Books

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing: Foundations and Applications Programming," Morgan Kaufmann, 2013.
2. Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, “Distributed and Cloud Computing: From Parallel Processing to the Internet of Things”, Morgan Kaufmann, 1st Edition, 2011.
3. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture," Prentice Hall, 2013.

Reference Books

1. Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)," Wiley, 2014.
2. Toby Velte, Anthony Velte, and Robert Elsenpeter, "Cloud Computing: A Practical Approach," McGraw-Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud," O'Reilly, 2009.

4. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications," Cambridge University Press, 2010.
5. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises," Recursive Limited, 2009.

Web References

1. https://www.nist.gov/programs-projects/cloud-computing
2. https://aws.amazon.com/
3. https://cloud.google.com/docs
4. https://docs.openstack.org/
5. https://cloudsecurityalliance.org/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	3	-	-	-	-	-	-	1	3	3	1
2	3	3	2	2	3	-	-	-	-	-	-	1	3	3	1
3	2	3	2	2	2	-	-	-	-	-	-	1	3	3	1
4	3	2	3	2	2	-	-	-	-	-	-	1	3	3	1
5	3	2	2	2	2	-	-	-	-	-	-	1	3	3	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**		Programme: **B.Tech**					
Semester	**VII**		Course Category: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23CCT712**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Blockchain Technology and Application**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)									
Prerequisite	Basics of Cryptography								
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)	
	CO1	Understand the Blockchain Fundamentals and Networks					**K2**	
	CO2	Demonstrate Proficiency in Bitcoin and Cryptocurrency Transactions					**K3**	
	CO3	Explain the Ethereum consensus mechanism and evaluate its impact on network security					**K3**	
	CO4	Designing blockchain applications using Hyperledger frameworks and Solidity programming.					**K3**	
	CO5	Apply Blockchain Solutions in Real-world Applications					**K3**	
UNIT - I	**Introduction to Blockchain**					**Periods:09**		
Introduction to Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing and public key cryptosystems, private vs. public Blockchain.							**CO1**	
UNIT - II	**Bitcoin and Cryptocurrency**					**Periods:09**		
Introduction to Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double- Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency.							**CO2**	
UNIT - III	**Ethereum and Consensus**					**Periods:09**		
Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.							**CO3**	
UNIT - IV	**Hyperledger and Solidity Programming**					**Periods:09**		
Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer. Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types.							**CO4**	
UNIT - V	**Blockchain Applications**					**Periods:09**		
Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.							**CO5**	
Lecture Periods:45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods:45**		

Text Books

1. Scott Marks, " Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the Revolutionary Blockchain Technology", 1st Edition, 2018.
2. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
3. Chandramouli Subramanian, Asha A George, Abhilash K A and MeenaKarthikeyan, "Blockchain Technology" , Universities Press, 1st Edition, 2020.

Reference Books

1. Kumar Saurabh|Ashutosh Saxena, "Blockchain Technology: Concepts and Applications", Wiley Publication, 2020
2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies:A Comprehensive Introduction" Princeton University Press, 2016
3. Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014. .
4. Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5. Daniel Drescher, Block chain basics A non-technical introduction in 25 steps, Apress , 2017.

6. D. Drescher, Blockchain Basics. Apress, 2017.
7. Paul Vigna and Michael J.Casey. The Age of Cryptocurrency, 2015.

Web References

1. https://nptel.ac.in/courses/106105184
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3. Ethereum Development Resources - https://ethereum.org/en/developers
4. https://www.universitiespress.com/schandramouli/blockchaintechnology

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	1	2	-	2	3	2	3
2	3	3	3	3	3	-	-	-	1	2	-	2	3	3	3
3	3	2	3	3	3	-	-	-	1	2	-	2	3	3	3
4	3	3	3	3	3	-	-	-	1	2	-	2	3	3	3
5	3	3	2	3	3	-	-	-	1	2	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Professional Elective – IV (Offered in Semester VII)		
Sl.No.	**Course Code**	**Course Title**
1	U23CCE713	Optical and Satellite Communication
2	U23CCE714	Deep Learning and Applications
3	U23CCE715	Software Design and Project Management
4	U23CCE716	Quantum Cryptography
5	U23ITEC03	Robotic Process Automation

Department	**Computer and Communication Engineering**	Programme: **B. Tech**						
Semester	**VII**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE713**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Optical and Satellite Communication**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective- IV)								
Prerequisite	Basics of communication systems							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Explain the fundamentals of optical fiber communication and system design.	**K2**
	CO2	Illustrate various optical components and multiplexing techniques used in optical communication.	**K3**
	CO3	Describe the fundamentals of satellite communication and link budget design..	**K2**
	CO4	Implement different satellite multiple access techniques (FDMA, TDMA, CDMA) and evaluate their effectiveness in communication systems.	**K3**
	CO5	Compute real-world applications of satellite communication, including VSAT, DTH, GPS, and satellite launch vehicles.	**K3**

UNIT-I	**Optical Communication Fundamentals**	**Periods: 09**	
Need for fiber optics, introduction to optical fiber, principle of light transmission through a fiber, fiber characteristics and classification, various fiber losses- Block diagram of a fiber optic system- Power budget analysis for a optical link-Recent applications of fiber optics.			**CO1**
UNIT-II	**Optical Components and its applications**	**Periods: 09**	
Sources - Light-emitting diodes (LEDs) and laser diodes (LDs), Detectors- PIN and avalanche photodiodes, Components- EDFA , Couplers, connectors, and splicing techniques, Application- Wavelength Division Multiplexing (WDM) concepts,Optical add-drop multiplexers (OADM) and FTTH.			**CO2**
UNIT-III	**Satellite Communication Fundamentals**	**Periods: 09**	
Review of Microwave Communications – Overview of satellite communications – Satellite orbits – Orbital mechanics and effects – Kepler's laws – Configurations of various orbits – Orbital elements – Elevation and azimuth angles – Doppler effect – Effect of the sun and moon – Sun transit outage. Satellite link models and design – Satellite system parameters – Link budget design.			**CO3**
UNIT-IV	**Satellite Communication Access techniques**	**Periods: 09**	
Satellite subsystems – AOCS – TTC&M – Power and communication subsystems – Computations and controlling by processors – Satellite multiple access schemes – FDMA – TDMA and CDMA – Spread spectrum concepts – Comparison of multiple access schemes			**CO4**
UNIT-V	**Applications of Satellite Communication**	**Periods: 09**	
Satellite applications – VSAT – DTH television principles – Direct broadcast radios – Principles of navigation – GPS – Satellites and launch vehicles – INSAT – IRS satellites – PSLVs – GSLVs.			**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Gerd Keiser, Optical fiber Communications, McGraw Hill International Edition, 5th Edition, 2017.
2. Timothy pratt Jeremy E. Allnutt "Satellite Communications" John Wiley and Sons, 3rd Edition, 2020
3. Wayne Tomasi, Electronics Communication systems, Pearson Education Private Limited, 5th Edition, 2004.

Reference Books

1. Govind Agarwal, Fiber optic Communication system, John Wiley & Sons Inc, 1st Edition 2021
2. GUPTA, S. C., Textbook On Optical Fiber Communication And Its Applications, 3rd Edition 2018
3. Dennis Roddy, "Satellite Communications" Mcgraw-Hill Publishing Company, 4th Edition, 2017.
4. Gerard Maral, Michel Bousquet, Zhili Sun, John Wiley & Sons, 6th edition 2020

Web References

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3. byjus.com › physics › satellite-communication
4. www.tutorialspoint.com
5. www.geeksforgeeks.org

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	1	-	-	-	-	-	-	1	3	2	2
2	3	3	3	2	1	-	-	-	-	-	-	1	3	3	2
3	3	3	3	3	2	-	-	-	-	-	-	2	3	3	2
4	3	2	3	3	2	-	-	-	-	-	-	2	3	3	2
5	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE714**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Deep Learning and Applications**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

CCE (Professional Elective- IV)

Prerequisite	Basics of Machine Learning and Python Programming		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Explain the fundamental concepts of deep learning, neural networks, activation functions, and optimization techniques.	**K2**
	CO2	Apply deep learning frameworks such as TensorFlow and PyTorch to build and train neural network models.	**K3**
	CO3	Demonstrate different deep learning architectures, including CNNs, RNNs, and GANs, to determine their suitability for specific applications.	**K3**
	CO4	Analyze deep learning models for real-world applications.	**K4**
	CO5	Evaluate the effectiveness of deep learning models by tuning hyperparameters, optimizing performance, and addressing ethical considerations.	**K4**

