SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM & SYLLABI

(Regulations 2023)

B.Tech - Electronics and Communication Engineering

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

B.TECH.

ELECTRONICS AND COMMUNICATION ENGINEERING

(Regulations-2023)

CURRICULUM & SYLLABI

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 a 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 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 the growth of society

VISION AND MISSION OF THE DEPARTMENT

VISION

Facilitate academic excellence and research among Electronics and Communication Engineers to meet Global needs with high competence and ethical professionalism

MISSION

M1: Academic Excellence	To impart learning skills to meet the global challenges in the field of Electronics and Communication Engineering
M2: Research and Innovation	To provide excellence in research and innovation through multidisciplinary specialization
M3: Employability and Entrepreneurship	To enhance inter and intrapersonal skills among students to make them employable and entrepreneurs
M4: Ethics	To inculcate the significance of human values and professional skills to serve the society

PROGRAMME OUTCOMES (POs)

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 public health and safety, and 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 contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of 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 engineering practice.

PO9: Individual and teamwork:

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, managing 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.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Technical Knowledge
Graduates will be able to develop an insightful combination of modern electronics and communication technology through technical knowledge.

PEO2: Research and Development
Enhance analytical and thinking skills to develop initiatives and innovative ideas for research and development, industry, and societal requirements.

PEO3: Leadership
Inculcate the qualities of teamwork as well as social, interpersonal, and leadership skills and adapt to the changing professional environments in the fields of engineering and technology.

PEO4: Professional Ethics
Motivate graduates to become good human beings and responsible citizens for the overall welfare of society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Domain Knowledge
Ability to understand the concepts in Electronics and Communication Engineering and to apply to different fields, such as Consumer Electronics, Communications, Signal Processing, etc.

PSO2: Embedded System Design
Ability to design a system based on the technical knowledge gained for embedded applications in electronics and communications engineering.

PSO3: Professional Competency
Ability to select cutting-edge engineering hardware and software tools to solve complex problems in Electronics and Communication Engineering

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

S. No	Category	Credits
1	Humanities and Social Sciences including Management courses	15
2	Basic Science courses	20
3	Engineering Science courses	28
4	Professional core courses	66
5	Professional Elective courses	18
6	Open Elective Courses	9
7	Project work, seminar, and internship	13
8	Ability Enhancement Courses	
9	Mandatory Courses	
Total Credits		**169**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S. No	Category	Credits per Semester								Total credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management courses	3	5	1	1	2			3	15
2	Basic Science courses	7	4	5	4					20
3	Engineering Science courses	8	8	4	4	4				28
4	Professional Core courses	4	4	13	11	8	15	11		66
5	Professional Elective courses				3	3	3	3	6	18
6	Open Electives					3	3	3		9
7	Project work and internship					1	1	3	8	13
8	Ability Enhancement Courses*									
9	Mandatory Courses*									
Total Credits		22	21	23	23	21	22	20	17	169

* AEC and MC are not included in 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 discipline. To earn an honours degree the student is required to earn an additional 18 - 20 credits (over and above the total 169 credits prescribed in the curriculum) starting from the 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 up to the third semester in the first attempt itself and has earned a CGPA / GPA of not less than 8.0.

The prescribed courses offered for Honours degree are given in Annexure -D

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	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23ESTC01	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
4	U23EETC01	Electrical Technology	ES	3	0	0	3	25	75	100
5	U23ECT101	Circuits and Networks	PC	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	U23ESPC02	Design Thinking and Idea Lab	ES	0	0	2	1	50	50	100
8	U23EEPC01	Electrical Technology Laboratory	ES	0	0	2	1	50	50	100
9	U23ECP101	Circuits and Networks Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23ECC1XX	Certification Course – I	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23ECM101	Induction Program	MC	3 Weeks			-	-	-	-
Total							**22**	**425**	**575**	**1000**

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	U23ESTC02	Engineering Mechanics	ES	3	0	0	3	25	75	100
3	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
4	U23ECT202	Electron Devices	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values - II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23ECP202	Electron Devices Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23ECC2XX	Certification Course – II	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23ECM202	Sports and Yoga or NSS/ NCC	MC	0	0	2	-	100	-	100
Total							**21**	**525**	**575**	**1100**

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	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
3	U23ECT302	Electronic Circuits	PC	3	0	0	3	25	75	100
4	U23ECT304	Sensors and its Applications	PC	3	0	0	3	25	75	100
5	U23ECT305	Engineering Electromagnetics	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ECB301	Signals and Systems	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
10	U23ECP303	Electronic Circuits Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23ECC3XX	Certification Course – III	AEC	0	0	4	-	100	-	100
12	U23ECS301	Skill Enhancement Course – I: PCB Design	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ECM303	Climate Change	MC	2	0	0	-	100	-	100
Total							**23**	**675**	**625**	**1300**

SEMESTER–IV

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC04	Numerical Methods and Optimization	BS	3	1	0	4	25	75	100
2	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
3	U23ECT406	Operational Amplifiers and Applications	PC	3	0	0	3	25	75	100
4	U23ECT407	Digital Circuits	PC	3	0	0	3	25	75	100
5	U23ECE4XX	Professional Elective – I	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ECB402	Analog Communication	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency -II	HS	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23ECP404	Integrated Circuits Laboratory	PC	0	0	2	1	50	50	100
10	U23ECP405	Digital Circuits Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23ECC4XX	Certification Course – IV	AEC	0	0	4	-	100	-	100
12	U23ECS402	Skill Enhancement Course- II: Repair and Maintenance of Electronics Equipment	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ECM404	Right to Information and Good Governance	MC	2	0	-	-	100	-	100
Total							**23**	**675**	**625**	**1300**

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	U23ITTC02	Programming in JAVA	ES	3	0	0	3	25	75	100
3	U23ECT508	Communication Networks	PC	3	0	0	3	25	75	100
4	U23ECT509	Digital Communication	PC	3	0	0	3	25	75	100
5	U23ECE5XX	Professional Elective – II	PE	3	0	0	3	25	75	100
6	U23XXO5XX	Open Elective – I	OE	3	0	0	3	25	75	100
Practical										
7	U23ITPC02	Programming in JAVA Laboratory	ES	0	0	2	1	50	50	100
8	U23ECP506	Communication Networks Laboratory	PC	0	0	2	1	50	50	100
9	U23ECP507	Digital Communication Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ECW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23ECC5XX	Certification Course – V	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ECM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
Total							**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	U23ECT610	Embedded Technology	PC	3	0	0	3	25	75	100
2	U23ECT611	Digital Signal Processing	PC	3	0	0	3	25	75	100
3	U23ECT612	Digital VLSI System Design	PC	3	0	0	3	25	75	100
4	U23ECE6XX	Professional Elective - III	PE	3	0	0	3	25	75	100
5	U23XXO6XX	Open Elective – II	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ECB603	Control System Engineering	PC	2	0	2	3	50	50	100
Practical										
7	U23ECP608	Embedded Technology Laboratory	PC	0	0	2	1	50	50	100
8	U23ECP609	Digital Signal Processing Laboratory	PC	0	0	2	1	50	50	100
9	U23ECP610	Digital VLSI System Design Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ECW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23ECC6XX	Certification Course – VI	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ECM606	Gender Equality	MC	2	0	-	-	100	-	100
Total							**22**	**625**	**575**	**1200**

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	U23ECT713	RF and Microwave Communication	PC	3	0	0	3	25	75	100
3	U23ECT714	Wireless Communication	PC	3	0	0	3	25	75	100
4	U23ECE7XX	Professional Elective - IV	PE	3	0	0	3	25	75	100
5	U23XXO7XX	Open Elective – III	OE	3	0	0	3	25	75	100
Practical										
7	U23ECPC01	Internet of Things Laboratory	PC	0	0	2	1	50	50	100
8	U23ECP711	High Frequency Communication Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ECW703	Project Phase – I	PA	0	0	4	2	50	50	100
11	U23ECW704	Internship/ Inplant training	PA	0	0	2	1	100	-	100
Total							**20**	**375**	**525**	**900**

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	U23ECE8XX	Professional Elective - V	PE	3	0	0	3	25	75	100
3	U23ECE8XX	Professional Elective - VI	PE	3	0	0	3	25	75	100
Project Work										
10	U23ECW805	Project Phase – II	PA	0	0	16	8	50	100	150
Total							**17**	**125**	**325**	**450**

Annexure – A

PROFESSIONAL ELECTIVE COURSES

Professional Elective –I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23ECE401	Transmission Lines and Waveguides
2	U23ECE402	Computer Architecture
3	U23ECE403	Industry 4.0 Technology
4	U23ECE404	Biomedical Electronics
5	U23ECE405	Electronic Measurement and Instrumentation
Professional Elective – II (Offered in Semester V)		
Sl. No	**Course Code**	**Course Title**
1	U23ECE506	Cloud Computing Techniques
2	U23ECE507	Introduction to MEMS
3	U23ECE508	Real-time Operating System
4	U23ECE509	Hardware Description Languages
5	U23ECE510	Network Information Security
Professional Elective –III (Offered in Semester VI)		
Sl. No	**Course Code**	**Course Title**
1	U23ICEC02	Soft Computing Techniques
2	U23BMEC02	Wearable Technology
3	U23ECE611	Satellite Communication
4	U23ECE612	Antennas and Wave Propagation
5	U23ECE613	Fog Computing
Professional Elective–IV (Offered in Semester VII)		
Sl. No	**Course Code**	**Course Title**
1	U23ICEC03	Intelligence Robotics Systems
2	U23ECEC01	Digital Image Processing
3	U23ECE714	Optical Communication
4	U23ECE715	Aircraft Communication and Navigation Systems
5	U23ECE716	Body Area Network
Professional Elective –V (Offered in Semester VIII)		
Sl. No	**Course Code**	**Course Title**
1	U23ITEC05	Augmented Reality and Virtual Reality
2	U23ECE817	Mobile Communication
3	U23ECE818	System on Chip Design
4	U23ECE819	Low Power VLSI Design
s5	U23ECE820	Cyber-Physical System
Professional Elective–VI (Offered in Semester VIII)		
Sl. No	**Course Code**	**Course Title**
1	U23ECEC02	Wireless Sensor Networks
2	U23ECEC03	High-Speed Networks
3	U23ECE821	Single Board Computer
4	U23ECE822	Cyber Security
5	U23ECE823	5G Communication Systems

Annexure – B

OPEN ELECTIVE COURSES

Open Elective- I (Offered in Semester V/ VI)			
S. No	**Course Code**	**Course Title**	**Permitted Departments**
1	U23ECOC01	Engineering Computation with MATLAB	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS, Mechatronics
2	U23ECOC02	Consumer Electronics	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
Open Elective- II (Offered in Semester VII)			
1	U23ECOC03	IIoT and its Applications	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, FT
2	U23ECOC04	RFID System Design and Testing	EEE, ICE, CSE, MECH, IT, CIVIL, CCE, BME, Mechatronics

COMMON COURSE OFFERED BY ECE

Sl. No.	**Course Code**	**Course Title**	**Courses Offered To**
1	U23ECTC01	Internet of Things	CCE
2	U23ECPC01	Internet of Things Laboratory	CCE
3	U23ECEC01	Digital Image Processing	IT, CSE, CCE, MECTR
4	U23ECEC02	Wireless Sensor Networks	IT
5	U23ECEC03	High-Speed Networks	CCE

Annexure-C

ABILITY ENHANCEMENT COURSES–(A) CERTIFICATION COURSES

S. No	Course Code	Course Title
1	U23ECCX01	Adobe Photoshop
2	U23ECCX02	Adobe Animate
3	U23ECCX03	Adobe Dreamweaver
4	U23ECCX04	Adobe After Effects
5	U23ECCX05	Adobe Illustrator
6	U23ECCX06	Adobe InDesign
7	U23ECCX07	Autodesk AutoCAD -ACU
8	U23ECCX08	Autodesk Inventor - ACU
9	U23ECCX09	Autodesk Revit - ACU
10	U23ECCX10	Autodesk Fusion 360 - ACU
11	U23ECCX11	Autodesk 3ds Max - ACU
12	U23ECCX12	Autodesk Maya - ACU
13	U23ECCX13	Cloud Security Foundations
14	U23ECCX14	Cloud Computing Architecture
15	U23ECCX15	Cloud Foundation
16	U23ECCX16	Cloud Practitioner
17	U23ECCX17	Cloud Solution Architect
18	U23ECCX18	Data Engineering
19	U23ECCX19	Machine Learning Foundation
20	U23ECCX20	Robotic Process Automation / Medical Robotics
21	U23ECCX21	Advance Programming Using C
22	U23ECCX22	Advance Programming Using C ++
23	U23ECCX23	C Programming
24	U23ECCX24	C++ Programming
25	U23ECCX25	CCNP Enterprise: Advanced Routing
26	U23ECCX26	CCNP Enterprise: Core Networking
27	U23ECCX27	Cisco Certified Network Associate - Level 2
28	U23ECCX28	Cisco Certified Network Associate- Level 1
29	U23ECCX29	Cisco Certified Network Associate- Level 3
30	U23ECCX30	Fundamentals of Internet of Things
31	U23ECCX31	Internet of Things
32	U23ECCX32	Java Script Programming
33	U23ECCX33	NGD Linux Essentials
34	U23ECCX34	NGD Linux I
35	U23ECCX35	NGD Linux II
36	U23ECCX36	Advance Java Programming

S. No	Course Code	Course Title
37	U23ECCX37	Android Programming / Android Medical App Development
38	U23ECCX38	Ansys
39	U23ECCX39	Catia
40	U23ECCX40	Communication Skills for Business
41	U23ECCX41	Coral Draw
42	U23ECCX42	Data Science Using R
43	U23ECCX43	Digital Marketing
44	U23ECCX44	Embedded System Using C
45	U23ECCX45	Embedded System With IOT
46	U23ECCX46	English For IT
47	U23ECCX47	Entrepreneurship And Business Plan
48	U23ECCX48	Estimation And Current Practices
49	U23ECCX49	Financial Planning, Banking and Investment Management
50	U23ECCX50	Foundation Of Stock Market Investing
51	U23ECCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	U23ECCX52	IOT Using Python
53	U23ECCX53	Plaxis
54	U23ECCX54	Soft Skills, Verbal, Aptitude
55	U23ECCX55	Software Testing
56	U23ECCX56	Solar And Smart Energy System With IOT
57	U23ECCX57	Solid Edge
58	U23ECCX58	Solid works
59	U23ECCX59	Staad Pro
60	U23ECCX99	Total Station
61	U23ECCX60	Hydraulic
62	U23ECCX61	PLC
63	U23ECCX62	Numatics
64	U23ECCX63	Agile Methodologies
65	U23ECCX64	Block Chain
66	U23ECCX65	Devops
67	U23ECCX66	Artificial Intelligence
68	U23ECCX67	Cloud Computing
69	U23ECCX68	Computational Thinking
70	U23ECCX69	Cyber Security
71	U23ECCX70	Data Analytics
72	U23ECCX71	Databases
73	U23ECCX72	Java Programming
74	U23ECCX73	Networking
75	U23ECCX74	Python Programming