UNIT-I	**Introduction to Deep Learning**	**Periods: 09**	
Fundamentals of Machine Learning and Deep Learning, Neural Networks: Perceptron, Multi-layer Perceptron (MLP), Activation Functions: Sigmoid, ReLU, Tanh, Softmax , Loss Functions and Optimization Techniques (Gradient Descent, Adam, RMSprop), Regularization: Dropout, Batch Normalization, Early Stopping.			**CO1**
UNIT-II	**Image Segmentation and Feature Extraction**	**Periods: 09**	
Convolutional Neural Networks (CNNs) and Applications, Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU) and Sequence Models, Autoencoders: Denoising and Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs)			**CO2**
UNIT-III	**Deep Learning Frameworks and Implementation**	**Periods: 09**	
Overview of Deep Learning Frameworks: TensorFlow, PyTorch, Building and Training Neural Networks in Python, Transfer Learning and Pretrained Models (ResNet, VGG, BERT), Hyperparameter Tuning and Model Evaluation Metrics, Handling Large Datasets: Data Augmentation, Feature Engineering			**CO3**
UNIT-IV	**Applications of Deep Learning**	**Periods: 09**	
Image Processing and Computer Vision (Object Detection, Image Segmentation), Natural Language Processing (Text Generation, Sentiment Analysis, Chatbots), Speech Recognition and Audio Processing, Healthcare Applications: Disease Diagnosis, Medical Image Analysis, Autonomous Systems: Self-driving Cars, Robotics			**CO4**
UNIT-V	**Advanced Topics and Research Trends**	**Periods: 09**	
Explainable AI (XAI) in Deep Learning, Ethical Considerations and Bias in Deep Learning Models, Deep Reinforcement Learning (DQN, PPO, A3C), Edge AI and Deployment of Deep Learning Models, Future Trends and Open Research Problems in Deep Learning			**CO5**

LecturePeriods:45	**Tutorial Periods: -**	**Practical Periods: -**	**TotalPeriods:45**

Text Books

1. François Chollet, “Deep Learning with Python”, 2nd Edition, 2021.
2. Christopher M. Bishop, “Deep Learning: Foundations and Concepts”, 2023.
3. Magnus Ekman, “Learning Deep Learning”, 2021.

Reference Books

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018.
2. Mark Nixon and Alberto S. Aguado, Feature Extraction & Image Processing for Computer Vision, Academic Press, 2019.
3. John W. Woods, Multidimensional Signal, Image, and Video Processing and Coding, Academic Press, 2011.
4. M. T. Sun and A. R. Reibman, Compressed Video over Networks, CRC Press, 2001.
5. David Bull and Fan Zhang, Intelligent Video Compression: A Deep Learning Approach, Elsevier, 2021.

Web References

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2. https://www.javatpoint.com
3. https://www.analyticsvidhya.com

4. https://www.tutorialspoint.com
5. https://www.javatpoint.com

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	-	2	3	2	2
2	3	3	3	2	3	-	-	-	-	-	-	2	3	3	2
3	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	3	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE715**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Software Design and Project Management**	3	-	-	3	25	75	100

CCE (Professional Elective- IV)

Prerequisite	Basic concept in Software Engineering		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the fundamentals of SDPM, including key methodologies like Agile, Scrum, and DevOps and the role of automation in modern project management.	**K2**
	CO2	Plan projects effectively, manage scope, timelines, and milestones, and collaborate efficiently in distributed teams using advanced tools.	**K2**
	CO3	Gain the skills to automate project workflows, integrate CI/CD pipelines, and leverage AI-driven insights for task management and decision-making.	**K3**
	CO4	Identify and mitigate project risks, understand cybersecurity measures, and ensure compliance with industry standards like GDPR and ISO 27001.	**K3**
	CO5	Analyze real-world case studies and apply SDPM concepts in a capstone project.	**K4**

UNIT-I	**Introduction to Software-Defined Project Management**	**Periods: 09**	
Concept of SDPM – Traditional vs. Software Defined Project Management (SDPM) – Importance of automation and tools in modern project management – Agile, Scrum, Kanban, Lean, SAFe (Scaled Agile Framework) – Waterfall vs. Agile vs. Hybrid approaches – Jira, Trello, ClickUp, Asana, Monday.com			**CO1**
UNIT-II	**Planning and Collaboration In SDPM**	**Periods: 09**	
Project Planning & Scope Management – Defining project scope, timeline, and milestones – Work Breakdown Structure (WBS) & Gantt Charts – Collaboration & Communication – Managing remote teams and distributed workforces – Documenting progress, creating reports, tracking changes – Microsoft Project, Jira, Trello, Confluence, Slack, MS Teams.			**CO2**
UNIT-III	**Automation, Integration & AI In Project Management**	**Periods: 09**	
Automation in Project Tracking – Workflow automation, CI/CD integration – Automating repetitive tasks and alerts – AI-driven Project Insights & Decision Making – AI in task assignment and risk prediction – AI-based project analytics & reporting – Zapier, Power Automate, GitHub Actions, Jenkins, Asana AI, Jira AI, ClickUp AI			**CO3**
UNIT-IV	**Risk Management, Security, and Compliance**	**Periods: 09**	
Risk Identification & Mitigation Strategies – Identifying potential project risks – Risk assessment models (Monte Carlo, PERT analysis) – Cybersecurity & Compliance in Project Management – Data security, role-based access control (RBAC) – Compliance standards (GDPR, ISO 27001, SOC 2) – RiskWatch, ServiceNow, SonarQube, Prisma Cloud.			**CO4**
UNIT-V	**Case Studies, Real-World Applications & Future Trends**	**Periods: 09**	
Case Studies on SDPM in IT Corporations – How Google, Microsoft, and startups manage projects – Lessons learned from failed and successful projects – Emerging Trends in Project Management – Cloud-based PM tools, Low-code/no-code tools for project automation - Implementing SDPM in a real-world scenario - using tools like Jira, Trello, GitHub, CI/CD for project execution.			**CO5**

LecturePeriods:45	**Tutorial Periods: -**	**Practical Periods: -**	**TotalPeriods:45**

Text Books

1. Kathy Schwalbe, Information Technology Project Management, Cengage Learning, 9th Edition, 2018
2. Bob Hughes, Mike Cotterell, and Rajib Mall, Software Project Management, McGraw Hill, 6th Edition, 2017.
3. Pankaj Jalote, Software Project Management in Practice, Addison-Wesley, 1st Edition, 2002.

Reference Books

1. Frederick P. Brooks Jr., The Mythical Man-Month: Essays on Software Engineering, Addison-Wesley, Anniversary Edition, 1995.
2. Steve McConnell, Rapid Development: Taming Wild Software Schedules, Microsoft Press, 1st Edition, 1996.
3. Scott Berkun, Making Things Happen: Mastering Project Management, O'Reilly Media, 1st Edition, 2008.
4. Mike Cohn, Agile Estimating and Planning, Prentice Hall, 1st Edition, 2005.
5. Tom DeMarco and Timothy Lister, Peopleware: Productive Projects and Teams, Addison-Wesley, 3rd Edition, 2013.

Web References

1. https://asana.com/resources/project-management-methodologies
2. https://www.smartsheet.com/content/project-management-automation
3. https://www.projectmanager.com/blog/project-management-methodology
4. https://zenphi.com/automation-in-project-management-a-complete-guide/
5. https://thedigitalprojectmanager.com/projects/project-management-automation/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	-	-	-	-	-	2	3	3	3
2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE716**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CA M	ESE	TM
Course Name	**Quantum Cryptography**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
CCE (Professional Elective- IV)								
Prerequisite	Basic mathematical knowledge and Communication theory							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the fundamental quantum information concepts, including qubits, density matrices, and quantum measurements.	**K2**
	CO2 Utilize entanglement for cryptographic purposes, understanding its properties and applications.	**K2**
	CO3 Implement privacy amplification and randomness extraction to enhance cryptographic security.	**K3**
	CO4 Comprehend the essential principles of secure key distribution, including the theoretical foundations and practical implementations.	**K3**
	CO5 Implement and evaluate quantum key distribution and other advanced quantum cryptographic protocols.	**K3**

UNIT - I	**Foundations of Quantum Information**	**Periods:09**
Qubits and Quantum States: Introduction to qubits, Superposition and quantum gates, Bloch sphere representation, Density Matrices: Representation of mixed states, Purity and mixedness, Quantum Measurements: Projective measurements, POVMs (Positive Operator-Valued Measures), Measurement postulates.		**CO1**
UNIT - II	**The Power of Entanglement**	**Periods:09**
Introduction to Entanglement: Definition and properties of entangled states, Purifications: Concept of purifying mixed states, Bell Nonlocality: Bell's theorem and Bell inequalities, Implications for quantum cryptography, Monogamy of Entanglement: Entanglement constraints and their implications, Cryptographic significance.		**CO2**
UNIT - III	**From Imperfect Information to Near Perfect Security**	**Periods:09**
Privacy Amplification: Techniques to enhance security from partial information, Protocols for privacy amplification, Randomness Extractors: Generating high-quality randomness from weak sources, Applications in cryptograph.		**CO3**
UNIT - IV	**Quantum Key Distribution**	**Periods:09**
Secure Key Distribution: Fundamentals of key distribution, Information reconciliation, Quantum Cryptography beyond Key distribution: Coin flipping, Two-party cryptography, Oblivious Transfer, Bit commitment, Kitaev's Lower Bound on Strong Coin Flipping		**CO4**
UNIT - V	**Quantum Key Distribution Protocols**	**Periods:09**
Quantum Key Distribution Protocols: BB84 QKD, A modified Protocol, Security of BB84 key distribution, Correctness of BB4 key distribution, Quantum Cryptography using Untrusted Devices: DIQKD protocol, Security of DIQKD, Testing EPR pairs		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Nielsen, M. A., & Chuang, I. L, "Quantum Computation and Quantum Information", 10th Anniversary Edition. Cambridge University Press, 2010.
2. Thomas Vidick, Stephanie Wehner, "Introduction to Quantum Cryptography", Cambridge University Press, 2023.
3. Wilde, M. M.,"Quantum Information Theory",Cambridge University Press, 2nd Edition, 2017.

Reference Books

1. Pirandola, S., Braunstein, S., "Advances in Quantum Cryptography", Optica Publishing Group, 2019.
2. Benenti, G., Casati, G., &Strini, G., "Principles of Quantum Computation and Information: Volume I: Basic Concepts", World Scientific Publishing Company, 2007.
3. Benenti, G., Casati, G., &Strini, G., "Principles of Quantum Computation and Information: Volume II: Basic Tools and Special Topics", World Scientific Publishing Company, 2007.
4. Barnett, S. M., "Quantum Information", Oxford University Press, 2009.

5. Wehner, S., Elkouss, D., & Hanson, R.,"Quantum Internet: A Vision for the Road Ahead", Science, 2018.
6. Pirandola, S., Braunstein, S. L., "Advances in Quantum Cryptography", 2019.

Web References

1. https://ocw.mit.edu/courses/mas-865j-quantum-information-science-spring-2006/pages/lecture-notes
2. https://www.qi.damtp.cam.ac.uk/files/PartIIIQC/Part%20IIC%20QIC/PartIIC%20QIClectures%20Full.pdf
3. https://ocw.tudelft.nl/courses/quantum-cryptography/?view=lectures
4. https://archive.nptel.ac.in/courses/115/101/115101092/
5. https://learning.quantum.ibm.com/course/practical-introduction-to-quantum-safe-cryptography/introduction-to-this-course

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	1	-	1	-	-	1	3	3	3
2	3	3	2	2	2	1	1	-	1	-	-	1	3	3	3
3	3	3	2	2	2	1	1	-	1	-	-	1	3	3	3
4	3	3	2	2	2	1	1	-	1	-	-	1	3	3	3
5	3	3	2	2	2	1	1	-	1	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Information Technology**		Programme: **B.Tech.**					
Semester	**VII**		Course Category Code: **PE**			*End Semester Exam Type: **TE**		
Course Code	**U23ITEC03**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Robotic Process Automation**		**3**	**-**	**-**	**3**	**25**	**75**	**100**
Common to IT and CCE (Professional Elective- IV)								
Prerequisite	Basic Programming Knowledge							
Course Outcomes	**On completion of the course, the students will be able to**						**BT Mapping (Highest Level)**	
	CO1	Understand the basics of Robotic Process Automation and UiPath Studio					**K2**	
	CO2	Apply the different types of variables, control flow and data manipulation techniques					**K3**	
	CO3	Manipulate the controls available in UiPath and extract data					**K3**	
	CO4	Use events handling and exception handling					**K3**	
	CO5	Explain the code management, deployment and maintenance of the bot					**K2**	
UNIT-I	**Introduction To Robotic Process Automation**					**Periods:09**		
Scope and techniques of automation, Robotic process automation - Benefits of RPA - Components of RPA - RPA platforms - The future of automation - UiPath stack- Learning UiPath Studio- Task Recorder								**CO1**
UNIT-II	**Automation Process Activities**					**Periods:09**		
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- CSV / Excel to data table and vice versa								**CO2**
UNIT-III	**Controls**					**Periods:09**		
Finding and attaching windows - Finding the control - waiting for a control - Act on a control - UiExplorer - Handling Events - Recorder: Desktop recording, Web recording - Screen Scraping - OCR								**CO3**
UNIT-IV	**Handling Events and Exceptions**					**Periods:09**		
Assistant bots, Monitoring trigger - Launching an assistant bot on a keyboard event. Exception Handling- Common exception handling- Loggin and taking screenshots- Debugging techniques -Collecting crash dumps- Error reporting.								**CO4**
UNIT-V	**Code Management, Deployment and Maintenance**					**Periods:09**		
Project Organization, Nesting workflows - Reusablity of workflows -Templates - Commenting techniques -State Machine. Publishing using publish utility - Orchestration Server- Control bots- Orchestration Server to deploy bots- License management - Publishing and managing updates.								**CO5**
Lecture Periods:45	**Tutorial Periods: -**		**Practical Periods:-**			**Total Periods:45**		

Text Books

1. Tom Taulli, - "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.
2. Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath", Packt Publishing, 2018.

Reference Books

1. Nandan Mullakara, Arun Kumar Asokan, Robotic Process Automation Projects, Packt Publishing, ISBN: 9781839217357, May 2020.
2. 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
3. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.

Web References

1. https://www.scribd.com/document/442266295/Sanet-st-Learning-Robotic-Proc-pdf
2. https://www.uipath.com/rpa/robotic-process-automation/
3. https://www.academy.uipath.com/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	2	-
2	3	2	-	-	3	-	-	-	-	-	-	-	3	3	-
3	3	2	-	-	3	-	-	-	-	-	-	-	3	3	-
4	3	2	-	-	3	-	-	-	-	-	-	-	3	3	-
5	2	1	-	-	2	-	-	-	-	-	-	-	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23ECPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internet of Things Laboratory**	**-**	**-**	**2**	**1**	**50**	**50**	**100**
(Common to ECE and CCE)								
Prerequisite	Basic knowledge of computer networks, operating systems and programming (Python/Java).							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Introduce students to IoT hardware components such as Raspberry Pi, sensors, and actuators, and familiarize them with their interfacing and initialization.	**K3**
	CO2 Enable students to implement IoT communication protocols (MQTT, HTTP) for data transmission and cloud connectivity.	**K3**
	CO3 Develop skills in cloud-based IoT data analysis and visualization using tools like AWS IoT Core, Azure IoT Hub, ThingsBoard, or Grafana.	**K4**
	CO4 Provide hands-on experience in IoT-based automation and security by integrating mobile applications, actuator control, and threat analysis.	**K5**
	CO5 Empower students to design and develop real-world IoT systems incorporating data retrieval, secure communication, visualization, and user alert mechanisms.	**K6**

List of Experiments

Section 1: Fundamentals of IoT

1. To retrieve Sensor data and practice conditional processing of the data using Raspberry Pi.
2. Familiarizing Raspberry Pi kit, Sensors, Actuators and practicing the initialization and interfacing of the kit with different components. (more specific)
3. To establish and understand communication protocols (MQTT and HTTP) to a IoT cloud server using Raspberry Pi.
4. To analyse Sensor data from Raspberry Pi on a cloud server (AWS IoT Core or Azure IoT Hub) and visualize the analysis.
5. To utilize Data visualization tools (ThingsBoard, Grafana, or Google Sheets) and present a real-time graph of the data and alert user based on sensor thresholds

Section 2: Advanced IoT Applications

6. To implement IoT-based automation to control actuators using a mobile app (Blynk app)
7. To develop an IoT system monitoring industry environmental parameters to generate alerts and predict machine maintenance
8. To implement IoT security measures by understanding and identifying threats, authenticated and authorized users and communicate with encryption.
9. To build a heart monitor using pulse sensor and visualize the data to end-device via Bluetooth.
10. To build and develop an end-to-end robust IoT device/system (Applicable in real-world) compromising data retrieval, encrypted communication, visualization, and control of the system with user-friendly application with alert generating protocols.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi, 2012
2. Adrian McEwen, “Designing the Internet of Things”, Wiley, 2007
3. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill, 2002
4. CunoPfister, “Getting Started with the Internet of Things”, O Reilly Media, 2015
5. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press

Web References

1. https://www.i-scoop.eu/internet-of-things-guide/
2. https://www.theinternetofthings.eu/
3. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/
4. https://www.coursera.org/learn/iot
5. https://onlinecourses.nptel.ac.in/noc21_ee85/preview

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	-	1	-
2	2	1	-	-	3	-	-	-	-	-	-	-	-	1	-
3	3	2	1	1	3	-	-	-	-	-	-	-	-	1	-
4	3	2	1	1	3	-	-	-	-	-	-	-	-	1	-
5	3	2	1	1	3	-	-	-	-	-	-	-	-	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in Practical class			Model Practical Examination	Attendance		
	Conduction of Practical	Record work	viva				
Marks	15	5	5	15	10	50	100

***** Application-oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**			Programme: **B.Tech.**				
Semester	**VII**			Course Category Code: **PC**		*End Semester Exam Type: **LE**		
Course Code	**U23CCP708**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**Cloud Computing and Distributed Systems Laboratory**			**-**	**-**	**2**	**1**	**50**	**50**	**100**
(CCE)								
Prerequisite	Basic knowledge of computer networks, operating systems and programming (Python/Java).							
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Explain the fundamental principles, characteristics, and evolution of cloud computing.						**K3**
	CO2	Implement virtual machines, containers (Docker, Kubernetes), and cloud storage solutions.						**K3**
	CO3	Differentiate between IaaS, PaaS, SaaS and evaluate Public, Private, Hybrid and Multi-cloud models.						**K3**
	CO4	Identify cloud security challenges, apply IAM (Identity Access Management) and manage cloud resources efficiently.						**K3**
	CO5	Build, deploy, and monitor cloud applications using platforms like AWS, Google Cloud and OpenStack.						**K3**

List of Experiments

1. Create and navigate an AWS/Azure/GCP account to explore cloud services.
2. Use AWS S3 or Google Cloud Storage to host a simple static website.
3. Simulate cloud elasticity by scaling a web application using AWS Auto Scaling.
4. Launch and configure a virtual machine on AWS EC2 or Google Compute Engine.
5. Deploy and terminate cloud instances dynamically using Terraform.
6. Develop a basic Python web application and deploy it on a cloud platform.
7. Use Google Cloud Operations Suite (Stackdriver) or AWS CloudWatch to monitor CPU, memory, and storage usage.
8. Implement a distributed computing example using Python's multiprocessing module.
9. Configure a load balancer for high availability in AWS or Google Cloud.
10. Set up and test examples of IaaS, PaaS, and SaaS using different cloud services.
11. Perform a case study on cloud migration challenges and advantages.
12. Use AWS Pricing Calculator or Google Cloud Pricing Tool to estimate cloud service costs.