S. No	Course Code	Course Title
76	U23ECCX75	Web Application Development (HTML, CSS, JS)
77	U23ECCX76	Network Security
78	U23ECCX77	MATLAB
79	U23ECCX78	Azure Fundamentals
80	U23ECCX79	Azure AI (AI-900)
81	U23ECCX80	Azure Data (DP -900)
82	U23ECCX81	Microsoft 365 Fundamentals (SS-900)
83	U23ECCX82	Microsoft Security, Compliance and Identity (SC-900)
84	U23ECCX83	Microsoft Power Platform (PI-900)
85	U23ECCX84	Microsoft Dynamics Fundamentals 365 – CRM
86	U23ECCX85	Microsoft Excel
87	U23ECCX86	Microsoft Excel Expert
88	U23ECCX87	Securities Market Foundation
89	U23ECCX88	Derivatives Equinity
90	U23ECCX89	Research Analyst
91	U23ECCX90	Portfolio Management Services
92	U23ECCX91	Cyber Security
93	U23ECCX92	Cloud Security
94	U23ECCX93	PMI – Ready
95	U23ECCX94	Tally – GST & TDS
96	U23ECCX95	Advance Tally
97	U23ECCX96	Associate Artist
98	U23ECCX97	Certified Unity Programming
99	U23ECCX98	VR Development

Annexure – D

HONORS DEGREE

Bachelor of Technology (Honors) in Electronics and Communication Engineering With specialization in "Internet of Things"

COURSE DETAILS											
Sl. No.	**Semester**	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
					L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory											
1	IV	U23ECX401	Smart Sensor Technologies for IoT	PC	3	1	0	4	25	75	100
2	V	U23ECX502	Embedded Hardware System Design	PC	3	1	0	4	25	75	100
3	VI	U23ECX603	IoT Networking and Communication	PC	3	1	0	4	25	75	100
4	VII	U23ECX704	Industrial Internet of Things	PC	3	1	0	4	25	75	100
5	VIII	U23ECX805	Privacy and Security in IoT	PC	3	1	0	4	25	75	100
Total								**20**	**125**	**375**	**500**
Equivalent NPTEL courses[##]											

s[##] The student shall be given the option to earn 3 credits through one equivalent 12-week NPTEL course instead of any one course listed for the Honours degree programme that should be completed before the commencement of the eighth semester. The equivalent courses are subject to change based on their availability as per the NPTEL course list.

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	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23ESTC01	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
4	U23EETC01	Electrical Technology	ES	3	0	0	3	25	75	100
5	U23ECT101	Circuits and Networks	PC	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	U23ESPC02	Design Thinking and Idea Lab	ES	0	0	2	1	50	50	100
8	U23EEPC01	Electrical Technology Laboratory	ES	0	0	2	1	50	50	100
9	U23ECP101	Circuits and Networks Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23ECC1XX	Certification Course – I	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23ECM101	Induction Program	MC	3 Weeks			-	-	-	-
Total							**22**	**425**	**575**	**1000**

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **BS**			*End Semester Exam: **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			BT Mapping
	On completion of the course, the students will be able to		
	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**

Textbooks

1. M.K. Venkataraman, "Engineering Mathematics, The National Publishing Company, Madras, 2016.
2. N. P Bali and Manish Goyal, "A Textbook 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/

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	**Physics and Chemistry**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **BS**			*End Semester Exam: **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
	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 reactions 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**

Textbooks

1. V Rajendran, “Engineering Physics”, 2nd Edition, TMH, New Delhi 2011.
2. S.S Dara – “A textbook 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	**Civil / Mechanical**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**			End Semester Exam: **TE**			
Course Code	**U23ESTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BASICS OF CIVIL AND MECHANICAL ENGINEERING**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
(Common to EEE, ECE, ICE, MECH, Civil, Mechatronics Branches)								
Prerequisite	Basic Science							

Course Outcomes			
	On completion of the course, the students will be able to		BT Mapping
	CO1	Understand the types of buildings and materials.	**K2**
	CO2	Summarize on the various components of buildings and surveying concepts	**K2**
	CO3	Identify the various infrastructure facilities	**K2**
	CO4	To familiarize the working principles of IC engines and automobile systems	**K2**
	CO5	To understand about the power generation systems and its components	**K1**
	CO6	To acquire knowledge about the various machining process.	**K2**

SECTION A - CIVIL ENGINEERING			
UNIT - I	**BUILDINGS AND BUILDINGS MATERIALS**	**Periods: 08**	
Buildings – Definition – Classification according to NBC-plinth area, Floor area, carpet area, floor space index - Development of Smart cities - green building, Benefits from green building. Building Materials - stone, brick, cement, cement mortar, concrete, steel, Timber - their properties and uses			**CO1**
UNIT - II	**BUILDINGS COMPONENTS AND SURVEYING**	**Periods: 08**	
Various Buildings Components and their functions. Foundation: function and types - Brick masonry, Stone Masonry and its types – Floors, Roofs and its types. Surveying: Objects – Classification – Principles – Measurements of Distances and areas – Leveling			**CO2**
UNIT - III	**BASIC INFRASTRUCTURE**	**Periods: 07**	
Roads and Bridges – types, components advantage and disadvantages. Railways - Permanent way and its elements. Sources of Water - Quality of Water- Domestic sewage Treatment – Rainwater harvesting – Dams - site selection for dam construction, types of dams.			**CO3**

SECTION B – MECHANICAL ENGINEERING			
UNIT- IV	**INTERNAL AND EXTERNAL COMBUSTION SYSTEMS**	**Periods: 08**	
IC engines – Classification – Working principles – Diesel and Petrol Engines: Two stroke and four stroke engines – merits and demerits. Steam generators (Boilers) – Classification – Constructional features (of only low-pressure boilers) – Boiler mountings and accessories – Merits and demerits – Applications.			**CO4**
UNIT- V	**POWER GENERATION SYSTEMS, REFRIGERATION AND AIR CONDITIONING SYSTEM**	**Periods: 07**	
Power plants: Thermal – Nuclear, Hydraulic, Solar, Wind, Geothermal, Wave, Tidal and Ocean Thermal Energy Conversion systems - Functions, Applications - Schemes and layouts (Description only) Refrigeration and Air Conditioning System: Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.			**CO5**
UNIT- VI	**MANUFACTURING PROCESS**	**Periods: 07**	
Lathe - types, Specifications, Operations of a centre lathe. Casting - Pattern making, Allowances, Green sand and dry sand moulding, casting defects. Welding - Arc and Gas welding process, brazing and soldering (process description only).			**CO6**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Textbooks

1. Dr. S. Jayakumar, “Basic Civil Engineering”, Aagash Nekaa Publications, 2011
2. G Shanmugam, MS Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education, 1st Edition, 2018.
3. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2010.

Reference Books

1. M.P. Poonia, S.C. Sharma and T.R. Banga, Basic Mechanical Engineering, Khanna Publishing House 2018.
2. S.S.Bhavikatti, Basic Civil engineering, New Age International Ltd. 2018.
3. V. Rameshbabu, Basic Civil & Mechanical Engineering, VRB Publishers Private Limited, January 2017.
4. Serope Kalpakjian, Steven Schmid, Manufacturing Engineering and Technology, 7th Edition, Pearson Publication, 2014.
5. Gopi Satheesh, Basic Civil engineering, Pearson Publications, 3rd Edition, 2015.

Web References

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

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	-	-	-	-	-	-	1	-	-	-
2	3	1	1	-	1	-	-	-	-	-	-	1	-	-	-
3	3	1	1	-	1	-	-	-	-	-	-	1	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-

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	**EEE**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**				*End Semester Exam: **TE**		
Course Code	**U23EETC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL TECHNOLOGY**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	Mathematics and Physics		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping
	CO1	Demonstrate the basics of domestic wiring, including the factors that influence the choice of wiring systems in residential buildings.	**K3**
	CO2	Understand the operation of transformers and their applications.	**K2**
	CO3	Explain the DC generators and motors, including their construction, principles of operation, and its characteristics.	**K2**
	CO4	Interpret the construction and working of AC machines for various applications.	**K2**
	CO5	Describe and compare the operation of special machines.	**K2**

UNIT-I	**BASICS OF ELECTRICAL ENERGY**	**Periods:09**
Introduction, conventional and non- conventional sources of Electrical Energy, Domestic wiring, Factors affecting the choice of wiring system, Types of Wires and cables, Types of Wiring, Typical House Wiring Circuits, Basics of Utility Supply, Knowledge about distribution box, MCB, plug types, fuses, insulators, live wire, neutral wire, Earthing and it types, construction and working of incandescent lamp, CFL and LED lamps.		**CO1**

UNIT-II	**TRANSFORMERS**	**Periods:09**
Single phase transformer: construction, principle of operation, EMF equation, Types, Phasor diagram, Equivalent circuit, Voltage Regulation, losses and efficiency. Load test. **Auto transformers:** construction, copper saving. Introduction to three phase transformer-Power Measurement using two Wattmeter methods.		**CO2**

UNIT-III	**DC MACHINES**	**Periods:09**
DC Generator: Construction, Principles of operation, Types, EMF equation, OCC and Load characteristics of series and shunt generator. **DC motor:** Principle of operation, Types, Torque Equation, electrical and mechanical characteristics of series and shunt motor, Speed control methods and applications, Need for starters and its types.		**CO3**

UNIT-IV	**AC MACHINES**	**Periods:09**
Three phase Induction Motor: Construction, principle of operation, Types, torque equation, Slip-torque characteristics. **Single Phase Induction Motor:** construction, principle of operation and starting methods**. Alternator:** Construction, Principles of operation, Types, EMF equation, Voltage regulation. **Synchronous motor:** Construction, Methods of starting, V and inverted V curves.		**CO4**

UNIT-V	**SPECIAL MACHINES**	**Periods:09**
Servo motor: DC and AC servomotors. **Stepper motors**: variable reluctance and permanent magnet stepper motors. Reluctance motor, Hysteresis motor, Universal motor, Repulsion motor and BLDC motor -Applications		**CO5**

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

Textbooks

1. B.L. Theraja, “Electrical Technology Vol.- II AC/DC Machines”, S. Chand, 2008
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, Tata McGraw Hill Education Private Limited, 2nd Edition, 2019.
3. D. P. Kothari and I. J. Nagrath, “Electric Machines”, Tata McGraw Hill Publishing Company Ltd, 5th Edition, 2017.

Reference Books

1. V. K. Mehta & Rohit Mehta, “Principle of Electrical Machines”, S. Chand Publishers, 2014.
2. D Kothari, I Nagrath, “Basic Electrical Engineering”, Tata Mcgraw Hill Education, 4th Edition, 2019.
3. M. S. Sukhija, T. K Nagsarkar, “Basic Electrical Engineering”, Oxford University Press, 2011.
4. S. K. Sahdev,” Fundamentals of Electrical Engineering and Electronics”, DhanpatRai and Co, 2017.
5. E.G. Janardanan, “Special Electrical Machines”, Prentice Hall India Learning Private Limited, 2014

Web References

1. https://www.coursera.org/lecture/linear-circuits-ac-analysis/5-1-transformers-dB0z9
2. https://www.elprocus.com/alternating-current-and-direct-current-and-its-applications/
3. https://www.electronicshub.org/electrical-systems-and-methods-of-electrical-wiring/
4. https://nptel.ac.in/courses/108/105/108105017/
5. https://lecturenotes.in/course/all/btech/electrical-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	3	3	1	2	-	1	-	-	-	1	1	3	2	-
2	3	3	3	1	2	-	1	-	-	-	1	1	3	2	-
3	3	3	3	1	2	-	1	-	-	-	1	1	3	2	-
4	3	3	3	1	2	-	1	-	-	-	1	1	3	2	-
5	3	3	3	1	2	-	1	-	-	-	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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **PC**				*End Semester Exam: **TE**		
Course Code	**U23ECT101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CIRCUITS AND NETWORKS**	3	-	-	3	25	75	100

Prerequisite	Basics of active and passive components		
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Infer the fundamental laws and elements of electrical *circuits.*	K2
	CO2	Apply the knowledge of basic circuital theorems and simplify the network.	K3
	CO3	Evaluate Steady state response and understand alternating current and voltages.	K3
	CO4	Demonstrate the concepts of two port networks and solve different Network Functions and parameters.	K3
	CO5	Design the different passive filters and attenuators for various applications	K3

UNIT-I	**CIRCUIT ELEMENTS AND KIRCHHOFF'S LAWS**	**Periods: 12**
Basic definitions: Voltage, Current, Power and Energy -Resistance Parameter, Inductance Parameter, Capacitance Parameter - Independent Energy Sources - Kirchhoff's Voltage Law, Kirchhoff's Current Law - Voltage and current Division rule - Power in Series and parallel Circuits - Star Delta transformation - Source Transformation Technique.		CO1
UNIT-II	**CIRCUIT THEOREMS FOR ANALYSING AC & DC CIRCUITS (Independent sources only)**	**Periods: 12**
Introduction- Nodal Analysis, Mesh Analysis - Superposition Theorem - Thevenin's Theorem - Norton's Theorem- Reciprocity Theorem - Compensation Theorem - Maximum Power Transfer Theorem - Duals and Duality - Tellegen's Theorem - Millman's Theorem - Application of theorems to DC and AC circuits		CO2
UNIT-III	**ALTERNATING CURRENTS & VOLTAGES AND STEADY-STATE RESPONSE**	**Periods: 12**
The Sine Wave, Angular Relation, The sine wave equation, Voltage and Current Values of a Sine Wave, Phase Relation - Pure Resistor, Pure Inductor, Pure Capacitor; Impedance Diagram, Phasor Diagram, Computation of active, reactive and apparent powers- power triangle, power factor Steady State Response: DC Response of an R-L Circuit, DC Response of an R-C Circuit, DC Response of an R-L-C Circuit		CO3
UNIT-IV	**TWO PORT NETWORK FUNCTIONS AND PARAMETERS**	**Periods: 12**
Introduction to two port networks- Driving point impedance and admittance, Transfer impedance and admittance, Voltage and current Transfer ratio, Concept of pole-zeros in network function - Open circuit impedance (Z) parameters - short circuit admittance (Y) parameters - transmission (ABCD) parameters and inverse transmission parameters - Hybrid (h) parameters and inverse hybrid parameters - Conversion between parameters		CO4
UNIT-V	**FILTERS AND ATTENUATORS**	**Periods: 12**
Fundamentals of filters, types of filters- low pass, high pass, band pass and band elimination filters, Constant K-filters. Attenuators: Symmetric and asymmetric attenuators- T-attenuators and π-attenuators only		CO5

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

Textbooks

1. A Sudhakar and Shyammohan S. Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill Education, Fifth edition July 2017
2. A William Hayt, “Engineering Circuit Analysis” 8th Edition, McGraw-Hill Education, 2016

Reference Books

1. Valkenberg V., “Network Analysis”, 3rd Ed., Prentice Hall International Edition. 2007.
2. Hayt and Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, New Delhi, 8th Ed, 2013.
3. Kuo F. F., “Network Analysis and Synthesis”, 2nd Ed., Wiley India. 2008.
4. PM Chandrashekaraiah, Electric Circuit and Network Analysis” First edition, CBS Publishers, 2015.
5. Joseph A. Edminister, Mahmood Maqvi, “Electric Circuits”, Schaum's Outline Series, 5th edition, TMH Publishers, 2016

Web References

1. https://www.tutorialspoint.com/network_theory/network_theory_twoport_parameter_conversions.htm
2. https://www.allaboutcircuits.com/textbook/alternating-current/chpt-8/low-pass-filters/
3. https://nptel.ac.in/courses/108/105/108105159/
4. https://www.newtondesk.com/network-theory-handwritten-study-notes/
5. https://lecturenotes.in/subject/25/network-theory-nt

* 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	3	1	-	-	-	-	-	-	1	3	2	-
2	3	3	3	3	1	-	-	-	-	-	-	1	3	2	-
3	3	3	3	3	1	-	-	-	-	-	-	1	3	2	-
4	3	3	3	3	1	-	-	-	-	-	-	1	3	2	-
5	3	3	3	3	1	-	-	-	-	-	-	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	**English**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **HS**			End Semester Exam: **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
	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	**WORK STEAD 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**

Textbooks

1. Richa Mishra, Ratna Rao, “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, Tal., “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	**Mechanical Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**			End Semester Exam: **LE**			
Course Code	**U23ESPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DESIGN THINKING AND IDEA LABORATORY**	**-**	**-**	**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
	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).