Lecture Periods: -	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski – Cloud Computing: Principles and Paradigms (Wiley, 2011)
2. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini – Cloud Computing: Concepts, Technology & Architecture (Prentice Hall, 2013)
3. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter – Cloud Computing: A Practical Approach (McGraw-Hill, 2010)
4. George Reese – Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (O'Reilly, 2009)
5. Arshdeep Bahga and Vijay Madisetti – Cloud Computing: A Hands-on Approach (CreateSpace, 2014)

Web References

1. https://docs.aws.amazon.com/
2. https://learn.microsoft.com/en-us/azure/
3. https://cloud.google.com/docs

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	1	1	2	3	-
2	3	2	1	1	1	-	-	-	-	-	1	1	2	3	-
3	3	2	1	1	1	-	-	-	-	-	1	1	2	3	-
4	3	2	1	1	-	-	-	-	-	-	1	1	2	3	-
5	3	2	1	1	-	-	-	-	-	-	1	1	2	3	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in Practical class			Model Practical Examination	Attendance		
	Conduction of Practical	Record work	viva				
Marks	15	5	5	15	10	50	100

***** Application-oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PA**			*End Semester Exam Type: **LE**			
Course Code	**U23CCW703**	Periods / Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**Project Phase – I**	**0**	**0**	**4**	**2**	**50**	**50**	**100**

(CCE)

Each student shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the supervisor. A student shall register for the Project Phasel in 7th respectively. The project team and the project title can be decided in the 6th semester itself.

The process and guidelines for industry/Research organization projects

• Students opting for the industry / research organization project should decide, identify and interact with relevant industry/ research organization in 6 th semester itself. Training and Placement cell shall help to establish contact with industries.
Students shall take necessary help from their department for exact plan of action and apply to the industry / research organization through proper channel. The project coordinator shall decide the schedule appropriately.
• Students shall submit the application attached with relevant details viz. correspondence with industry, area and nature of project and its proposal to the department before the end of 6th semester.
• Head of the Institution / Dean Academics / Dean R&D / Placement Officer shall issue permission letter to the students on the recommendation of HoD and supervisor. Students shall be allowed to do the final year project work in the industry.
• An internal supervisor from the department and mentor from the industry/ research organization where the project is to be undertaken shall be allocated to the students. Both supervisors should discuss and finalize the scope of the project work and monitor the progress together.
• Internal supervisor should visit the industry a minimum of 3 times in a semester to see the progress of his/her students and a brief report should be submitted to the HoD about the progress.
• Students should maintain a record on the progress and get the approval from both internal and external supervisors at least twice in a month either by physically or through email communication. If the progress is not found satisfactory due to any reason, the supervisor should take the corrective action, after consulting with
project coordinator and HoD.
• Progress report and certificate of completion of the project work from the industry / research organization shall be submitted by the students to the respective supervisor. The mode of evaluation shall be same as that of the in-house project.

The Process and guidelines for in-house project

• Students execute their in-house project in the Department with proper approval from the HoD through the respective supervisor.
• Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of project supervisor(s).
• Students should maintain a record on the progress and get the approval from supervisor at least once in a week. If the progress is not found satisfactory due to any reason, the supervisor should take the corrective action, after consulting with project coordinator and HoD.

*** TE – Theory Exam, LE – Lab Exam**

Evaluation Method

S.No	Description			Marks
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee	10	15
		Supervisor	5	
b	Review 2	Review Committee	10	15
		Supervisor	5	
c	Review 3	Review Committee	15	20
		Supervisor	5	
	Total CAM			50
2	**End Semester Marks**			
a	Evaluation of Phase I report and Viva-voce			50
	Total ESM			50
	Total Marks			100

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PA**			*End Semester Exam Type: **-**			
Course Code	**U23CCW704**	Periods / Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**Internship / Inplant Training**	**0**	**0**	**2**	**1**	**100**	**-**	**100**

(CCE)

The student is required to undergo 'internship' in industry / research laboratory / higher learning institution for a minimum period of 4 weeks during vacations and shall complete the internship before the completion of 7th semester.

i) The internship carries 1 credit.

ii) Each spell of internship shall be for a period not less than 2 weeks.

iii) The main purpose of internship is to enhance the general professional outlook and capability of the student to advance his/her chances of improving the career opportunities. The student should get prior approval from the Head of the Department and Training and Placement cell at the college before undertaking the internship and submit a detailed report after completion for the purpose of assessment. The internship marks will be given in 7th semester mark sheet.

iv) The project work carried out in industry in the eighth semester is not to be treated as internship.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Report	**Presentation**	
Marks	50	50	100

Department	**Management Studies**	Programme: B.Tech						
Semester	**VIII**	Course Category Code: **HS**			*End Semester Exam Type: **TE**			
Course Code	**U23HSTC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Entrepreneurship and Business Management**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Nil							

Course Outcomes	***On completion of the course, the students will be able to***	**BT Mapping (Highest Level)**
	CO1 Students will gain knowledge, Skills and competencies related to entrepreneurship and the entrepreneur.	**K2**
	CO2 Students will be able to identify and evaluate innovative business ideas and opportunities.	**K3**
	CO3 Students will be able to develop and design a comprehensive business plan.	**K6**
	CO4 Students will be able explore various sources of finance and support systems for entrepreneurs	**K4**
	CO5 Students will understand core concepts and functions of business management.	**K2**

UNIT-I	**INTRODUCTION TO ENTREPRENEURSHIP**	**Periods: 9**
Entrepreneurship: meaning, importance of entrepreneurship, concepts, Characteristics, Theories of entrepreneurship, Challenges of entrepreneurs in India, Entrepreneurial Competencies, Entrepreneurial mobility, Entrepreneur v/s intrapreneur, Functions of Entrepreneurs, Types of Entrepreneurs, IPR related issues for Entrepreneur.		**CO1**
UNIT-II	**BUSINESS IDEA DEVELOPMENT**	**Periods: 9**
Creativity and innovation, Opportunity Sensing and Idea Generation, Techniques of Idea generation; Invention, Innovation and Imitation, identifying sources of opportunities, Business opportunity in India, RAMP Model for Opportunity Evaluation, Mullin' Seven Domains Model, Feasibility Analysis, Prototype, laboratory and market test, Pitching the Business Idea		**CO2**
UNIT-III	**BUSINESS PLAN DEVELOPMENT**	**Periods: 9**
Business Plan: Meaning, Importance, Components, Preparation, SWOT analysis, competitor analysis, Operation and Financial plan., Market assessment, technology search, production capacity, Infrastructure requirement, Pitching the Business Plan, Business Incubation and development, Concepts of Incubation, Activities of incubation center		**CO3**
UNIT-IV	**ENTREPRENEURIAL FINANCE AND MSME SCHEMES**	**Periods: 9**
Bank Loans, Project finance, Seed Funding, Angel Investment, Venture capital, Crowd funding, Government Grants and Subsides, Overview of MSME, Policies, Role of MSME, Schemes for entrepreneurial development: PMMY, PMKVY, GeM, ESDP, TUFS, MSME Champions Scheme, MSME Hackathons 4.0, Make in India		**CO4**
UNIT-V	**BUSINESS MANAGEMENT**	**Periods: 9**
Meaning and definition of business management, Features of business management, Nature of business management, Significance of Management, levels of Management, Functions of management, POSDCORB Concept, role of strategic planning in entrepreneurship, Types of Business Ownership, Social Responsibility of Business		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods:**	**Total Periods: 45 Periods**

Text Books

1. Scarborough, N. M., & Cornwall, J. R. (2015). Essentials of entrepreneurship and small business management, Global Edition (8th ed.). Pearson Education Limited.
2. Barringer, B. R. (2015). *Preparing Effective Business Plans: An Entrepreneurial Approach* (2nd ed.). Pearson Education.

3. Koontz, H., & Weihrich, H. (2019). Essentials of Management: An International, Innovation and Leadership Perspective (10th ed.). McGraw Hill Education.

Reference Books

1. Morris, M. H., Kuratko, D. F., & Covin, J. G. (2011). Corporate entrepreneurship & innovation (3rd ed.). Cengage Learning.
2. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2016). *Entrepreneurship* (10th ed.). Tata McGraw Hill.
3. Binion, K. D. (2014). *Startups Made Easy: Fundamentals for Entrepreneurs*. K Works Publication, Michigan.
4. Mahawar, M. K., Mungi, A., Raul, H. G., & Gupta, M. K. (2023). Entrepreneurship and Small Business Management (1st ed.). AG Publishing House.
5. Desai, V. (2021). Dynamics of Entrepreneurial Development and Management (Revised ed.). Himalaya Publishing House.
6. Tripathi, P. C., & Reddy, P. N. (2023). Principles of Management (6th ed.). Tata McGraw Hill.

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1. https://www.shiksha.com/online-courses/articles/entrepreneurship-development/
2. https://www.sidbi.in/institutional-finance
3. https://msme.gov.in/prime-minister-employment-generation-programme-and-other-credit-support-schemes
4. https://www.msmetamilnadu.tn.gov.in/tansidco.php#chart-line
5. https://www.msmetamilnadu.tn.gov.in/aabcs.php
6. https://my.msme.gov.in/inc/JoinMsmehackthon.aspx
7. https://www.tiic.org/entrepreneur-development-scheme/
8. https://tnau.ac.in/executive-development-programme/

COs/Pos Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	-	-	2	1	1	1
CO2	1	1	2	2	2	1	1	2	2	2	2
CO3	1	1	2	2	2	1	-	2	1	2	2
CO4	1	1	1	2	2	1	-	2	1	1	2
CO5	-	-	-	-	1	1	-	2	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Internal Assessment Marks (IAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

Professional Elective – V (Offered in Semester VIII)		
Sl.No.	**Course Code**	**Course Title**
1	U23CCE817	Massive MIMO Networks
2	U23CCE818	Telecommunication and Switching Techniques
3	U23CCE819	Generative AI for Communication
4	U23CCE820	Game Theory and its Application
5	U23ECEC03	High Speed Networks

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23CCE817**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Massive MIMO Networks**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
	(CCE)							
Prerequisite	Basics of Digital Communication, Wireless Communication and Signals & Systems.							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand and explain massive MIMO networks	**K2**
	CO2 Analyze massive MIMO propagation channels and their capacity bounds	**K3**
	CO3 Examine channel estimation techniques for single-cell systems.	**K3**
	CO4 Analyze channel estimation techniques for multi-cell systems.	**K3**
	CO5 Explain the concepts underlining the deployment of single and multicell massive MIMO systems	**K2**

UNIT-I	**Massive MIMO Networks**	**Periods: 09**
Definition of Massive MIMO, Correlated Rayleigh Fading, System Model for Uplink and Downlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favorable Propagation, Local Scattering Spatial Correlation Model.		**CO1**
UNIT-II	**The Massive MIMO Propagation Channel**	**Periods: 09**
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.		**CO2**
UNIT-III	**Single-Cell Systems**	**Periods: 09**
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		**CO3**
UNIT-IV	**Multi-Cell Systems**	**Periods: 09**
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		**CO4**
UNIT-V	**Case Studies**	**Periods: 09**
Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: Preliminaries and Algorithms, Multi-Cell Deployment Examples: Mobile Access – Dense Urban Scenario – Suburban Scenario – Minimum Per-Terminal Throughput Performance -Additional Observations – Comparison of Power Control Policies		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Emil Bjornson, Jakob Hoydis and Luca Sanguinetti, “Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency”, Foundations and Trends, Now, 2017.
2. Thomas L. Marzetta, Erik G. Larsson, Hong Yang, Hien Quoc Ngo, “Fundamentals of Massive MIMO”, Cambridge University Press 2016.

Reference Books .

1. Leibo Liu, Guiqiang Peng, Shaojun Wei, “Massive MIMO Detection Algorithm and VLSI Architecture”, Springer 2019.
2. Long Zhao, Hui Zhao, Kan Zheng, “Wei Xiang Massive MIMO in 5G Networks: Selected Applications”, Springer 2018.
3. Shahid Mumtaz, Jonathan Rodriguez, Linglong Dai, “mmWave Massive MIMO A Paradigm for 5G”, Elsevier, 2017.

Web References

1. https://www.cambridge.org/core/books/fundamentals-of-massive-mimo/C43AF993A6DA7075EC5F186F6BAC914Bhttps://nptel.ac.in/courses/117/103/117103064/
2. https://ieeexplore.ieee.org/document/7279381

3. https://arxiv.org/pdf/1802.07696.pdf
4. https://ieeexplore.ieee.org/document/8454394
5. https://ieeexplore.ieee.org/document/9272763

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO's	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	2	1	1	2	2	-	-	-	-	-	3	1	2
2	3	3	2	2	2	2	-	-	-	-	-	2	2	1
3	3	2	2	2	2	2	-	-	-	-	-	3	3	2
4	3	3	2	2	2	2	-	-	-	-	-	3	1	3
5	3	2	2	3	2	2	-	-	-	-	-	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE818**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Telecommunication & Switching Techniques**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Basics of Algorithms and Probability							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the fundamentals of telephone communication and various switching systems.	**K2**
	CO2 Analyze digital switching systems, stored program control (SPC) switches, and digital switching networks	**K3**
	CO3 Apply telecommunication traffic theory, calculate traffic load using Erlang formulas, and evaluate network performance and congestion.	**K3**
	CO4 Explain signaling concepts, customer line signaling, PCM and FDM signaling, inter-register signaling, and common channel signaling (CCS).	**K3**
	CO5 Demonstrate the architecture and operation of telecommunication networks, along with numbering, routing, charging, and management.	**K3**

UNIT - I	**Introduction to Telephone communication & Switching Systems**	**Periods:09**
Introduction to telephone communication- Manual switching system - Automatic Strowger switching system- Crossbar switching system- Signaling in Automatic Strowger Switching System- Elements of a Switching System- Design parameters of Switching System.		**CO1**
UNIT - II	**Digital Switching Systems**	**Periods:09**
Fundamentals: Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing.		**CO2**
UNIT - III	**Telecommunication Traffic**	**Periods:09**
Fundaments of traffic theory- Erlang and Grade of service (GoS) - Unit of traffic Congestion Traffic measurement - A mathematical model Local calls systems-Queuing systems. - Network traffic load and parameters.		**CO3**
UNIT - IV	**Telecommunication Signaling**	**Periods:09**
Introduction to signaling- Need for signaling in telecommunication systems -Customer line signaling- Audio frequency junction and trunk circuits-FDM carrier systems-PCM signaling- Inter register signaling- Common channel signaling principles-CCITT signaling, Digital customer line signaling.		**CO4**
UNIT - V	**Telecommunication Networks**	**Periods:09**
Introduction-Analog networks-Integrated digital networks-Integrated service digital networks-Cellular radio networks-Intelligent networks-Private networks-numbering-charging-Routing-Network management.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Thiagarajan Viswanathan & Manav Bhatnagar**, "**Telecommunication Switching Systems and Networks*"*, 3rd Edition, PHI Learning Private Limited, 2013.
2. J.E. Flood**,** "Telecommunications Switching, Traffic and Networks, 1st Edition (reprint), Pearson Education India, 2016.
3. Behrouz A. Forouzan**,** "Data Communications and Networking*"*, 5th Edition, McGraw Hill Education, 2012.

Reference Books

1. Thiagarajan Vishwanathan, Telecommunication Switching Systems and Networks, PHI Joseph Y. Hui, Switching and Traffic Theory for Integrated Broad Band Networks, Kleewer Academic publishers, 1990
2. V.E. Benes, Mathematical Theory of Connecting Networks & Telephone Traffic, Academic Press, 1965 G. Hebuterve, Traffic Flow in Switching Systems, Artech House, 1987.

3. John C. Bellamy “Digital Telephony”, 3rd Edition, Wiley Publications, 2000, ISBN: 978-0471352795.

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1. https://www.tutorialspoint.com/telecommunication /index.htm
2. https://www.geeksforgeeks.org/telecomunicationandswitching networks/
3. https://towardsdatascience.com/
4. https://www.coursera.org/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

CO’s	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	1	-	-	-	-	-	-	-	-	-	1	-	3
2	3	3	3	2	2	-	-	-	-	-	-	3	2	1
3	3	3	2	3	3	-	-	-	-	-	-	1	3	2
4	2	2	1	-	-	-	-	-	-	-	-	1	3	2
5	2	2	2	2	2	-	-	-	-	-	-	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23CCE819**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Generative AI for Communication**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Machine Learning and Artificial Neural Networks							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the scope, evolution, and applications of Generative AI.	**K2**
	CO2 Describe modern generative model architectures.	**K2**
	CO3 Apply generative models for text, image, and audio generation.	**K3**
	CO4 Analyze synthetic media and social impact in AI-generated content.	**K3**
	CO5 Assess multimodal generative AI systems and their applications	**K3**