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

Textbooks

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

Web References

1. 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 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	**EEE**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**				*End Semester Exam: **LE**		
Course Code	**U23EEPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL TECHNOLOGY LABORATORY**	**-**	**-**	**2**	**1**	**50**	**50**	**100**

Prerequisite	**Mathematics and Physics**		
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Understand the practical aspects of domestic wiring.	K3
	CO2	Demonstrate the operations of various Transformers.	K3
	CO3	Illustrate the operational details of the DC machines by conducting various tests.	K3
	CO4	Compare the various speed control techniques of DC motors.	K3
	CO5	Infer the performance of AC machines by conducting suitable experiments.	K3

List of Experiments:

1. Domestic Wiring Practice (Staircase Wiring, Doctor's Room Wiring, Godown Wiring)
2. Load test on single phase transformer.
3. Load test on 3 phase transformers
4. Measurement of three phase power using two wattmeter method
5. OCC and Load test on DC shunt Generator.
6. Load test on DC shunt motor.
7. Load test on DC series motor
8. Speed control methods of DC motor.
9. Load test on single phase Induction Motor.
10. Load test on 3 phase induction motor.

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

Reference Books

1. B.L. Theraja, "Electrical Technology Vol.- II AC/DC Machines", S. Chand, 2008
2. D. C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill Education Private Limited, 2nd Edition, 2019.
3. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 5th Edition, 2017.
4. V. K. Mehta & Rohit Mehta, "Principle of Electrical Machines", S. Chand Publishers, 2014.
5. D Kothari, I Nagrath, "Basic Electrical Engineering", Tata Mcgraw Hill Education, 4th Edition, 2019.
6. M. S. Sukhija, T. K Nagsarkar, "Basic Electrical Engineering", Oxford University Press, 2011.

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1. https://www.electrical4u.com/electric-machines/
2. https://www.javatpoint.com/electrical-machines-tutorial
3. https://www.coursera.org/lecture/linear-circuits-ac-analysis/5-1-transformers-dB0z9
4. https://www.elprocus.com/alternating-current-and-direct-current-and-its-applications/
5. https://www.electronicshub.org/electrical-systems-and-methods-of-electrical-wiring/

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	-	-	1	3	1	-
2	3	2	1	-	2	-	-	-	3	-	-	1	3	1	-
3	3	2	1	-	2	-	-	-	3	-	-	1	3	1	-
4	3	2	1	-	2	-	-	-	3	-	-	1	3	1	-
5	3	2	1	-	2	-	-	-	3	-	-	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 classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**ECE**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **PC**				*End Semester Exam: **LE**		
Course Code	**U23ECP101**	Periods / Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**CIRCUITS AND NETWORKS LABORATORY**	0	0	2	1	50	50	100

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Familiarize with the fundamentals of basic circuit elements.	K2
	CO2	Perform Analysis and verification of network theorems	K2
	CO3	Develop the application of theoretical concepts on circuits	K3
	CO4	Illustrate various network parameters.	K4
	CO5	Demonstrate the concepts of two port networks and simulation models	K4

List of Exercises

1. Study of passive and active components
2. Construction of series and parallel circuits using resistors and verification using KVL and KCL
3. Verification of mesh and nodal analysis
4. Verification of Thevenin's and Norton's Theorem
5. Verification of superposition Theorem
6. Verification of maximum power transfer theorem
7. DC response of RL, RC and RLC circuits
8. Determination of Z and Y parameters of a two-port network.
9. Determination of ABCD and h parameters of a two-port network.
10. Design of LPF and HPF using passive components
11. Simulate an LPF and HPF using PSPICE simulation tool and compare the results

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

Reference Books

1. Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition. 2007.
2. Hayt and Kemmerly, "Engineering Circuit Analysis," McGraw Hill Education, New Delhi, 8th Ed, 2013.
3. Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India, 2008.
4. PM Chandrashekaraiah, Electric Circuit and Network Analysis" First edition, CBS Publishers, 2015.
5. Joseph A. Edminister, Mahmood Maqvi, "Electric Circuits," Schaum's Outline Series, 5th edition, TMH Publishers, 2016

Web References

1. https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtual-lab/latest/circuit-construction-kit-dc-virtual-lab_en.html
2. https://www.circuitlab.com/editor/#?id=7pq5wm&from=homepage
3. http://vlabs.iitkgp.ac.in/be/#
4. http://www.allaboutcircuits.com/technical-articles/an-introduction-to-filters/
5. http://www.learnabout-electronics.org/ac_theory/filters81.php

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	3	-	-	-	-	-	-	-	-	3	2	2
2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
4	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
5	3	3	3	3	3	-	-	-	-	-	-	-	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	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECC1XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - I**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

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	**ECE**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **MC**			End Semester Exam: -			
Course Code	**U23ECM101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUCTION PROGRAM - (UHV-I)**	-	-	-	Non-Credit	-	-	-
Prerequisite	-							

Course Outcomes			BT Mapping
	On completion of the course, the students will be able to		
	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. R.R Gaur, R. Asthana, G.P. Bagaria," A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
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. Dr.K.K.Pillay,"Social Life of Tamils", A joint publication of TNTB & ESC and RMRL
8. R.Balakrishnan, "Journey of Civilization",Roja muthiah research publishers, 1st Edition 2019
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
5. https://education.nsw.gov.au/teaching-and-learning/curriculum/creative-arts

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	U23ESTC02	Engineering Mechanics	ES	3	0	0	3	25	75	100
3	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
4	U23ECT202	Electron Devices	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values - II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23ECP202	Electron Devices Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23ECC2XX	Certification Course – II	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23ECM202	Sports and Yoga or NSS/ NCC	MC	0	0	2	-	100	-	100
Total							**21**	**525**	**575**	**1100**

Department	**Mathematics**	Programme : **B.Tech.**						
Semester	**II**	Course Category: **BS**				End Semester Exam: **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 Outcome	On completion of the course, the students will be able to	BT Mapping
	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 series 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 Ordinary Differential Equations of second order with constant coefficients.		**CO4**
UNIT – V	**Z – TRANSFORMS**	**Periods:12**
Z-transforms – Elementary Properties – Inverse Z-transforms (using partial fraction and Residues) – Solution of difference equations using Z - transform.		**CO5**

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

Textbooks

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, 2nd Edition, 2016.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand, New Delhi, 22nd Edition 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 India Education services Pvt. Ltd, India 1st 2017.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. G. Balaji, "Engineering Mathematics - Transforms and Partial Differential Equations", 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/

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 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	**Mechanical Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **ES**			End Semester Exam: **TE**			
Course Code	**U23ESTC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MECHANICS**	**2**	**1**	**-**	**3**	**25**	**75**	**100**
(Common to EEE, ECE, MECH, CIVIL, Mechatronics Branches)								
Prerequisite	Engineering Physics							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Recognize the basics of equilibrium of particles in 2D and 3D	**K2**
	CO2	Review the requirements of equilibrium of rigid bodies in 2D and 3D.	**K2**
	CO3	Solve problem related to friction force.	**K3**
	CO4	Compute the center of mass and moment of inertia of surfaces and solids.	**K3**
	CO5	Predict displacement, velocity and acceleration of dynamic particles.	**K3**

UNIT- I	**BASICS AND STATICS OF PARTICLES**	**Periods: 09**
Introduction - Units and Dimensions - Vectorial representation of forces and moments – Coplanar Forces - Lami's theorem, Parallelogram and triangular Law of forces -Resolution of forces - Equilibrium of a particle - Principle of transmissibility - Equivalent system of force - Free body diagram		**CO1**
UNIT- II	**EQUILIBRIUM OF RIGID BODIES**	**Periods: 09**
Types of supports and their reactions -requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis -Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem -Equilibrium of Rigid bodies in two dimensions – Forces in space -Equilibrium of a particle in space - Equivalent systems of forces - Equilibrium of Rigid bodies in three dimensions (Descriptive only).		**CO2**
UNIT - III	**STRUCTURAL ANALYSIS OF TRUSSES AND FRICTION**	**Periods: 09**
Trusses - Definition of a truss - Simple Trusses - Analysis of Trusses - Method of joints - Method of sections - Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction -wedge friction- Rolling resistance.		**CO3**
UNIT - IV	**PROPERTIES OF SURFACES AND SOLIDS**	**Periods: 09**
Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas- Parallel axis theorem and perpendicular axis theorem, radius of gyration of area- product of inertia- mass moment of inertia.		**CO4**
UNIT - V	**DYNAMICS OF PARTICLES**	**Periods: 09**
Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy Equation of particles -Impulse and Momentum -Impact of elastic bodies.		**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Textbooks

1. Beer, and Johnston Jr. E.R. "Vector Mechanics for Engineers", McGraw-Hill Education India Pvt Ltd., 11th Edition, 2016.
2. J.L. Meriam & L.G. Karidge, Engineering Volume I and Engineering Mechanics: Dynamics, 8th edition, Wiley student edition, 2016.
3. R.C, Hibbeller, "Engineering Mechanics", Prentice Hall, 14th edition, 2016.

Reference Books

1. Arthur P. Boresi and Richard J. Schmidt, “Engineering Mechanics: Statics and Dynamics”, Thomson Asia
2. Private Limited, Singapore, 2010.
3. D.P.Sharma “Engineering Mechanics”, Dorling Kindersley India Pvt. Ltd, New Delhi, 2010
4. S.Rajasekaran, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2012.
5. S.S.Bhavikatti and K.G. Rajashekarappa, Engineering Mechanics, New Age International(P) Ltd, New Delhi, 7th Edition, 2019.

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2. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/Engineeringmechanics/Tableof Contents.html
3. https://nptel.ac.in/courses/112/106/112106286/
4. https://www.coursera.org/learn/engineering-mechanics-statics
5. https://nptel.ac.in/courses/122/104/122104014/

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	2	-	2
2	3	2	2	3	-	-	-	-	-	-	-	1	2	-	2
3	3	2	2	3	-	-	-	-	-	-	-	1	2	-	2
4	3	2	2	3	-	-	-	-	-	-	-	1	2	-	2
5	3	2	2	3	-	-	-	-	-	-	-	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
	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	**CSE**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **ES**			End Semester Exam: **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 basics of Computers.	**K2**
	CO2 Illustrate the concepts of control structures and looping.	**K2**
	CO3 Implement programs using arrays and functions.	**K3**
	CO4 Demonstrate programs using Structure and Pointers.	**K3**
	CO5 Build the programs using Union and 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 – Pointer's 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**

Textbooks

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, FourthEdition,2014

Reference Books

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

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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/

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 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	**Electronics and Communication Engineering**	Programme: B.**Tech**.						
Semester	**II**	Course Category: **PC**				*End Semester Exam: **TE**		
Course Code	**U23ECT202**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**ELECTRON DEVICES**	3	-	-	3	25	75	100

Prerequisite	**Mathematics and Physics**		
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Explain the basic semiconductor theory concepts about the various diodes with its applications.	K1
	CO2	Summarize the working principle and characteristics of BJTs and its various configurations.	K2
	CO3	Interpret the working principle and characteristics of JFET and MOSFETs.	K2
	CO4	Explain the characteristic of Special Semiconductor devices and other power devices.	K1
	CO5	Discuss the operation of Rectifiers and Regulators.	K2

UNIT- I	**SEMICONDUCTOR DIODES**	**Periods: 09**
Diode: PN Junction Diode, Resistance Levels, Diode Equivalent Circuits, Transition and Diffusion Capacitance, Reverse Recovery Time, Zener Diodes, Point - Contact Diode. Diode Applications - Series Diode Configurations - Parallel and Series-Parallel Configurations – Clippers – Clampers - Voltage-Multiplier Circuits.		CO1
UNIT- II	**BIPOLAR JUNCTION TRANSISTORS**	**Periods: 09**
BJT: Construction and operation of NPN and PNP transistors- Current equations, Types of Configurations - CE, CB, CC - Early Effect. Hybrid Equivalent model, Ebers Moll Model.		CO2
UNIT- III	**FIELD EFFECT TRANSISTORS**	**Periods: 09**
FET: JFETs – Construction and Characteristics, - Pinch off voltage MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET-Characteristics – Comparison of MOSFET with JFET, NMOS, PMOS, CMOS.		CO3
UNIT- IV	**SPECIAL SEMICONDUCTOR DEVICES**	**Periods: 09**
Metal-Semiconductor Junction- Schottky barrier diode, Varactor diode, Tunnel diode, Dual-Gate MOSFET, FINFET, MESFET, PINFET, CNTFET, Gallium Arsenide device. Power Devices: Construction, operation and applications of UJT, SCR, DIAC, TRIAC		CO4
UNIT- V	**APPLICATIONS OF SEMICONDUCTOR DEVICES**	**Periods: 09**
Rectifiers and Filters: Half wave, Full wave and bridge rectifier, Ripple factor calculation for C, L, LC and CLC filter. Regulators: Voltage regulators, Shunt voltage regulator, Series voltage regulator, short circuit protection circuit, Current limiting circuit, Fold back limiting, switching regulator		CO5

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

Textbooks

1. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, “Electronic Devices and circuits,” Fifth Edition, Tata McGraw- Hill, 2012
2. Robert L. Boylestad, “Electronic Devices and Circuit Theory,” Pearson, 11th edition 2015
3. David A. Bell,” Electronic devices and circuits,” Oxford University higher education, 5th edition 2008

Reference Books

1. Sedra and Smith, “Microelectronic Circuits”, Oxford University Press, 5th Edition, 2005.
2. Donald A Neaman, “Semiconductor Physics and Devices,”4th edition, McGraw Hill Education India Private Ltd., 2011.
3. Thomas L. Floyd, “Electronic devices” Conventional current version, Pearson prentice hall, 10th Edition, 2017.
4. Balbir Kumar, Shail.B. Jain, “Electronic devices and circuits” PHI learning private limited, 2nd edition, 2014.
5. J. Millman, C. Halkias and Chetan D. Parikh, “Integrated Electronics” Tata McGraw Hill, 2nd edition

2010
6. Muhammed H. Rashid, “Power Electronics”, Pearson Education/PHI, 2004.

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1. https://www.electrical4u.com/diode-working-principle-and-types-of-diode/
2. https://www.allaboutcircuits.com/video-tutorials/transistors/
3. https://onlinelibrary.wiley.com/doi/full/10.1002/inf2.12016
4. https://nptel.ac.in/courses/117/106/117106091/
5. https://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	3	3	2	2	1	-	-	-	-	-	1	3	1	-
2	3	3	2	3	2	1	-	-	-	-	-	1	3	1	-
3	3	3	2	3	2	2	-	-	-	-	-	1	3	1	-
4	3	2	3	3	2	1	-	-	-	-	-	1	3	1	-
5	3	2	3	2	3	1	-	-	-	-	-	1	3	1	-
6	3	2	3	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	10		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	**II**	Course Category: **HS**				End Semester Exam: **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 Branch)								
Prerequisite	UHV - I							

Course Outcomes			BT Mapping
	On completion of the course, the students will be able to		
	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**

Textbook

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

Reference Books

1. A Nagraj, Jeevan Vidya Prakashan, Amarkantak, "Jeevan Vidya: EkParichaya", 2013.
2. A.N. Tripathi, "Human Values", New Age International Publishers, New Delhi, 3rd Edition, 2019.
3. Annie Leonard, "The Story of Stuff", Free Press, Reprint Edition, 2011.
4. Mohandas Karam chand Gandhi, "The Story of My Experiments with Truth – Mahatma Gandhi Autobiography", Fingerprint Publisher, 2009.

5. E. F Schumacher, “Small is Beautiful”, Vintage Publisher, 1993.
6. Cecile Andrews, “Slow is Beautiful”, New Society Publishers, 2006.
7. J C Kumarappa, “Economy of Permanence”, Sarva Seva Sangh Prakashan, 2017.
8. Pandit Sunderlal, “Bharat Mein Angreji Raj”, Prabhat Prakashan Publisher, 2021.
9. Dharampal, “Rediscovering India”, Stosius Inc/Advent Books Division Publisher, 1983.
10. Mohandas K. Gandhi, “Hind Swaraj or Indian Home Rule”, Gyan Publishing House, 2023.
11. Maulana Abdul Kalam Azad, “India Wins Freedom”, Orient BlackSwan Publisher, 1st Edition, 1988.
12. Life of Vivekananda, **“**Romain Rolland (English)”, Advaita Ashrama Publisher, India, 4th Edition, 2010.
13. Mahatma Gandhi, “Romain Rolland (English)”, Srishti Publishers & Distributors, 2020.

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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 Methods

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: **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
	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**

Textbooks

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

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

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	**Mechanical**	Programme : **B.Tech.**						
Semester	**First / Second**	Course Category: **ES**			End Semester Exam: **LE**			
Course Code	**U23ESPC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING GRAPHICS USING AUTOCAD**	**-**	**-**	**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
	CO1	Familiarize with the fundamentals and standards of engineering graphics.	**K3**
	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 bedrooms, 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: 30**	**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

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	**CSE**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **ES**			End Semester Exam: **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 Outcome		On completion of the course, the students will be able to	BT Mapping
	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

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

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 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	**Electronics and Communication Engineering**	Programme: **B.Tech**.						
Semester	**II**	Course Category: **PC**			*End Semester Exam: **LE**			
Course Code	**U23ECP202**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**ELECTRON DEVICES LABORATORY**	-	-	2	1	50	50	100

Prerequisite	**Mathematics and Physics**	
Course Outcome	On completion of the course, the students will be able to	**BT** Level
	CO1 Examine the VI characteristics of various semiconductor diodes	K4
	CO2 Inspect the Input -Output Characteristics of various configurations of BJT	K4
	CO3 Distinguish the characteristics of JFET and MOSFET	K4
	CO4 Illustrate the electrical characteristics SCR and UJT	K4
	CO5 Predict the diodes used for Rectifiers, Voltage regulators, Clippers and Logic Gates verification	K3

List of Experiments:

List of Lab Activities and Experiments

1. V-I characteristics of semiconductor diodes
    i. PN Junction diode
    ii. Point contact diode
    iii. Zener diode
2. Characteristics of BJT in CB configuration
    i. Determination of input and output characteristics
    ii. Determination of voltage gain, current gain, input and output resistances from the characteristics
3. Characteristics of BJT in CE configuration
    i. Determination of input and output characteristics
    ii. Determination of voltage gain, current gain, input and output resistances from the characteristics
4. Characteristics of JFET
    i. Determination of output and transfer characteristics
    ii. Determination of pinch-off voltage, Rd, Gm and μ from the characteristics
5. Characteristics of MOSFET
    i. Determination of output and transfer characteristics
    ii. Determination of pinch-off voltage, rd, gm and μ from the characteristics
6. Characteristics of UJT and SCR.
7. Characteristics of photonic devices
    i. Determination of V-I characteristics of LED
    ii. Determination of V-I and intensity characteristics of phototransistor
8. Rectifiers and Voltage Regulators
    i. Determination of ripple factor for different types of rectifiers with and without filters.
    ii. Voltage regulation characteristics of the shunt, series and IC regulators
9. Clipper circuits using diodes: Positive, negative, biased and combinational clippers.
10. Switching circuit
    i. AND and OR logic gates using diodes.
    ii. NOT gate using transistor

Reference Books

1. Sedra and Smith, “Microelectronic Circuits,” Oxford University Press, 5th Edition, 2005.
2. Donald A Neaman, “Semiconductor Physics and Devices,”4th edition, McGraw Hill Education India Private Ltd., 2011.
3. Thomas L. Floyd, “Electronic devices” Conventional current version, Pearson prentice hall, 10th Edition, 2017.
4. Balbir Kumar, Shail.B. Jain, “Electronic devices and circuits” PHI learning private limited, 2nd edition, 2014.
5. J. Millman, C. Halkias and Chetan D. Parikh, “Integrated Electronics” Tata McGraw Hill, 2nd edition 2010
6. Muhammed H. Rashid, “Power Electronics”, Pearson Education/PHI, 2004.

Web References

1. https://www.industrial-electronics.com/experiments_0.html
2. http://www2.ece.ohio-state.edu/ee327/
3. http://www.vlab.co.in/broad-area-electronics-and-communications.
4. https://www.electrical4u.com/diode-working-principle-and-types-of-diode/
5. https://www.allaboutcircuits.com/video-tutorials/transistors/

* 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	2	2	-	-	-	-	-	-	1	3	1	-
2	3	1	2	2	2	-	-	-	-	-	-	1	3	1	-
3	3	2	3	2	2	-	-	-	-	-	-	1	3	1	-
4	3	2	3	2	2	-	-	-	-	-	-	1	3	1	-
5	3	2	3	2	2	-	-	-	-	-	-	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 classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECC2XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - II**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23ECM202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sports and Yoga or NSS/ NCC**	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

III - Semester

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	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
3	U23ECT302	Electronic Circuits	PC	3	0	0	3	25	75	100
4	U23ECT304	Sensors and their Applications	PC	3	0	0	3	25	75	100
5	U23ECT305	Engineering Electromagnetics	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ECB301	Signals and Systems	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	General Proficiency – I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
10	U23ECP303	Electronic Circuits Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23ECC3XX	Certification Course – III	AEC	0	0	4	-	100	-	100
12	U23ECS301	Skill Enhancement Course – I: PCB Design	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ECM303	Climate Change	MC	2	0	0	-	100	-	100
Total							**23**	**675**	**625**	**1300**

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **BS**				*End Semester Exam: **TE**		
Course Code	**U23MATC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROBABILITY AND STATISTICS**	**3**	**1**	**-**	**4**	**25**	**75**	**100**

(Common to All Branches Except CSBS)

Prerequisite	Basic Probability	
Course Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Understand the concept of probability.	**K3**
	CO2 Solve the problem of 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**

Textbooks

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, 15th Edition, 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	**Artificial Intelligence and Data Science**	Programme: **B.Tech**						
Semester	**III**	Course Category: **ES**			End Semester Exam: **TE**			
Course Code	**U23ADTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN PYTHON**	**3**	**0**	**0**	**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**
CO1	Interpret the basic concepts of Python programs.	**K2**
CO2	Articulate the concepts of Sets, Dictionaries, and Object-Oriented concepts.	**K2**
CO3	Experiment with the NumPy package.	**K3**
CO4	Apply and analyze Data Manipulation with Pandas.	**K3**
CO5	Illustrate programming concepts 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**

Textbooks

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

*** 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	3	-	-	-	-	-	-	-	2	2	2
2	2	3	2	2	3	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3
5	3	3	3	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	**III**	Course Category**: PC**				*End Semester Exam**: TE**		
Course Code	**U23ECT302**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONIC CIRCUITS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Knowledge of electronic components, circuit analysis**		
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Design the amplifier circuits using various biasing methods.	**K2**
	CO2	Analyze the single-stage BJT amplifiers using a small signal equivalent model	**K4**
	CO3	Illustrate the design and analyze multistage and feedback amplifiers	**K3**
	CO4	Determine the frequency response of amplifiers	**K3**
	CO5	Analyze the Oscillators, large-scale amplifiers and their classifications	**K4**

UNIT-I	**BIASING AND STABILITY**	**Periods:09**
Introduction – Transistor Biasing – Types of Configurations – Transistor as an Amplifier – Large Signal, DC and Small Signal CE Values of Current Gain – Bias Stability – Methods of Transistor Biasing – Bias Compensation – Biasing the FET – Use of JFET as Voltage Variable Resistor – Charge Transfer Devices (CTDs).		CO1
UNIT-II	**SMALL SIGNAL AMPLIFIERS**	**Periods:09**
Introduction - Two port Devices and Network Parameters – The Hybrid Model for Two Port Network – Analysis of a Transistor Amplifier Circuit using h parameters – Simplified CE Hybrid Model – Analysis of CC and CB Amplifier using the Approximate Model – BJT Amplifiers – Single Stage Amplifiers – Small Signal Analysis of Single Stage BJT Amplifier – FET Amplifier – The FET Small Signal Model		CO2
UNIT-III	**MULTISTAGE AMPLIFIERS AND FEEDBACK AMPLIFIERS**	**Periods:09**
Introduction – Different Coupling Schemes Used in Amplifiers – Direct Coupled (D.C.) -RC Coupled Amplifier - Transformer Coupled Amplifier- General Analysis of Cascade Amplifiers. **Feedback Amplifiers:** Basic concept of feedback, Transfer gain with feedback - Voltage Series, Voltage Shunt, Current Series, Current Shunt.		CO3
UNIT-IV	**FREQUENCY RESPONSE OF AMPLIFIERS**	**Periods:09**
Introduction – General shape of Frequency Response of Amplifier –Low Frequency response of Transistor Amplifier – Effect of Coupling Capacitor C_C on Low-Frequency Amplifier – High-Frequency π Model for a Transistor – FET Model at High Frequency – Frequency Response of FET Amplifier.		CO4
UNIT-V	**OSCILLATORS AND POWER AMPLIFIER**	**Periods:09**
OSCILLATORS**:** Introduction – Classification of Oscillators – Conditions for Oscillation –– Hartley Oscillator – Colpitts Oscillator – RC Phase Shift Oscillator POWER AMPLIFIER: Classification Based on Biased Condition – Class A Large Signal Amplifiers- Transformer Coupled Class A Audio Power Amplifier-Efficiency of Class A, Class B Amplifiers – Push Pull Amplifier- Complementary Symmetry (Class B) Push Pull Amplifier.		CO5

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

Textbooks

1. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 4th Edition, McGraw Hill Education (India) Private Ltd., 2017
2. David A. Bell, Electronic Devices & Circuits, 5th Edition, Oxford University Press, 2008.

Reference Books

1. Millman J, Halkias.C.andSathyabradaJit, Electronic Devices and Circuits, 4th Edition, McGraw Hill Education (India) Private Ltd., 2015.
2. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, McGraw Hill Education (India) Private Ltd., 2010.

Web References

1. https://nptel.ac.in/courses/108102095
2. https://lecturenotes.in/subject/7/analog-electronic-circuits-aec
3. https://gradeup.co/electronics-communication-exams/analog-circuits
4. http://www.electronics.teipir.gr/personalpages/papageorgas/download/2/shmeiwseis/ELECTRONIC_COMPONENTS/varistor/Analog_Electronics.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	2	1	2	1	1	-	-	-	-	-	-	1	3	-	-
2	3	2	2	1	1	-	-	-	-	-	-	1	3	-	-
3	3	2	2	1	1	-	-	-	-	-	-	1	3	-	-
4	3	2	2	1	1	-	-	-	-	-	-	1	3	-	-
5	2	1	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	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	**III**	Course Category: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ECT304**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SENSORS AND THEIR APPLICATIONS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Explain the principles of the sensor and illustrate the calibration	**K2**
	CO2	Analyze different types of range and sensors	**K2**
	CO3	Determine the principles of Force, magnetic, and heading sensors	**K3**
	CO4	Analyze different optical and thermal sensors	**K4**
	CO5	Select and apply suitable sensors for real-time applications	**K4**

UNIT-I	**FUNDAMENTALS OF SENSORS**	**Periods:09**
Definition and Classification of sensors - Parameters of sensors - Sensor Characteristics - Study of Static and Dynamic Characteristics – Errors in Measurement – Calibration and Standards – Principle of Physical and Chemical transduction - Sensor reliability and stability Study.		**CO1**
UNIT-II	**MOTION, PROXIMITY AND RANGING SENSING SYSTEMS**	**Periods:09**
Motion Sensors– Potentiometers, Resolver, Encoders–Optical, Magnetic, Inductive, Capacitive, LVDT–RVDT, Accelerometer– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).		**CO2**
UNIT-III	**FORCE, MAGNETIC AND HEADING SENSORS**	**Periods:09**
Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement, and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.		**CO3**
UNIT-IV	**OPTICAL, PRESSURE AND TEMPERATURE SENSORS**	**Periods:09**
Photoconductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric–Tactile sensors, Temperature–IC, Thermistor, RTD, Thermocouple. Flow and Level measurement, Radiation Sensors, Smart Sensors, Flim Sensors		**CO4**
UNIT-V	**APPLICATIONS IN MODERN ENGINEERING**	**Periods:09**
Application of sensors: Onboard automobile sensors, home appliance sensors, aerospace sensors, medical diagnostics sensors, and sensors for environmental monitoring. Sensors in Manufacturing.		**CO5**

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

Textbooks

1. Patranabis D.," Sensor and Transducers", Prentice Hall of India (Pvt) Ltd., second edition 2005 (revised).
2. Renganathan S.," Transducer Engineering", Allied Publishers (P) Ltd.,2005(revised).
3. D.V.Murthy.," Transducers and Instrumentation" PHI Learning Private Limited., Rajkamal Electric Press, second editin,2011.
4. Sabrie Solomon.," Sensors Handbook" McGraw-Hill, Second Edition,2020.