UNIT-I	**Foundations of Generative AI for Communication**	**Periods: 9**
Definition, scope and evolution of Generative AI, Overview of text, speech, image, and video generation, Modern Generative AI models: LLMs, diffusion models, multimodal models, Role of Generative AI, Applications of Generative AI in digital media and information systems, Opportunities and risks, Technical and societal limitations		**CO1**
UNIT-II	**Generative Model Architectures**	**Periods: 9**
Generative modeling paradigms (GANs, VAEs, diffusion, transformers), Autoencoders for content generation, Advanced GAN architectures for image and video synthesis, Diffusion models for media data, Representation learning, Basic evaluation metrics (FID, BLEU, ROUGE).		**CO2**
UNIT-III	**Language and Text Generation Systems**	**Periods: 9**
Transformer-based text generation, overview of major LLMs (GPT, BERT, T5, LLaMA), Tokenization methods (BPE, SentencePiece), Text generation mechanisms in LLMs, Prompt engineering techniques (zero-shot, few-shot, role prompting), Retrieval-augmented generation (RAG), Applications of LLMs in chatbots, translation, and summarization.		**CO3**
UNIT-IV	**Synthetic Media and Ethical Impact**	**Periods: 9**
AI-generated text, speech, and visual content systems, Deepfake technologies, Bias and fairness, Copyright and ownership, Misinformation and content manipulation, Ethical, legal, and social implications of Generative AI.		**CO4**
UNIT-V	**Multimodal and Future Communication Systems**	**Periods: 9**
Multimodal Generative AI (text–image–audio–video), Generative AI for research and documentation, Explainability and transparency, Automation and workforce impact, Role of Generative AI in future industries such as Media, Healthcare, Education, and Finance.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Amit Bahree, *Generative AI in Action*, Manning, 2023.
2. Bernard Marr, "Generative AI in Practice: 100+ Amazing Ways Generative Artificial Intelligence is Changing Business and Society," Wiley, 2023.
3. David Foster, *Generative Deep Learning*, O'Reilly, 2022.

Reference Books

1. Sebastian Raschka, Yuxi (Hayden) Liu, and Vahid Mirjalili, "Machine Learning with PyTorch and Scikit-Learn," Packt Publishing, 2022.
2. Tom Hope, Yehezkel S. Resheff, and Itay Lieder, "Learning Generative Adversarial Networks," O'Reilly Media, 2020.
3. Francois Chollet, "Deep Learning with Python," Manning Publications, 2021.
4. Andriy Burkov, "The Hundred-Page Machine Learning Book," Andriy Burkov Publishing, 2019.
5. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning," MIT Press, 2016.

Web References

1. https://ai.googleblog.com
2. https://openai.com/research
3. https://huggingface.co/models

4. https://www.technologyreview.com/topic/artificial-intelligence
5. https://arxiv.org

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	2	2	1	3	-	-	-	1	2	1	3	2	1
2	3	3	2	2	3	-	-	-	1	2	1	3	2	2
3	3	3	2	2	3	2	2	3	1	2	2	2	3	2
4	2	3	2	2	2	3	2	3	1	2	2	2	3	1
5	3	2	2	1	2	-	-	3	1	2	2	2	3	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE820**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Game Theory and its Application**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)								
Prerequisite	Basics of Algorithms and Computer Systems.							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand fundamental concepts and models of game theory	**K2**
	CO2 Analyze strategic interactions using classical and non-cooperative games	**K3**
	CO3 Apply equilibrium concepts to real-world decision-making problems	**K3**
	CO4 Design and evaluate games under uncertainty and incomplete information	**K3**
	CO5 Explore various applications of Game Theory	**K3**

UNIT - I	**Fundamentals of Game Theory**	**Periods:09**
Introduction to game theory and strategic decision making. Elements of a game, types of games, and classification of strategic interactions. Payoff representation, rationality assumptions, and real-world motivation.		**CO1**
UNIT - II	**Non-Cooperative Games and Equilibrium Concepts**	**Periods:09**
Strategic-form games and best response strategies. Nash equilibrium, dominance, and mixed strategies. Computation and interpretation of equilibria in practical scenarios.		**CO2**
UNIT - III	**Cooperative Games and Mechanism Design**	**Periods:09**
Cooperative games, coalitions, and characteristic function form. Core, Shapley value, and fair allocation mechanisms. Introduction to mechanism design and incentive compatibility.		**CO3**
UNIT - IV	**Games with Incomplete Information and Dynamics**	**Periods:09**
Bayesian games and games of incomplete information. Repeated games, dynamic strategies, and subgame perfect equilibrium. Learning, signaling, and reputation in strategic environments.		**CO4**
UNIT - V	**Applications of Game Theory**	**Periods:09**
Game theory applications in economics and business strategy. Applications in computer science: networks, security, and distributed systems. Game-theoretic models in AI, multi-agent systems, and social computing.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Steven Tadelis, *Game Theory: An Introduction*, Princeton University Press, 2013.
2. Martin J. Osborne, *An Introduction to Game Theory*, Oxford University Press, 2004.
3. Drew Fudenberg and Jean Tirole, *Game Theory*, MIT Press, 1991.

Reference Books

1. Noam Nisan et al., Algorithmic Game Theory, Cambridge University Press, 2007.
2. Roger B. Myerson, Game Theory: Analysis of Conflict, Harvard University Press, 1997.
3. Mas-Colell, Whinston, and Green, Microeconomic Theory, Oxford University Press, 1995.

Web References

1. https://plato.stanford.edu/entries/game-theory/
2. https://www.coursera.org/learn/game-theory
3. https://ocw.mit.edu/courses/game-theory/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	2	2	2	3	2	3
2	3	3	3	3	3	-	-	-	2	2	2	3	3	3
3	3	2	3	3	3	-	-	-	2	3	3	3	3	3
4	3	3	3	3	3	-	-	-	2	3	3	3	3	3
5	3	3	2	3	3	-	-	-	2	2	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electronics and Communication Engineering**		Programme: **B.Tech**					
Semester	**VIII**		Course Category: **PC**			End Semester Exam Type: **TE**		
Course Code	**U23ECEC03**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**High Speed Networks**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to ECE and CCE)									
Prerequisite	Basic knowledge about the circuits and their analysis.								
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Explain the architecture and working of high-speed networks, including ATM, Frame Relay, and wireless technologies.						**K2**	
	CO2	Illustrate congestion control mechanisms and traffic management strategies in high-speed networks.						**K3**	
	CO3	Apply TCP and ATM congestion control techniques to optimize network performance.						**K2**	
	CO4	Demonstrate the effectiveness of QoS mechanisms such as Integrated and Differentiated Services in high-speed networks.						**K2**	
	CO5	Implement QoS protocols like RSVP, MPLS, and RTP to enhance real-time communication in high-speed networks.						**K3**	
UNIT - I	**High Speed Networks**						**Periods:09**		
Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories - AAL. High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fiber Channel - Wireless LAN's: applications, requirements - Architecture of 802.11								**CO1**	
UNIT - II	**Congestion and Traffic Management**						**Periods:09**		
Queuing Analysis- Queuing Models - Single Server Queues - Effects of Congestion- Congestion Control - Traffic Management - Congestion Control in Packet Switching Networks - Frame Relay Congestion Control.								**CO2**	
UNIT - III	**TCP and ATM Congestion Control**						**Periods:09**		
TCP Flow control - TCP Congestion Control - Retransmission - Exponential RTO backoff - KARN's Algorithm - Window management - Performance of TCP over ATM. Traffic and Congestion control in ATM - Traffic Management Framework, GFR traffic management								**CO3**	
UNIT - IV	**Integrated and Differentiated Services**						**Periods:09**		
Integrated Services Architecture - Approach, Components, Services - Queuing Discipline, FIFO, FQ, PS, WFQ - Random Early Detection, Differentiated Services								**CO4**	
UNIT - V	**Protocols for QoS Support**						**Periods:09**		
RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms -Multiprotocol Label Switching - Operations, Label Stacking, Protocol details - RTP -Protocol Architecture, Data Transfer Protocol, RTCP								**CO5**	
Lecture Periods:45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods:45**		

Text Books

1. William Stallings, "High-Speed Networks and Internets: Performance and Quality of Service," Prentice Hall, 2nd Edition, 2002.
2. Jorge Crichigno, Elie Kfoury, Elias Bou-Harb, Nasir Ghani, "High-Speed Networks: A Tutorial," Springer, 1st Edition, 2022.

Reference Books

1. Ilya Grigorik, "High Performance Browser Networking," O'Reilly Media, 1st Edition, 2013.
2. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture",Cisco Press, Volume 1 and 2, 2003
3. James P. G. Sterbenz, Joseph D. Touch, "High-Speed Networking: A Systematic Approach to High- Bandwidth Low-Latency Communication," Wiley-Interscience, 1st Edition, 2001.
4. Warland & Pravin Varaiya, "High Performance Communication Networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.