Reference Books

1. Bradley D.A., and Dawson, Burd and Loader, "Mechatronics, Thomson Press India Ltd",2004.
2. Bolton W, "Mechatronics", Thomson Press, third edition,2004.
3. Ian R Sinclair, —Sensors and Transducers‖, Third Edition, Newnes publishers,2001.
4. RobertB. Northrop, "Introduction to Instrumentation and Measurement", 3rdEdition", CRC Press Taylor and Francis Group,2005
5. CurtisD. Johnson, "Process Control Instrumentation Technology", Prentice Hall International Edition, 2015.

Web References

1. https://www.first-sensor.com/en/applications/industrial/
2. https://www.finoit.com/blog/top-15-sensor-types-used-iot/
3. https://www.iaasiaonline.com/smart-sensors-for-industrial-applications-2/
4. https://www.plantautomation-technology.com/articles/types-of-sensors-used-in-industrial-automation
5. https://www.thomasnet.com/articles/instruments-controls/sensors
6. https://onlinecourses.nptel.ac.in/noc21_ee32/preview
7. https://onlinecourses.nptel.ac.in/noc23_ee95/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	2	2	1	1	1	-	-	-	-	-	-	1	2	1	-
2	2	1	2	1	1	-	-	-	-	-	-	1	2	1	-
3	2	1	2	1	1	-	-	-	-	-	-	1	2	1	-
4	2	1	2	1	1	-	-	-	-	-	-	1	2	1	-
5	2	2	1	1	2	-	-	-	-	-	-	1	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	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	**III**	Course Category**: PC**			*End Semester Exam**: TE**			
Course Code	**U23ECT305**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING ELECTROMAGNETICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Differential and Integral Calculus	
Course Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Infer different types of coordinate systems and use them for solving the problems of electromagnetic field theory.	**K2**
	CO2 Apply basic laws of electrostatics to determine force and electric field intensity.	**K2**
	CO3 Infer magnetic vector quantities, inductance, and energy densities of various cables.	**K2**
	CO4 Explain the magnetostatics of circuits using basic relations to analyze the effect of magnetic forces, materials and calculate inductance.	**K2**
	CO5 Understand electromagnetic wave propagation and characterize its parameters.	**K2**

UNIT-I	**VECTOR ANALYSIS**	**Periods:09**
Scalar and Vectors - Vector Algebra - Vector components and unit vector - Different Co-ordinate Systems: Cylindrical and Spherical-Relationship between Co-ordinate systems - vector field - Gradient, Divergence and Curl - Divergence theorem - Stoke's theorem.		**CO1**
UNIT-II	**ELECTROSTATICS**	**Periods:09**
Coulomb's Law-Electric field intensity (E) - Field due to point and continuous charges distribution-Field of a line charge Field of a sheet charge - Electric flux density (D) - Gauss's law - Application of Gauss's Law - Electrical potential- Point charge and system of charge- Electric dipole –Capacitance.		**CO2**
UNIT-III	**MAGNETOSTATICS**	**Periods:09**
Lorentz Law of force, magnetic field intensity (H) - Biot-Savart's Law - Ampere's Law - Magnetic field intensity due to straight conductors, an infinite sheet of current, at the centre of the toroid, along the axis of the circular loop and solenoid – Magnetic Flux-Magnetic flux density (B) – Derivation of the steady magnetic field.		**CO3**
UNIT-IV	**MAGNETIC FORCES AND MATERIALS**	**Periods:09**
Magnetic materials - Magnetization - Boundary conditions – Magnetic Scalar and vector potential - Magnetic force – Force on a moving charge, differential current element- Force between differential current element- Torque on a closed circuit - Inductance and mutual inductance.		**CO4**
UNIT-V	**ELECTROMAGNETIC WAVES**	**Periods:09**
Faraday's laws, Induced EMF - Maxwell's Equations: Differential and integral form – Electro Magnetic Wave equations - Wave parameters: velocity, intrinsic impedance, propagation constant – Uniform plane wave and its properties - Waves in free space, dielectrics, conductor-Skin depth-Poynting vector and Poynting Theorem.		**CO5**
Lecture Periods:45	**Tutorial Periods: -** **Practical Periods: -**	**Total Periods:45**

Textbooks

1. Mathew N. O. Sadiku, Elements of Electromagnetics, Oxford University Press, 6th Edition, 2014.
2. William. H. Hayt, Engineering Electromagnetics, Tata McGraw Hill, 7th Edition, 2012.
3. Kraus, John D.., Fleisch, Daniel A.. Electromagnetics: With Applications. Singapore: WCB/McGraw-Hill, 1999.

Reference Books

1. K.A.Gangadhar, Field Theory, Khanna Publishers, New Delhi, 16th Edition, 2015.
2. 2 S.P. Ghosh and LipikaDatta, Electromagnetic Field Theory, Tata McGraw Hill Educational Private Limited New Delhi, First Edition, 2012.
3. Joseph.A.Edminister, Thoery and problems of Electromagnetics, Schaum Series, Tata McGraw Hill, Second Edition, 1993.

Web References

1. https://archive.nptel.ac.in/courses/108/104/108104087/
2. https://archive.nptel.ac.in/courses/108/101/108101112/
3. https://onlinecourses.nptel.ac.in/noc20_ee20/preview
4. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7397573
5. https://archive.nptel.ac.in/courses/108/106/108106073/

*** 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	1	1
2	3	2	1	1	-	-	-	-	-	-	-	-	3	1	1
3	3	2	1	1	-	-	-	-	-	-	-	-	3	1	1
4	3	2	1	1	-	-	-	-	-	-	-	-	3	1	1
5	3	2	1	1	-	-	-	-	-	-	-	-	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**III**	Course Category: **PC**				*End Semester Exam: **TE & LE**		
Course Code	**U23ECB301**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SIGNALS AND SYSTEMS**	**2**	**-**	**2**	**3**	**50**	**50**	**100**

Prerequisite	• Solid understanding of differential and integral calculus. • Basic knowledge of matrix operations and eigenvalues/eigenvectors. • Ability to solve ordinary differential equations and grasp Laplace transforms.		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping
	CO1	Classify and perform operations on various types of signals and systems continuous and discrete time signals.	**CO1**
	CO2	Apply Fourier, Laplace and Z-transforms on continuous and discrete time signals.	**CO2**
	CO3	Develop the responses of continuous and discrete-time systems	**CO3**
	CO4	Experiment with continuous and discrete-time signals using MATLAB.	**CO4**
	CO5	Solve the impulse, step responses and perform convolutions using MATLAB.	**CO5**

UNIT-I	**INTRODUCTION TO SIGNALS AND SYSTEMS**	**UNIT-I**
Standard Signals - Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals- Deterministic & Random signals, Periodic & Aperiodic signals, Odd & Even signals, Energy & Power signals, Causal & Non-causal, Operation on Signals, Classification of Systems-CT systems & DT systems- Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.		**CO1**
UNIT-II	**ANALYSIS OF CONTINUOUS AND DISCRETE TIME SIGNALS**	**UNIT-II**
Continuous Time Signals: Continuous Time Fourier Transform (CTFT)-Properties, Inverse Continuous Time Fourier Transform, Dirichlet Conditions, Laplace Transform- Properties, Inverse Laplace Transform **Discrete Time Signals:** Discrete Time Fourier Transform (DTFT)-Properties, Inverse Discrete Time Fourier Transform, Z-Transform-Properties, Inverse Z-Transform- Partial fraction and Long Division Method.		**CO2**
UNIT-III	**ANALYSIS OF CONTINUOUS AND DISCRETE-TIME SYSTEMS**	**UNIT-III**
Continuous Time Systems- Transfer function, Step response, Impulse response, Convolution Integral, Block diagram representation- Cascade & Parallel form **Discrete Time Systems**- System function, Step response, Impulse response, Convolution Sum, Block diagram representation- Cascade & Parallel form		**CO3**
UNIT-IV	**GENERATION AND ANALYSIS OF SIGNALS USING MATLAB**	**UNIT-IV**
1. Write a MATLAB program to generate Continuous-time signals 2. Write a MATLAB program to generate Discrete time signals. 3. Write a MATLAB program to perform mathematical operation on signals. 4. Compute and plot the Continuous Time Fourier Transform (CTFT) of a given signal and its magnitude and phase spectra using MATLAB.		**CO4**
UNIT-V	**ANALYSIS OF SYSTEMS USING MATLAB**	**Periods: 15**
1. Write a MATLAB program to compute and plot the impulse response of a given discrete-time system with a specified system function. 2. Write a MATLAB program to compute and plot the step response of a given discrete-time system with a specified system function. 3. Write a program to compute and plot the convolution integral of two continuous-time signals. 4. Write a program to compute and plot the convolution sum of two discrete-time signals.		**CO5**

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

Textbooks

1. A. Nagoor Kani, “Signals and Systems”, Tata McGraw Hill Education Private Limited,2010
2. Alan V. Oppenheim, Alan S. Will sky, Syed Hamid Nawab, “Signals and Systems”, 2nd Edition, Pearson Education, 2015
3. Vinay K. Ingle and John G.Proakis, Digital Signal Processing using MATLAB, Cengage learning, Third Edition, 2011.
4. P. Ramesh Babu,” Signals and Systems”, Fifth Edition, SciTech Publishers, 2014

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1. B. P. Lathi, “Principles of Linear Systems and Signals”, 2nd Edition, Oxford, 2009
2. M. J. Roberts, “Signals and Systems Analysis using Transform methods and MATLAB”, McGraw- Hill Education, 2018
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.
4. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems – Continuous and Discrete”, Pearson, 2007.

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1. https://www.studocu.com/row/document/qassim-university/signal-and-system/signals-and-systems-lab-manual/7736836
2. https://infonics.files.wordpress.com/2015/03/signals-systems-using-matlab-luis-f-chaparro.pdf
3. https://nptel.ac.in/courses/108/104/108104100/
4. http://signalsandsystems.wikidot.com/notes-signals-problems
5. http://signalsandsystems.wikidot.com/problems
6. https://archive.nptel.ac.in/courses/108/106/108106163/
7. https://testbook.com/objective-questions/mcq-on-signals-and-systems--5eea6a0839140f30f369d725
8. https://www.sanfoundry.com/1000-signals-systems-questions-answers/

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	-	-	3	3	1	-
2	3	2	2	2	2	-	-	-	1	-	-	3	3	1	-
3	3	2	2	2	2	-	-	-	1	-	-	3	3	1	-
4	3	2	2	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 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
Conduction of Practical	15	End Semester Practical Conduction	15	
Report	10	Result	10	
Viva	5	Viva	5	
Total	30	Total	30	

Department	**English**	Programme**: B.Tech.**						
Semester	**III**	Course Category **HS**				*****End Semester Exam: **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 Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Interpret meaning and apply reading strategies in technical and non-technical contexts	**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 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 a 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**

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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.

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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	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

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

Evaluation Method

<table>
<tr><td colspan="5">Practical</td></tr>
<tr><td colspan="2">Continuous Assessment Internal Evaluation</td><td colspan="2">End Semester External Evaluation</td><td>Total Marks</td></tr>
<tr><td colspan="2">50 marks</td><td colspan="2">50 marks</td><td rowspan="7">100</td></tr>
<tr><td>Conduction of Practical
(Assignment 1&2 -10 Marks
Performance in practical classes - 5 Marks)</td><td>15</td><td>Listening (L)</td><td>20</td></tr>
<tr><td>Record</td><td>5</td><td>Speaking(S)</td><td>10</td></tr>
<tr><td>Viva</td><td>5</td><td>Reading(R)</td><td>10</td></tr>
<tr><td>Model Practical Examination
(Model Exam is conducted for 50 Marks that will be converted to 15 Marks)</td><td>15</td><td rowspan="2">Writing(W)</td><td rowspan="2">10</td></tr>
<tr><td>Attendance</td><td>10</td></tr>
</table>

Department	**Mathematics**	**Programme: B.Tech.**						
Semester	**III**	Course Category: **BS**			*****End Semester Exam: **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 Outcome	On completion of the course, the students will be able to	**BT Mapping**
	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, eigenvalues, 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 for f(x).
6. Find the Laplace Transform for 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: 30**	**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.

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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	1	1
2	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
3	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
4	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
5	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
	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	**Artificial Intelligence and Data Science**	Programme: **B.Tech**						
Semester	**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**
	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 with the concept using data visualization.	**K3**
	CO5	Analyze real-time datasets,	**K3**

List of Exercises

1. Build a Python program to implement the Fibonacci series.
2. Build a Python program to get a range of numbers from the 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 the 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 the 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. Implement an application to process 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.

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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

*** 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	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 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

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

Department	**Electronics and Communication Engineering**		Programme**: B.Tech**					
Semester	**III**		Course Category**: PC**			*****End Semester Exam**: LE**		
Course Code	**U23ECP303**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONIC CIRCUITS LABORATORY**		**-**	**-**	**2**	**1**	**50**	**50**	**100**
Prerequisite	Ability to assemble a circuit on a breadboard, and test and troubleshoot prototype circuits.							
Course Outcome	On completion of the course, the students will be able to							**BT Mapping**
	CO1	Design and Test Single stage BJT/JFET amplifiers						**K2**
	CO2	Design and Test Multistage amplifiers						**K2**
	CO3	Design and test the performance of multistage amplifiers						**K3**
	CO4	Construct and verify the characteristics of Oscillators.						**K3**
	CO5	Simulate and analyze the oscillators using Multisim.						**K3**

List of Experiments:

1. Design and implement the Common Emitter Amplifier and test its performance with and without load.
2. Design and implement the FET Amplifier and test its performance with and without load.
3. Analysis of Cascade amplifiers.
4. Design and construct Current Series feedback amplifiers.
5. Design and construct Voltage Shunt feedback amplifiers.
6. Characteristics of Hartley Oscillators
7. Characteristics of Colpitts Oscillators
8. Design and construct a Class A Power amplifier.
9. Characteristics of RC phase shift oscillator and test its Performance.
10. Simulate the experiment listed from 1 to 9 using Multisim.

Reference Books

1. Donald A Neaman, Electronic Circuits Analysis and design, 7th Edition
2. Muhammad H. Rashid, Microelectronic Circuits: Analysis and Design, 3rd Edition, Cengage Learning
3. David A. Bell, Electronic Devices and Circuits, Prentice Hall of India, 5th edition

Web References

1. https://nptel.ac.in/courses/108102095/
2. https://www.docsity.com/en/exercises/engineering/analogue-ic-design/
3. http://www.owlnet.rice.edu/~dodds/Files331/analog_expt.
4. https://www.allaboutcircuits.com/worksheets/
5. https://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	1	-	-	-	-	-	-	-	-	-	3	-	2
2	3	2	1	-	-	-	-	-	-	-	-	-	3	-	2
3	2	2	2	-	-	-	-	-	-	-	-	-	3	-	2
4	2	2	2	-	-	-	-	-	-	-	-	-	3	-	2
5	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
	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	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECC3XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - III**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **AEC**			*End Semester Exam: -			
sCourse Code	**U23ECS301**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE - I: PCB DESIGN**	**-**	**-**	**2**	**-**	**-**	**-**	**100**

Prerequisite	Basics of Electronic Components and Circuits	
Course Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Infer the fundamentals 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 Experiments:

List of Lab Experiments

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 netlist - Creating a netlist - 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 a schematic tool. - Design transfer using a Netlist. - 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.

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”, ELSEVIER SCIENCE & 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.

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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-boardbasics.php
5. https://resources.pcb.cadence.com/blog/2019-what-is-the-pcb-fabrication-process-an-introduction

*** 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	2	-	-	-	2	-	-	1	3	3	1
2	3	1	2	1	2	-	-	-	2	-	-	1	3	3	1
3	3	1	2	1	2	-	-	-	2	-	-	1	3	3	1
4	3	1	2	1	2	-	-	-	2	-	-	1	3	3	1
5	3	1	2	1	2	-	-	-	2	-	-	1	3	3	1

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

Evaluation Method

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

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

Department	**Electronics and Communication Engineering**	Programme**: B.Tech.**						
Semester	**III**	Course Category **MC**				*****End Semester Exam: **LE**		
Course Code	**U23ECM303**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CLIMATE CHANGE**	**-**	**-**	**2**	**-**	**100**	**-**	**100**

Prerequisite	Basics of English Language

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 Feedback-The Montreal Protocol UNFCCC - IPCC Evidence 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: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods: 30**

Textbooks

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
5. Dash Sushil Kumar, "Climate Change an Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

1. Bill McKibben (2012), The Global Warming Reader: A Century of Writing About Climate Change, Penguin.
2. Jason Smerdon (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.

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

*** TE – Theory Exam, LE – Lab Exam**

Evaluation Method

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

IV- Semester

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC04	Numerical Methods and Optimization	BS	3	1	0	4	25	75	100
2	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
3	U23ECT406	Operational Amplifiers and Applications	PC	3	0	0	3	25	75	100
4	U23ECT407	Digital Circuits	PC	3	0	0	3	25	75	100
5	U23ECE4XX	Professional Elective – I	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ECB402	Analog Communication	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency -II	HS	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23ECP404	Integrated Circuits Laboratory	PC	0	0	2	1	50	50	100
10	U23ECP405	Digital Circuits Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23ECC4XX	Certification Course – IV	AEC	0	0	4	-	100	-	100
12	U23ECS402	Skill Enhancement Course - II: Repair and Maintenance of Electronics Equipment	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ECM404	Right to Information and Good Governance	MC	2	0	-	-	100	-	100
Total							**23**	**675**	**625**	**1300**

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **BS**				*End Semester Exam: **TE**		
Course Code	**U23MATC04**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NUMERICAL METHODS AND OPTIMIZATION**	**3**	**1**	**-**	**4**	**25**	**75**	**100**

(Common to EEE, ECE, ICE, BME, MECH, CIVIL & MECHATRONICS)

Prerequisite	Basic Mathematics	
Course Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Solve Algebraic and Transcendental equations	**K2**
	CO2 Solve Simultaneous Equations by various Numerical Techniques.	**K3**
	CO3 Apply the Numerical Techniques of interpolation in various Intervals.	**K3**
	CO4 Solve Linear programming problems by using Optimization Techniques.	**K3**
	CO5 Find the solution to Transportation and Assignment Problems.	**K3**

UNIT – I	**SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS**	**Periods:12**
Solution of Algebraic and Transcendental equations – Bisection method - Method of False position – Newton Raphson method (single only) – Eigen value and Eigen vector by Power method.		CO1
UNIT – II	**LINEAR SYSTEM OF EQUATIONS**	**Periods:12**
Solutions of Linear system of equations and Matrix Inversion – Gauss Elimination and Gauss - Jordan methods. Iterative methods – Gauss Jacobi – Gauss-Seidel.		CO2
UNIT – III	**INTERPOLATION AND SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**Periods:12**
Interpolation by Newton's Forward and Backward Difference formula for equal intervals – Lagrange's method for unequal intervals. Integration by Trapezoidal and Simpson's rules (Single integration only). Fourth order Runge-Kutta method for solving first-order Differential Equations.		CO3
UNIT – IV	**LINEAR PROGRAMMING PROBLEMS**	**Periods:12**
Linear Programming Problems – Graphical Method – Simplex Method: Big M method – Two phase method.		CO4
UNIT – V	**TRANSPORTATION AND ASSIGNMENT PROBLEMS**	**Periods:12**
Transportation Problems – Initial basic feasible solution using North-West Corner rule, Least Cost Method, Vogel's Approximation Method – Optimality in Transportation Problem by Modified Distribution (MODI) Method. Assignment Problems – Solutions of Assignment Problems by Hungarian Method – Unbalanced Assignment Problems.		CO5

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

Textbooks

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", S. Chand Limited, 2008.
2. R. Panneerselvam "Operations Research" Prentice Hall of India, 2nd Edition,2004.
3. P.K. Gupta, D.S. Hira, "Operations Research", S. Chand, 5th Edition, 2018.

Reference Books

1. AtulGoyal, Madhuchanda Rakshit Suchet Kumar, "Numerical Methods", New India Publishing Agency, 1st Edition, 2019.
2. Rajesh Kumar Gupta, "Numerical Methods - Fundamental and Applications", Cambridge University Press, 1st Edition, 2019.
3. S.Kalavathy, "Operation Research" ,Vikas Publishing house,4th Edition,2012.
4. Kevin J. Hastings, "Introduction to the Mathematics of Operations Research with Mathematica", Taylor and Francis, 2nd Edition, 2019.
5. T. Veerarajan, "Operations Research", McGraw Hill, 1st Edition, 2018.

Web References

1. https://nptel.ac.in/courses/111106101/
2. https://www.geektonight.com/operation-research-notes-pdf/#.XrXzoP8za00
3. https://freecomputerbooks.com/Numerical-Methods-with-Applications.html
4. https://www.pphmj.com/journals/IJNMA.html
5. https://nptel.ac.in/courses/106/108/106108056/

*** 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	-	-	-	-	-	1	1	1	1
2	3	3	3	2	-	1	-	-	-	-	-	1	1	1	1
3	3	3	3	2	-	1	-	-	-	-	-	1	1	1	1
4	3	3	3	2	1	1	1	-	-	-	1	1	1	1	1
5	3	3	3	2	1	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	**Computer Science and Engineering**	Programme: **B.Tech**						
Semester	**IV**	Course Category: **ES**			End Semester Exam: **TE**			
Course Code	**U23CSTC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to All Branches except CSBS and FT)

Prerequisite	Any Programming Knowledge		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Compute time and space complexity for given problems	**K2**
	CO2	Demonstrate stack, queue, and its operation.	**K2**
	CO3	Illustrate the various operations of the linked list.	**K3**
	CO4	Use the concepts of trees 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 Queues: 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**

Textbooks

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++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.
5. Mark Allen Weiss," Algorithms, Data Structures and Problem-Solving with C++", Addison- Wesley Publishing Company, Illustrated
6. Edition, 1995.

Web References

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/

*** 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
	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	**IV**	Course Category: **PC**			*End Semester Exam: **TE**			
Course Code	**U23ECT406**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**OPERATIONAL AMPLIFIERS AND APPLICATIONS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Basic knowledge about the circuits and its analysis.		
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Explain the internal structure of operational amplifiers and their characteristics.	**K2**
	CO2	Experiment with the applications of operational amplifiers.	**K2**
	CO3	Construct the comparator and waveform generators using an operational amplifier.	**K3**
	CO4	Interpret the principle and operation of PLL and Data converters.	**K3**
	CO5	Choose special-function ICs based on their application for modern electronic equipment.	**K4**

UNIT-I	**OPERATIONAL AMPLIFIER**	**Periods:09**
Introduction to Integrated Circuits- Classification of ICs - Operational Amplifier: Basic Information of Op-Amp, Ideal Op Amp- Operational Amplifier Internal Circuit– Differential Amplifier - Characteristics of Op-Amp - DC Characteristics, AC Characteristics - Frequency Response- Frequency Compensation - Slew Rate		CO1
UNIT-II	**OPERATIONAL AMPLIFIER APPLICATIONS**	**Periods:09**
Closed Loop Op Amp Configuration - Inverting and Non - inverting Amplifiers- Voltage Follower- Differential Amplifier Summing Amplifier, Averaging Circuits – Subtractor- Instrumentation amplifier -V to I and I to V Converter - Precision rectifier - log and antilog amplifiers - Multiplier and Divider- Differentiator- Integrator, - 1st Order LPF, HPF and all-pass filters.		CO2
UNIT-III	**COMPARATORS AND WAVEFORM GENERATORS**	**Periods:09**
Comparators: Open Loop Op Amp Configuration - Inverting, Non-Inverting Comparator- Applications of Comparator- Regenerative Comparator (Schmitt trigger) - Waveform Generators: Multivibrators - Astable, Monostable - Triangular wave generator- Principles of Sine wave Oscillator- RC Phase Shift, Wien Bridge Oscillator.		CO3
UNIT-IV	**UNIT IV PHASE-LOCKED LOOP AND DATA CONVERTER**	**Periods:09**
Block Diagram of PLL- Principles-Types- Phase Detector- Voltage Controlled Oscillator-IC 566 and IC 565 Internal Block Diagram- PLL Applications - Data Converter and Applications- Sample and Hold circuits, D/A Techniques: Binary Weighted Resistor- R-2R Ladder DAC and Inverted R-2R Ladder DAC- A/D converter: Flash - Successive Approximation Converter - Dual Slope ADC.		CO4
UNIT-V	**UNIT V SPECIALIZED ICS**	**Periods:09**
IC 555 Timer -Internal Functional Diagram - Monostable and Astable Multivibrator using 555 Timer – Applications - Voltage regulator, Fixed and Adjustable Voltage Regulators (Positive and Negative voltage regulators-78XX, 79XX, Adjustable Voltage Regulator LM723) - Dual Voltage supply – Switch Mode Power Supply (LM 1577/LM 2577)		CO5

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

Textbooks

1. D.Roy Choudhry, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 4th Edition 2017.
2. Ramakant A.Gayakwad, OP-AMP and Linear IC's , Prentice Hall of India, 4th Edition 2015.
3. Sergio Franco, Design with operational amplifiers and analog integrated circuits, McGraw-Hill, 3rd Edition 2017.

Reference Books

1. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits. Pearson Education, 6th Edition 2004.
2. David L.Terrell,Op Amps-Design, Application, and Troubleshooting, Elsevier publications, 2nd Edition 2005.

3. S.Salivahanan & V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill Publications, 2nd Edition 2016.
4. B.S.Sonde, “System design using Integrated Circuits” , 2nd Edition, New Age International Pvt. Ltd., 2nd Edition2011
5. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2001.

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1. http://www.nptelvideos.in/2012/11/analog-ics.html
2. https://www.intel.in/content/www/in/en/history/museum-making-silicon.html
3. https://developer.qualcomm.com/download/sd820e/qualcomm-snapdragon-820e-processor-apq8096sge
4. https://electrobian.files.wordpress.com/2016/07/linear-integrated-circuits-notes-arunkumar-pdf-apkart-
5. com.pdf
6. https://learnengineering.in/ec6404-linear-integrated-circuits/

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	3	-	3
2	3	1	-	-	-	-	-	-	-	-	-	1	3	-	3
3	3	1	-	-	-	-	-	-	-	-	-	1	3	-	3
4	3	1	-	-	-	-	-	-	-	-	-	1	3	-	3
5	3	1	-	-	-	-	-	-	-	-	-	1	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	**IV**	Course Category: **PC**				*End Semester Exam: **TE**		
Course Code	**U23ECT407**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL CIRCUITS**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Infer the fundamental concepts of digital electronics	**K2**
	CO2	Understand Logic Gates and illustrate logic minimization	**K2**
	CO3	Design combinatorial logic circuits including arithmetic logic and selection logic	**K3**
	CO4	Design sequential logic circuits including counters, shift registers	**K3**
	CO5	Categorize and realize the memory devices.	**K3**

UNIT-I	**BINARY NUMBERS**	**Periods:09**
Introduction to Digital Systems, Number Systems- Binary, Octal, Decimal and Hexadecimal, Methods of base conversions, Representation of signed numbers; Fixed- and floating-point numbers, Binary Arithmetic - Addition, Subtraction, Complementary numbering systems: 1's and 2's Complements, Error detection and correction codes - parity check codes and Hamming codes		
UNIT-II	**BOOLEAN THEOREMS AND LOGIC REDUCTION**	**Periods:09**
Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms-Sum of Products Form, Product of Sum Form, Gate level minimization - Karnaugh-Map Method, Logic expression simplification with grouping cells: Quine Mc Clusky Method; Prime implicants, Prime applicant chart, NAND and NOR Implementation.		
UNIT-III	**COMBINATIONAL LOGIC CIRCUIT AND DESIGN**	**Periods:09**
Binary adders- Half adder, Full adder, Binary Subtractor-Half subtractor, Full subtractor, Parallel Binary Adders, BCD Adders, Encoder, Decoder, Comparator, Code convertor, Multiplexers, Demultiplexers, Parity Generator and Checker		
UNIT-IV	**SEQUENTIAL LOGIC CIRCUITS**	**Periods:09**
Gated Latches & Flip Flops- Level triggered and Edge triggered Flip-Flops, Flip Flop Conversion. Shift registers, General model of sequential circuits- Mealy/Moore models -Excitation table- State table-State diagram, Design of Synchronous sequential circuits - Counters, Shift Registers, Ring counters, Johnson counters, Hazards logic circuits- Hazard free realization Logic		
UNIT-V	**SEMICONDUCTOR MEMORY AND PROGRAMMABLE DEVICES**	**Periods:09**
Semiconductor memories- Classification of memories, Programmable Logic Devices, Logic Implementation with Programmable Logic Array (PLA), Programmable Array Logic (PAL) – concept of Field Programmable Gate Arrays (FPGA).		