Web References

1. https://plato.stanford.edu/entries/game-theory/
2. https://www.coursera.org/learn/game-theory
3. https://ocw.mit.edu/courses/game-theory/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	3	1	-
2	3	2	1	1	-	-	-	-	-	-	-	3	1	-
3	3	2	1	1	-	-	-	-	-	-	-	3	1	-
4	3	2	1	1	-	-	-	-	-	-	-	3	1	-
5	3	2	1	1	-	-	-	-	-	-	-	3	1	-

***Correlation Level: 1 - Low, 2 - Medium, 3 – High**

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Professional Elective – VI (Offered in Semester VIII)		
Sl.No.	**Course Code**	**Course Title**
1	U23CCE821	4G/5G Communication Networks
2	U23CCE822	AI Principles for Edge Computing
3	U23CCE823	Big data Analytics
4	U23CCE824	Mobile Application Engineering
5	U23ITEC04	Human Computer Interaction

Department	**Computer and Communication Engineering**	Programme:**B.Tech.**						
Semester	**VIII**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23CCE821**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**4G/5G Communication Networks**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
Prerequisite	Basics of Digital Communication, Wireless Communication and Signals & Systems.							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (HighestLevel)
	CO1 Understand the evolution of wireless networks	**K2**
	CO2 To gain an understanding of the fundamental principles of 5G networks.	**K2**
	CO3 Comprehend the 5G architecture and protocols	**K3**
	CO4 Understand dynamic spectrum management	**K3**
	CO5 Learn the security aspects in 5G networks	**K3**

UNIT-I	**Evolution of Wireless Networks**	**Periods: 09**
Networks evolution: 2G, 3G, 4G, evolution of radio access networks, need for 5G, Comparison between 4G and 5G, Next Generation Core (NG-Core), virtualized Evolved Packet Core (vEPC). Internet of Things (IoT) support in 5G, software-defined networking (SDN) and network function virtualization (NFV).		**CO1**
UNIT-II	**5G Concepts and Challenges**	**Periods: 09**
Fundamentals of 5G technologies, overview of 5G core network architecture, 5G New Radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G, massive MIMO technology, beamforming techniques in 5G networks.		**CO2**
UNIT-III	**Network Architecture Processes**	**Periods: 09**
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, GRE.		**CO3**
UNIT-IV	**Dynamic Spectrum Management and MM-Waves**	**Periods: 09**
Mobility management in 5G networks, command and control mechanisms, dynamic spectrum access, spectrum sharing techniques, spectrum trading concepts, cognitive radio based on 5G, millimeter wave (mm-Wave) communication, challenges and advantages of mm-Wave bands.		**CO4**
UNIT-V	**Security In 5G Networks**	**Periods: 09**
Security features in 5G networks, security architecture of 5G systems, network domain security, user domain security, flow-based Quality of Service (QoS) framework, security threats in 5G networks, techniques for mitigating security threats in 5G.		**CO5**

LecturePeriods:45	**Tutorial Periods:**	**Practical Periods:-**	**Total Periods:45**

Text Books

1. Saro Velrajan, An Introduction to 5G Wireless Networks: Technology, Concepts and Use Cases, First Edition, 2020.
2. Stephen Rommer, 5G Core Networks: Powering Digitalization, Academic Press, Elsevier, 2019.
3. Jyrki T. J. Penttinen, 5G Simplified: ABCs of Advanced Mobile Communications, Wiley Publications, 2019.

Reference Books.

1. Erik Dahlman, Stefan Parkvall, Johan Sköld, 5G NR: The Next Generation Wireless Access Technology, Academic Press, Elsevier, 2020.
2. Wan-Lei Anthony Lee, 5G System Design: An End-to-End Perspective, Springer Publications, 2019.
3. Jyrki T. J. Penttinen, 5G Simplified: ABCs of Advanced Mobile Communications, Wiley Publications, 2019.
4. Afif Osseiran et al., 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016.
5. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, Wiley Publications, 2015.

Web References

1. https://www.telcomaglobal.com/p/difference-between-4g-and-5g-network-architecture
2. https://bit.ly/4G-vs-5G-dup
3. https://bit.ly/5G-overview-SD
4. https://www.mdpi.com/1424-8220/22/1/26
5. https://www.mdpi.com/1424-8220/22/1/26

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	2	-	-	1	-	-	-	-	-	-	1	2	1
2	3	3	2	-	2	-	-	-	-	-	-	2	3	2
3	3	2	3	2	2	-	-	-	-	1	-	2	3	3
4	3	3	2	3	2	-	-	-	-	-	-	2	2	3
5	3	2	2	2	3	-	-	1	-	-	-	2	2	3

***Correlation Level: 1 - Low, 2 - Medium, 3 – High**

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE822**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI Principles for Edge Computing**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to CSE, IT and CCE)								
Prerequisite	Basics of Algorithms and Computer Systems.							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Understand fundamentals of AI for Edge Computing and intelligent edge devices.	**K2**
	CO2	Apply edge-aware knowledge representation and on-device inference techniques.	**K3**
	CO3	Analyze lightweight machine learning and reasoning models for edge environments.	**K3**
	CO4	Design AI models handling uncertainty, latency, and resource constraints at the edge.	**K3**
	CO5	Explore real-world applications of Edge AI across industries.	**K3**

UNIT - I	**Introduction to AI for Edge Computing**	**Periods:09**	
Introduction to AI in Edge Computing and its evolution from cloud-centric AI. Edge computing architecture, intelligent edge devices, and AI agents. Key characteristics, use cases, challenges, and overview of Edge AI frameworks.			**CO1**
UNIT - II	**Knowledge Representation and Inference at the Edge**	**Periods:09**	
Knowledge representation techniques for resource-constrained edge environments. Symbolic, sub-symbolic, and semantic models supporting edge-based intelligence. On-device inference, distributed knowledge processing, and context-aware edge systems.			**CO2**
UNIT - III	**Lightweight Learning and Reasoning Models**	**Periods:09**	
Principles of lightweight machine learning and TinyML for edge intelligence. Model compression techniques and deployment of neural, tree-based, and rule-based models. Fuzzy logic and logical reasoning methods for localized and collaborative edge learning.			**CO3**
UNIT - IV	**Probabilistic Reasoning and Optimization in Edge AI**	**Periods:09**	
Uncertainty modeling and probabilistic reasoning in dynamic edge environments. Bayesian, temporal, and Markov-based inference techniques for edge data streams. Latency-aware decision making, energy-efficient optimization, and federated learning concepts.			**CO4**
UNIT - V	**Applications of Edge AI**	**Periods:09**	
Edge AI applications in healthcare, smart cities, and industrial automation. Predictive maintenance, surveillance systems, and autonomous edge-based solutions. Emerging real-time applications in robotics, agriculture, and environmental monitoring.			**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2020.
2. Xiaofei Wang et al., Edge AI: Convergence of Edge Computing and Artificial Intelligence, Springer, 2020.
3. Pete Warden and Daniel Situnayake, TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers, O'Reilly Media, 2019.

Reference Books

1. Wolfgang Ertel, Introduction to Artificial Intelligence, 2nd Edition, Springer, 2018.
2. David Poole and Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, 2nd Edition, Cambridge University Press, 2017.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
4. Weisong Shi et al., Edge Computing: Vision and Challenges, IEEE Computer Society, 2016.
5. Michael Wooldridge, An Introduction to Multi-Agent Systems, 2nd Edition, Wiley, 2009.

Web References

1. https://www.tutorialspoint.com/artificial_intelligence/index.htm
2. https://www.javatpoint.com/artificial-intelligence-ai
3. https://www.geeksforgeeks.org/artificial-intelligence/
4. https://towardsdatascience.com/
5. https://www.coursera.org/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	2	2	2	3	2	3
2	3	3	3	3	3	-	-	-	2	2	2	3	3	3
3	3	2	3	3	3	-	-	-	2	3	3	3	3	3
4	3	3	3	3	3	-	-	-	2	3	3	3	3	3
5	3	3	2	3	3	-	-	-	2	2	3	3	3	3

***Correlation Level: 1 - Low, 2 - Medium, 3 – High**

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**	Programme: **B.Tech**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23CCE823**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Bigdata Analytics**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Basics of Java, Python, SQL, and Linux Environment	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify types of digital data and understand the fundamental architecture of the Hadoop Ecosystem.	**K2**
	CO2 Apply HDFS commands and data ingestion tools like Flume and Sqoop for distributed storage.	**K3**
	CO3 Design and implement MapReduce programs to solve data-intensive computational problems.	**K3**
	CO4 Analyze and process large datasets using Pig, Hive, and HBase within the Hadoop environment.	**K4**
	CO5 Design and apply Machine Learning techniques using Python and PySpark for big data solutions.	**K3**

UNIT - I	**Introduction to Big Data and Hadoop**	**Periods:09**
Types of Digital Data: Structured, Semi-structured, and Unstructured – Introduction to Big Data: Characteristics (V's), Evolution, and Business Implications – Big Data Analytics – History of Hadoop – Apache Hadoop Framework – Analyzing Data with Unix tools vs. Hadoop – Hadoop Streaming – Hadoop Ecosystem Overview – IBM Big Data Strategy: Introduction to Infosphere BigInsights and Big Sheets.		**CO1**
UNIT - II	**Hadoop Distributed File System (HDFS)**	**Periods:09**
The Design of HDFS – HDFS Concepts: NameNodes, DataNodes and Block Management – Command Line Interface – Hadoop File System Interfaces – Data Flow: Anatomy of File Read and Write – Data Ingest: Flume and Sqoop – Hadoop Archives – Hadoop I/O: Compression, Serialization, Avro, and File-Based Data Structures.		**CO2**
UNIT - III	**MapReduce Framework**	**Periods:09**
Anatomy of a MapReduce Job Run – Failures and Recovery – Job Scheduling – Shuffle and Sort Phase – Task Execution – MapReduce Types and Input/Output Formats – MapReduce Features: Counters, Sorting and Joins – Developing MapReduce Applications		**CO3**
UNIT - IV	**Hadoop Ecosystem Components**	**Periods:09**
Pig: Introduction – Execution Modes – Pig Latin – User Defined Functions (UDFs) – Data Processing Operators. **Hive:** Hive Services – Hive Metastore – Comparison with RDBMS – HiveQL – Tables and Querying. **HBase:** HBase Basics – Column-Oriented Storage Architecture – Clients – HBase vs. RDBMS. **Big SQL:** Introduction to Large-Scale Query Processing.		**CO4**
UNIT - V	**Data Analytics with Python and PySpark**	**Periods:09**
Python for Data Analytics – Libraries: NumPy, Pandas, Matplotlib, Seaborn – Data Preprocessing and Visualization – Introduction to Machine Learning: Supervised and Unsupervised Learning – Scaling Analytics: Introduction to Big Data Analytics using PySpark.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", 2nd Edition, Wiley, 2019.
2. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media, 2015.