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

Textbooks

1. Morris Mano M and Michael D. Ciletti, Digital Design, Pearson, Sixth Edition, 2018.
2. John F. Wakerly, Digital Design Principles and Practices, Prentice Hall, Fifth Edition, 2021.
3. Salivahanan S and Arivazhagan S, Digital Circuits and Design, Oxford University Press, Fifth Edition, 2017.

Reference Books

1. Charles H. Roth and Larry M. Hanny, Fundamentals of Logic Design, Cengage Learning, Sixth Edition, 2010.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated circuits: A design perspective, Pearson, Second Edition, 2016.
3. Kenneth L. Short, VHDL for Engineers, Prentice Hall, 2009.

Web References

1. https://nptel.ac.in/courses/108/105/108105132/
2. https://www.electronics-tutorials.ws/logic/logic_1.html
3. https://www.worldscientific.com/worldscibooks/10.1142/10998
4. https://www.classcentral.com/course/swayam-digital-electronic-circuits-12953
5. https://www.allaboutcircuits.com/video-tutorials/analog-and-digital-electronics/

*** 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	-	2	-	-	-	-	-	1	3	2	1
2	3	2	2	1	-	2	-	-	-	-	-	1	3	2	1
3	3	2	2	1	-	2	-	-	-	-	-	1	3	2	1
4	3	2	2	1	-	2	-	-	-	-	-	1	3	2	1
5	3	2	2	1	-	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	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	**IV**	Course Category: **PC**				*End Semester Exam: **TE & LE**		
Course Code	**U23ECB402**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ANALOG COMMUNICATION**	**2**	**-**	**2**	**3**	**50**	**50**	**100**
Prerequisite	Signal System							

Course Outcome		On completion of the course, the students will be able to	BT Mapping
	CO1	Understand about Amplitude Modulation	**K2**
	CO2	Explain Angle Modulation Systems	**K2**
	CO3	Demonstrate Pulse Modulation and Pulse Code Modulation	**K2**
	CO4	Analyze the performance of AM, FM, and Pulse signals	**K3**
	CO5	Analyze the performance of AM, FM and Pulse signals using MATLAB/ Multisim	**K3**

UNIT-I	**Amplitude Modulation**	**Periods: 10**
Introduction to communication - Need for modulation - Frequency Translation- Transmitter – Receiver – Multiplexing of Signals -Amplitude Modulation- Generation and Demodulation of AM waves-AM Transmitter and Receiver-Double Side Band-Suppressed Carrier-Single Sideband Modulation-Vestigial-Sideband Modulation-Noise in Amplitude Modulated Systems-Comparison-Frequency Division Multiplexing. Noise – Introduction, External Noise, Internal Noise, Signal to noise ratio, Noise Figure		**CO1**
UNIT-II	**Angle Modulation Systems**	**Periods: 10**
Definition of FM, FM and PM Signals, Modulation Index, Bandwidth Requirements, Narrowband FM-Wideband FM- Spectral Characteristics FM Generation – Phase Modulators – FM Detectors – FM Transmitters and Receivers -Comparison between AM and FM		**CO2**
UNIT-III	**Pulse Modulation and Pulse Code Modulation**	**Periods: 10**
Introduction – Sampling Theorem - Pulse Amplitude Modulation (PAM) -Pulse Width Modulation (PWM) – Pulse Position Modulation (PPM) – Pulse Code Modulation (PCSM) – Generation of PAM, PWM, PPM – PCM Transmitter and Receiver – Delta Modulation – Noise characteristics in PCM.		**CO3**
I	**Write a program to perform the following modulation and Demodulation** (Any Six Experiments)	**Periods: 15**
1. Amplitude Modulation & Demodulation 2. DSB-SC Modulation & Demodulation 3. SSB-SC Modulation & Demodulation 4. Frequency Modulation & Demodulation 5. Spectral Characteristics of AM &FM 6. Pulse Amplitude Modulation & Demodulation 7. Pulse Width Modulation 8. Pulse Position Modulation & Demodulation.		**CO4**
II	**Construct the Simulink Block to perform the following modulation and analyze the spectral characteristics** (Any Six Experiments)	**Periods: 15**
1. Amplitude Modulation & Demodulation (Under modulation, Perfect modulation & Over modulation) 2. AM DSB-SC Signal Generation and Detection 3. AM SSB-SC Signal Generation and Detection 4. Frequency Division Multiplexing with AM DSB-SC signals 5. Frequency Modulation signal Generation and Detection 6. FM Demodulation with PLL 7. Pulse Amplitude Modulation and Demodulation 8. Time Division Multiplexing 9. PWM modulation and Demodulation 10. PPM modulation and demodulation		**CO5**

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

Textbooks

1. V Chandra Sekar, “Analog Communication”, Oxford University Press, 2nd edition, 2011
2. Ramakrishna Rao, “Analog Communication”, Tata McGraw-Hill, Publications, 2011.

Reference Books

1. Bruce Carlson, & Paul B. Crilly, “Communication Systems – An Introduction to Signals & Noise in Electrical Communication”, McGraw-Hill International Edition, 5th Edition, 2010
2. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley, 2005
3. V Chandra Sekar, “Analog Communication”, Oxford University Press
4. Simon Haykin, “Communication Systems”, Wiley-India edition, 3rd edition, 2010
5. J. M. Wozencraft and I. M. Jacobs, Principles of Communication Engineering, Wiley, 1965.

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1. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ee06/
2. http://www.ee.iitm.ac.in/~andrew/videolectures/EE419/index.html
3. https://new.siemens.com/global/en/company/about/history/technology/information-and-communications-technology/telephony.html
4. https://www.vedantu.com/revision-notes/cbse-class-12-physics-notes-chapter-15-communication-systems
5. https://learn.careers360.com/physics/communication-systems-chapter/

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	3	-	1
2	3	1	-	-	1	-	-	-	-	-	-	1	3	-	1
3	3	1	-	-	1	-	-	-	-	-	-	1	3	-	1
4	3	1	-	-	1	-	-	-	-	-	-	1	3	-	1
5	3	1	-	-	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
Conduction of Practical	15	End Semester Practical Conduction	15	
Report	10	Result	10	
Viva	5	Viva	5	
Total	30	Total	30	

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

Department	**English**	Programme: **B.Tech**.						
Semester	**IV**	Course Category: **HS**			*End Semester Exam: **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 Outcome			**BT Mapping**
	On completion of the course, the students will be able to		
	CO1	Infer ideas to attend international standardized tests by broadening receptive and productive skills	**K2**
	CO2	Interpret the types of writing in different situations	**K3**
	CO3	Acquire meticulous exposure to 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:06**
Listening: Listening in 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:06**
Listening: Listening to 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:06**
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:06**
Listening: Listening to 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:06**
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/

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	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

***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 Science and Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **ES**			*End Semester Exam: **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 Except CSBS and FT)								
Prerequisite	Basic Programming Knowledge							

Course Outcomes		**On completion of the course, the students will be able to**	**BT Mapping**
	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 Exercises:

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 the following operations a) Insert an element into a list. a) Delete an element from the list b) Search for a key element in the list c) Count the number of nodes in the 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:
8. Insert an element into a binary search tree.
9. Delete an element from a binary search tree.
10. Search for a key element in a binary search tree.
11. Write a C program that use recursive functions to traverse the given binary tree in
12. Preorder b) Inorder c) Postorder.
13. Write a C program to perform the AVL tree operations.
14. Write a C program to implement Graph Traversal Techniques.
15. Write a C program to implement the Set operations.
16. Union b) Intersection c) Difference.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**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 Subramaniam, "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

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

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PC**				*End Semester Exam: **LE**		
Course Code	**U23ECP404**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTEGRATED CIRCUITS LABORATORY**	**-**	**-**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Basic Knowledge about circuits and their analysis	
Course Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Analyze the various linear and non-linear applications of op-amp.	**K4**
	CO2 Examine and analyze filter circuits using op-amp	**K4**
	CO3 Design and analyze oscillators and multi-vibrator circuits using op-amp	**K6**
	CO4 Distinguish the various applications of linear ICs like 741, 555 timers, and XR2240	**K4**
	CO5 Examine the use of OP-AMP as an analog-to-digital and digital-to-analog converter.	**K4**

List of Experiments:

1. Applications of Op-amp: To study the application of Op-amp IC741 as
   a. Inverting amplifier
   b. Non-inverting amplifier
   c. Voltage follower
2. Applications of Op-amp: To study the application of Op-amp IC741 as
   a. Summer
   b. Subtractor
3. Differentiator and Integrator
   Design the op-amp as a differentiator and integrator for various time constants.
4. Comparator circuits
   a. To study zero crossing detector, window detector
   b. Design Schmitt trigger using op-amp 741.
5. Signal converters.
   To design and study the operation of op-amp as V to I and I to V converters.
6. Active filters using Op-amp.
   Design and test the performance of a 1st order LPF, HPF, BPF, and BSF
7. Multi vibrators using Op-Amp
   To design and study the working of
   a. Astable Multi vibrator and
   b. Monostable Multivibrator using IC 741.
8. Data converters
   Construction and study performance of
   a. DAC circuits – R-2R and ladder type.
   b. Successive approximation type ADC.
9. Multi vibrators using IC 555
   To design and study the working of
   a. Astable multivibrator
   b. Monostable Multi vibrator using IC 555.
10. Frequency synthesizers
    To study the performance of Frequency multiplier using PLL IC 565
11. Precision rectifiers - To study the performance of half-wave and full-wave precision rectifiers using IC 741.

Fixed Voltage regulator (Using 78XX,79XX), Adjustable Voltage regulator (using LM317)

Reference Books

1. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits. Pearson Education, 6th Edition 2004.
2. David L.Terrell, Op-Amps-Design, Application, and Troubleshooting, Elsevier publications, 2nd Edition 2005.
3. S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill Publications, 2nd Edition 2016.
4. B.S.Sonde, "System design using Integrated Circuits" , 2nd Edition, New Age International Pvt. Ltd., 2nd Edition 2011.
5. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.

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1. http://www.nptelvideos.in/2012/11/analog-ics.html
2. https://www.intel.in/content/www/in/en/history/museum-making-silicon.html
3. https://developer.qualcomm.com/download/sd820e/qualcomm-snapdragon-820e-processor-apq8096sge
4. https://electrobian.files.wordpress.com/2016/07/linear-integrated-circuits-notes-arunkumar-pdf-apkart-com.pdf
5. https://learnengineering.in/ec6404-linear-integrated-circuits/

*** 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	3	2	2	-	1	-	-	-	1	-	-	1	3	-	-
3	3	2	2	-	1	-	-	-	1	-	-	1	3	-	-
4	3	2	2	-	1	-	-	-	1	-	-	1	3	-	-
5	3	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
	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	**Electronics and Communication Engineering**	Programme: **B.Tech**.						
Semester	**IV**	Course Category: **PC**			*End Semester Exam: **LE**			
Course Code	**U23ECP405**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**DIGITAL CIRCUITS LABORATORY**	-	-	2	1	50	50	100

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Devise the function of logic gates	**K2**
	CO2	Demonstrate various combinational circuits like adder, subtractor, and comparator	**K3**
	CO3	Demonstrate various combinational circuits like a multiplexer, Demultiplexer encoder, decoder	**K3**
	CO4	Design and implement the ripple counter	**K3**
	CO5	Design and implement synchronous sequential circuits	**K3**

List of Experiments:

1. Verify the logic gates.
2. Realization of functions using basic and universal gates (SOP and POS forms).
3. Design and implementation of code converters using logic gates.
    i) BCD Code to Excess-3 Code and vice versa.
    ii) Binary Code to Gray Code and vice versa
4. Design and realization of half adder, full adder, half subtractor, and full subtractor using.
    i) Basic gates and
    ii) Universal gates.
5. Design and implementation of a 2-bit Magnitude Comparator using Logic Gates and a 4-bit magnitude comparator IC.
6. Design and implementation of 4-bit binary adder/ subtractor BCD adder, using IC 7483
7. Design and implementation of multiplexer and demultiplexer using logic gates and MUX & DEMUX ICs (74150, 74154).
8. Design and implementation of encoder, decoder using logic gates, simple Priority Encoder, and 4 to 16-line decoder using 3 to 8-line decoder ICs.
9. Implementation of Flip Flops: SR, D, T, JK, and Master Slave JK Flip Flops using basic gates
10. Construction and verification of 4-bit ripple counter and mod-10 / mod-12 ripple counter.
11. Design and implementation of various shift registers.
12. Design and implementation of 3-bit synchronous up/down counters Ring counters, and Johnson counters.

Reference Books

1. Leach Malvino, “Digital Principles and Applications”, Tata McGraw Hill, Fifth edition, 2005.
2. Morris Mano M and Michael D. Ciletti, Digital Design, Pearson, Sixth Edition, 2018.
3. John F. Wakerly, Digital Design Principles and Practices, Prentice Hall, Fifth Edition, 2021.
4. Salivahanan S and Arivazhagan S, Digital Circuits and Design, Oxford University Press, Fifth Edition, 2017.
5. Kenneth L. Short, VHDL for Engineers, Prentice Hall, 2009.