Reference Books

1. Wes McKinney, "Python for Data Analysis", 3rd Edition, O'Reilly Media, 2022.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Paul Zikopoulos et al., "Harness the Power of Big Data: The IBM Big Data Platform", Tata McGraw Hill, 2012

Web References

1. https://jssstuniv.in/wp-content/uploads/2022/11/COURSE-MODULES.pdf
2. https://onlinecourses.nptel.ac.in/noc26_cs86/preview
3. https://ieeexplore.ieee.org/document/9596417/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	2	2	2	3	2	3
2	3	3	3	3	3	-	-	-	2	2	2	3	3	3
3	3	2	3	3	3	-	-	-	2	3	3	3	3	3
4	3	3	3	3	3	-	-	-	2	3	3	3	3	3
5	3	3	2	3	3	-	-	-	2	2	3	3	3	3

***Correlation Level: 1 - Low, 2 - Medium, 3 – High**

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Department	**Computer and Communication Engineering**		Programme: **B.Tech**					
Semester	**VIII**		Course Category: **PE**			End Semester Exam Type: **TE**		
Course Code	**U23CCE824**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Mobile Application Engineering**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
(CCE)									
Prerequisite	Basics of Algorithms and Probability								
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Acquire the knowledge on Android OS and its features.						**K2**	
	CO2	Acquire knowledge on GUI design required for Android App development.						**K3**	
	CO3	Apply the knowledge of persistence Data storage mechanism in Android Apps.						**K3**	
	CO4	Develop web based mobile application that accesses internet and location data.						**K3**	
	CO5	Apply the knowledge in App development using telephony and Google Map services						**K3**	
UNIT - I	**Introduction and Mobile OS**						**Periods:09**		
Mobile applications – Characteristics and Benefits – Application Model – Frameworks and Tools – Mobile OS: Android, iOS – versions with its features – Android architecture –ART (Android Runtime) – ADB (Android Debug Bridge) – Application framework basics.								**CO1**	
UNIT - II	**User Interface Design**						**Periods:09**		
Designing the right UI – GUI for Android – activity and its lifecycle – Material Design: new themes, new widgets, Cardlayouts – Backward compatibility – v7 appcompat library – Intent object, intent filters, adding categories – Menus – fragment and its lifecycle.								**CO2**	
UNIT - III	**Data Persistence**						**Periods:09**		
Different Data persistence schemes – content provider and resolver – shared preferences – saved instance – file read/write operations – SQLite database – Android in build content providers – user content provider.								**CO3**	
UNIT - IV	**Android Application Development**						**Periods:09**		
Communication via the web – Telephony Manager: Sending SMS and making calls – Google maps service using API – Publishing Android Apps: Guidelines, policies and process of uploading Apps to Google Play								**CO4**	
UNIT - V	**Android Service Component**						**Periods:09**		
Intent Service – Remote service – Service handlers – communication between service and Activity – Broadcast Receivers: Local Broadcast Manager, Dynamic Broadcast Receiver – System Broadcast – Pending Intent, Notifications – Packaging and deployment								**CO5**	
Lecture Periods:45		**Tutorial Periods: -**			**Practical Periods: -**			**Total Periods:45**	

Text Books

1. Reto Meier, “Professional Android 4 Application Development”, Wiley, 2012
2. Wei-Meng Lee, “Beginning Android Application Development”, Wiley Publishing, 2011
3. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, “Programming Android”, O’Reilly, 2011
4. Rick Rogers, John Lombardo, Zigurd Mednieks, Blake Meike, “Android Application Development”, O’Reilly, 2010

Reference Books

1. Rick Rogers, John Lombardo, Zigurd Mednieks, Blake Meike, “Android Application Development”, O’Reilly, 2010

Web References

1. https://www.tutorialspoint.com/mobile-application-development/index.htm
2. https://www.javatpoint.com/ mobile-application-development/
3. https://www.geeksforgeeks.org/ mobile-application-development/

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	3	3	3	3	1	-	-	2	2	2	3	2	3
2	3	3	3	3	3	3	-	-	2	2	2	3	3	3
3	3	2	3	3	3	1	-	-	2	3	3	3	3	3
4	3	3	3	3	3	1	-	-	2	3	3	3	3	3
5	3	3	2	3	3	3	-	-	2	2	3	3	3	3

***Correlation Level: 1 - Low, 2 - Medium, 3 – High**

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus

Department	**Information Technology**			Programme: **B.Tech.**					
Semester	**VIII**			Course Category Code: **PE**			*End Semester Exam Type: **TE**		
Course Code	**U23ITEC04**			Periods / Week			Credit	Maximum Marks	
				L	T	P	C	CAM	ESE	TM
Course Name	**Human Computer Interaction**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to IT and CCE)									
Prerequisite	Programming Fundamentals and Software Engineering Concepts								
Course Outcomes	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Understand the foundations and principles of Human Computer Interaction (HCI)						**K2**	
	CO2	Analyze user needs and develop effective user interface designs						**K3**	
	CO3	Design prototypes using HCI methods for efficient interaction						**K3**	
	CO4	Evaluate interactive systems using usability metrics and testing techniques						**K3**	
	CO5	Integrate emerging technologies and accessibility in interface design						**K2**	

Unit- I	**Introduction to HCI**	**Periods: 09**
Introduction to HCI - Goals and scope of HCI - History & evolution of HCI - Human capabilities & limitations - Perception, Sensory systems, visual perception - Design implications for interfaces- Motor Control -Human movement & interfaces - Cognition - Memory, attention, mental models - Cognitive load & implications for interface design.		**CO1**
Unit- II	**Human Cognition and User Psychology**	**Periods: 09**
Human Memory & Perception - Cognitive Models in HCI - Attention & Mental Workload - Human Motor Performance - Human Error Types and Prevention - Mental Models and Conceptual Models - Interaction Styles - Affordances and Signifiers - Feedback and Visibility.		**CO2**
Unit- III	**Design Process, Prototyping & Case Study**	**Periods: 09**
HCI Design Lifecycle - User Requirements Gathering - Task Analysis Techniques - Contextual Inquiry - Storyboarding and Scenarios - Paper Prototyping - Low and High-Fidelity Prototypes - Interface Design Rules Case Study: Iterative Usability Evaluation of Wearable UI Prototype		**CO3**
Unit- IV	**Evaluation Techniques and Metrics**	**Periods: 09**
Usability Testing Fundamentals - Formative vs Summative Evaluation - Heuristic Evaluation - Cognitive Walkthroughs - Think-Aloud Protocol - User Satisfaction Metrics - Performance and Error Metrics - Accessibility Evaluation- Reporting and Iterating Design		**CO4**
Unit- V	**Advanced Topics in HCI**	**Periods: 09**
Mobile & Touch Interfaces - Voice User Interfaces (VUI) - Gesture-based Interaction - Augmented/Virtual Reality Interfaces - Brain-Computer Interfaces - Multi-Modal Interfaces - Accessibility and Inclusive Design - Privacy, Ethics and Security in HCI - Future Trends in HCI		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Helen Sharp, Jennifer Preece, Yvonne Rogers," Interaction Design: Beyond Human-Computer Interaction", 5th edition, John Wiley & Sons, 2019.
2. Kasper Hornbæk, Per Ola Kristensson, Antti Oulasvirta, "Introduction to Human-Computer Interaction" Oxford University Press, 2025.

Reference Books

1. Alan Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, "Human–Computer Interaction**"** ,3rd Edition, Pearson Education 2004, ISBN-13: 978-8131717035
2. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmqvist, Nicholas Diakopoulos, " Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th edition Pearson Education, 2016.

TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
1	3	2	-	-	1	-	-	-	-	-	2	2	2	3
2	2	3	3	-	2	-	-	1	1	-	2	2	2	3
3	2	2	3	-	3	-	-	2	1	1	2	2	2	3
4	2	3	2	3	2	-	-	1	1	-	2	2	2	3
5	2	2	3	-	3	2	2	1	1	-	3	2	2	3

***Correlation Level: 1 - Low, 2 - Medium, 3 – High**

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application-oriented / Problem-solving / Design / Analytical in content beyond the syllabus