Web References

1. https://nptel.ac.in/courses/108/105/108105132/
2. https://www.electronics-tutorials.ws/logic/logic_1.html
3. https://www.worldscientific.com/worldscibooks/10.1142/10998
4. https://www.classcentral.com/course/swayam-digital-electronic-circuits-12953
5. https://www.allaboutcircuits.com/video-tutorials/analog-and-digital-electronics/

*** 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	2	-	-	-	2	-	-	1	3	2	1
2	3	2	2	1	2	-	-	-	2	-	-	1	3	2	1
3	3	2	2	1	2	-	-	-	2	-	-	1	3	2	1
4	3	2	2	1	2	-	-	-	2	-	-	1	3	2	1
5	3	2	2	1	2	-	-	-	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
	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	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECC4XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - IV**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**IV**	Course Category: **AEC**				*End Semester Exam: -		
Course Code	**U23ECS402**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE- II: REPAIR AND MAINTENANCE OF ELECTRONICS EQUIPMENT**	**-**	**-**	**2**	**-**	**100**	**-**	**100**

Prerequisite	Understanding of electronic components and circuits. Knowledge of control theory and controllers. Familiarity with automation systems and sensors. Ability to use measurement instruments for troubleshooting. Awareness of safety procedures for electronics and electrical systems.		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Infer the Identification and testing of various active and passive components	**K2**
	CO2	Devise and troubleshooting of electronic equipment.	**K4**
	CO3	Manipulate and configure various analog and digital circuits	**K3**
	CO4	Interpret the installation of various real time systems.	**K3**
	CO5	Test and demonstrate the servicing of Cell phone, Computer, LED/ LCD TV, and Computer. Demonstrate the automation tools	**K4**

LIST OF EXPERIMENTS

1. Study of various handheld tools.
2. Test the performance of different passive electronic components and active electronic components like general purpose transistor/ FET/ MOSFET/ SCR/ DIAC/ TRIAC with DMM and CRO OR Components Tester
3. Test the performance of miscellaneous electronics components (transformers, Loudspeaker, microphone, Relays, Solenoid, Switches, DC Motors, Stepper Motor, sensors, Opto-electronics components
4. Verify the functionality of TTL and CMOS Digital IC's using IC tester.
5. Test the given regulated power supply circuit/ SMPS (from any television/fridge/ computer system/ laboratory etc.)
6. Demonstrate steps of installation of online/ Offline UPS
7. Identify basic sections of a personal computer and list the technical specifications of various computer peripherals. (e.g. CPU, Monitor, Keyboard, Mouse, Speaker, Web cam, Printer, Scanner, microphone, speakers, modem, projector etc.). Troubleshoot the booting process of computer system.
8. Demonstrate troubleshooting steps of Laptop for the common fault.
9. Explore circuit of any home theatre system and prepare its circuit diagram /wiring diagram.
10. Practice steps for mobile troubleshooting.
11. Test and calibrate sensors commonly used in automation systems.
12. Understand the input/output (I/O) modules of a PLC.
13. Simulate a control system using software tools.

Reference Books

1. Singh K. Sudeep. "Troubleshooting and Maintenance of Electronics Equipment", Katson Book, New Delhi, III edition, Reprint 2017
2. Khandpur R. S.," Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition, Tata McGraw-Hill Education, New Delhi, India, latest edition.
3. Manohar Lotia, "Mobile repairing Books ", BPB Publication, New Delhi, latest edition 2005.

4. Stephen J. Bigelow, “PC Troubleshooting and Repair”, Dream tech Press, New Delhi, 2008

Web References

1. https://nielit.gov.in/kohima/content/repairing-maintenance-electronics-products.
2. http:// youtube.com (Repairing of various gazette)
3. http://computer.howstuffworks.com/computer-hardware-channel.html
4. http://www.automationtechnology.de/cms/en/markets- solutions/electronics.html
5. https://edu.gcfglobal.org/en/computerbasics/basic-troubleshooting-techniques/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	1	3	-	-	-	2	-	-	1	3	1	1
2	3	2	2	1	3	-	-	-	2	-	-	1	3	1	1
3	3	2	2	1	3	-	-	-	2	-	-	1	3	1	1
4	3	2	2	1	3	-	-	-	2	-	-	1	3	1	1
5	3	2	2	1	3	-	-	-	2	-	-	1	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
	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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **MC**			*End Semester Exam: **-**			
Course Code	**U23ECM404**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RIGHT TO INFORMATION AND GOOD GOVERNANCE**	**2**	**0**	**-**	**-**	**100**	**-**	**100**

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.

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

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.

UNIT- IV	**JUDICIARY AND RIGHT TO INFORMATION ACT**	**Periods:06**

Protection of Right to access the information - Role of the Supreme Court and High Court's Recent attempts of dilution of the right to information Law

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

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

Evaluation Method

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

V- Semester

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	U23ITTC03	Programming in JAVA	ES	3	0	0	3	25	75	100
3	U23ECT508	Communication Networks	PC	3	0	0	3	25	75	100
4	U23ECT509	Digital Communication	PC	3	0	0	3	25	75	100
5	U23ECE5XX	Professional Elective – II	PE	3	0	0	3	25	75	100
6	U23XXO5XX	Open Elective – I	OE	3	0	0	3	25	75	100
Practical										
7	U23ITPC03	Programming in JAVA Laboratory	ES	0	0	2	1	50	50	100
8	U23ECP506	Communication Networks Laboratory	PC	0	0	2	1	50	50	100
9	U23ECP507	Digital Communication Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ECW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23ECC5XX	Certification Course – V	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ECM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
Total							**21**	**600**	**600**	**1200**

Department	**Master of Business Administrations**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **BS**			*End Semester Exam: **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			
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Differentiate between various types of research and apply appropriate research methods to solve engineering problems.	**K3**
	CO2	Ability to identify research problems, perform comprehensive literature reviews, and use various tools and services for effective information retrieval.	**K4**
	CO3	Gain proficiency in designing experiments, analyzing data, and interpreting results using both numerical and graphical methods.	**K4**
	CO4	Structure and write research papers and dissertations effectively, following ethical guidelines and avoiding common pitfalls like plagiarism.	**K5**
	CO5	understand the fundamentals of intellectual property rights, including how Protect and enforce them, which is crucial for innovation and entrepreneurship in engineering.	**K3**

UNIT – I	**INTRODUCTION TO RESEARCH**	**Periods:09**
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:09**
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:09**
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:09**
Preparing a Research Report: Key Sections (Abstract, Introduction, Methodology, Results, Discussion, Conclusion). Referencing and Citation: Brief Overview. Ethical Considerations in Research: Introduction to Scientific Misconduct.		CO4
UNIT – V	**INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)**	**Periods:09**
Basics of Intellectual Property Rights - Introduction to Patents, Copyrights, and Trademarks - Overview of the Registration Process.		CO5

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

Textbooks

1. Kumar, R. Research Methodology: A Step-by-Step Guide for Beginners, 5th Edition, SAGE Publications, 2019.
2. Ram Ahuja, Research methods, Rawat Publications, 2nd edition, 2022
3. Creswell, J. W., and Creswell, J. D. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, SAGE Publications, 2018.

Reference Books

1. Thiel DV. Research methods for engineers. Cambridge: Cambridge University Press; 2014.
2. Ganesan R. Research methodology for engineers. Chennai: MJP Publishers; 2024.
3. Agarwal C, Sharma V. Research methodology in sociology. New Delhi: Commonwealth Publishers; 2012.
4. Thody A. Writing and presenting research. 2nd edition, London: SAGE Publications; 2006.
5. Kothari CR. Research methodology – methods and techniques. 5th edition, New Delhi: New Age International Publishers; 2023.

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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/

*** 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	-	-	2	2	3	-	-	-
2	3	1	1	3	1	-	2	-	-	1	2	-	-	-	-
3	1	3	3	1	3	-	2	-	-	2	2	-	-	-	-
4	-	-	1	2	-	-	2	3	2	2	-	2	-	-	-
5	2	2	2	2	2	2	3	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
	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: **ES**			End Semester Exam: **TE**			
Course Code	**U23ITTC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN JAVA**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Any Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping**
	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 – Data Types - Variables, Types, Expressions, Assignment Statements, Conditional and Iterative Control Structures - Arrays **OOPs with Java:** Class – Objects – Methods - Access Modifiers – Abstraction – Encapsulation - Constructors - this – static - Garbage Collection – Nested Classes. **String**: String Class– Built-in Methods – StringBuilder – String Buffer		**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 **Packages:** Define – Create – Access – Import – Autoboxing and Auto unboxing		**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: Array List and LinkedList. Set: HashSet and Tree Set. Map: HashMap – Stack – Queue. Lambda Expressions. **I/O Streams:** Streams – Byte Streams and Character Streams – File Input Stream and File Output Stream – File Reader and File Writer.		**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**

Textbooks

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	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	**V**	Course Category: **PC**			*End Semester Exam: **TE**			
Course Code	**U23ECT508**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Communication Networks**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Basic knowledge about the circuits and its analysis.	
Course Outcome	On completion of the course, the students will be able to	**BT Mapping**
	CO1 Understanding the network types, protocol layering, and application layer protocols.	**K2**
	CO2 Understanding the signal transmission, IP addressing, and various wireless communication technologies.	**K3**
	CO3 Explore the link layer protocols, error control, and sliding window protocols.	**K3**
	CO4 Explore the network and transport layer services, routing, and transport protocols.	**K3**
	CO5 Understanding the evolution of mobile networks and supporting technologies from 2G to 5G.	**K3**

UNIT-I	**NETWORKING AND APPLICATION LAYER PROTOCOLS**	**Periods:09**
Data Communication - Networks – Network Types – Protocol Layering – TCP/IP Protocol Suite – OSI Model. **Application Layer:** Application Layer Paradigms - Client/Server Paradigm –WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP-SMTP-POP3-IMAP4-Telnet		**CO1**
UNIT-II	**SIGNAL TRANSMISSION LAYER**	**Periods:09**
Signals - Signal Impairment - Digital Transmission - Analog Transmission – Multiplexing - Transmission Media; IPV4 Addresses - IPV6 Addressing – IPV6 Protocol; ETHERNET - WIFI - BLUETOOTH - 6LowPAN – Zigbee - LoRa		**CO2**
UNIT-III	**DATA LINK LAYER PROTOCOLS AND TECHNIQUES**	**Periods:09**
Nodes and Links- Framing- Error Control- Data-Link Layer Protocols -A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel - Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat.		**CO3**
UNIT-IV	**ROUTING ALGORITHMS AND TRANSPORT LAYER**	**Periods:09**
Network Layer Services – Packet switching – Performance – Routing Algorithm – Unicast Routing Protocols – Multicasting routing Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol		**CO4**
UNIT-V	**EVOLUTION OF MOBILE NETWORKS**	**Periods:09**
Introduction - Mobile Network Evolution - Information Theory – Modulations - Second-generation Mobile Network - Third-generation Mobile Networks - Fourth-generation Mobile Networks - Fifth-generation Networks - Supporting Technologies (ADSL2+, VDSL2, FTTN, RFID, NFC only)		**CO5**

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

Textbooks

1. Behrouz A. Forouzan, “Data communication and Networking”, 6th Edition, Tata McGraw – Hill, 2022.
2. Ajay R. Mishra “Fundamentals of Network Planning and Optimisation 2G/3G/4G: Evolution to 5G” 2nd Edition, Wiley.

Reference Books

1. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Seventh Edition, Pearson Education, 2016.
2. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2nd Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open-Source Approach”, Mc Graw Hill Publisher, 2011.
4. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
5. Andrew S Tanenbaum, “Computer Networks, 4th Edition. Pearson Education, PHI, 2022.

Web References

1. https://archive.nptel.ac.in/courses/117/105/117105148/#data communication networks
2. https://www.springer.com/series/15179 Networks and systems
3. https://nptel.ac.in/courses/106106091 Computer Networks
4. https://archive.nptel.ac.in/courses/106/106/106106243/ Advanced computer networks
5. https://onlinecourses.nptel.ac.in/noc22_ee61/preview Communication Network

* 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	3	-	-	-	-	3	2	-	2
2	2	3	-	-	-	2	3	-	-	-	-	3	2	-	2
3	2	3	-	-	-	2	3	-	-	-	-	3	2	-	2
4	2	3	-	-	-	2	3	-	-	-	-	3	2	-	2
5	2	3	-	-	-	2	3	-	-	-	-	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
	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	**V**	Course Category: **PC**			*End Semester Exam: **TE**			
Course Code	**U23ECT509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL COMMUNICATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Knowledge on Analog Modulation and Digital Circuits		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Understand Digital Modulation schemes	**K1**
	CO2	Implement and understand passband transmission systems	**K2**
	CO3	Understand advanced modulation schemes	**K2**
	CO4	Understand Multiple Access Techniques s	**K2**
	CO5	Understand Communications Link Synchronization	**K2**

UNIT-I	**BASEBAND AND DIGITAL MODULATION TECHNIQUES**	**Periods:09**
Baseband Modulation Techniques (PAM, PWM and PPM), Sampling and Quantizing - Digital Modulation Techniques - Pulse Code Modulation (PCM) System) - Differential PCM (DPCM) System - Delta Modulation (DM) System – Matched Filter Receiver - Probability of error for Matched filter - Inter Symbol Interference (ISI) and Eye pattern.		**CO1**
UNIT-II	**PASSBAND TRANSMISSION SYSTEM**	**Periods:09**
Passband Transmission System Model – Passband Modulation Techniques- Generation, Signal Space diagram, Detection, Probability of Error for BFSK - BPSK – QPSK – M-Ary PSK and FSK (Qualitative Treatment) – QAM System.		**CO2**
UNIT-III	**SPREAD SPECTRUM MODULATION**	**Periods:09**
Use of Spread Spectrum, Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access, Ranging using DSSS, Frequency Hopping Spread Spectrum, PN – Sequence Generation and characteristics, Synchronization in Spread Spectrum Systems.		**CO3**
UNIT-IV	**MULTIPLE ACCESS TECHNIQUES**	**Periods:09**
Multiple Access Techniques, multipath channels, classification, Coherence time, Coherence bandwidth, Statistical characterization of multi path channels, Binary signaling over a Rayleigh fading channel, Diversity techniques - Diversity in time, frequency and space. TDMA and CDMA – RAKE receiver. Source coding of speech.		**CO4**
UNIT-V	**COMMUNICATIONS LINK SYNCHRONIZATION**	**Periods:09**
Communications Link Synchronization: Introduction, Frequency and Phase Synchronization, Symbol Synchronization, Synchronization with continuous Phase modulations, Frame Synchronization, Network Synchronization.		**CO5**

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

Textbooks

1. S. Haykin, “Digital Communications”, John Wiley, 2005
2. Kamilo Feher, Wireless Digital Communications: Modulation and Spread Spectrum Applications, Prentice Hall India Learning Private Limited,1998.
3. B. Sklar, “Digital Communication Fundamentals and Applications”, 2nd Edition, Pearson Education, 2009.

Reference Books

1. J.G Proakis, “Digital Communication”, 4th Edition, Tata Mc Graw Hill Company, 2001.
2. Sam Shanmugham – Digital and Analog Communication systems, Wiley India.
3. B.P.Lathi, “Modern Digital and Analog Communication Systems” 3rd Edition, Oxford University Press 2007.
4. Herbert Taud, Donald L. Schiling, Goutam Saha, “Principles of Communication Systems”, 3rd edition, McGraw-Hill 2008.
5. Robert G. Gallager, “Principles of Digital Communication,” Cambridge University Press, 2008.

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1. https://epxx.co/artigos/baseband1.html
2. https://www.salimwireless.com/2024/03/baseband-modulation-techniques.html
3. https://www.tutorialspoint.com/passband-transmission
4. https://www.tutorialspoint.com/what-is-pass-band-transmission-in-computer-networks
5. https://www.geeksforgeeks.org/difference-between-fdma-tdma-and-cdma/

*** 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	1	1
2	2	1	1	1	1	-	-	-	-	-	-	1	1	1	1
3	2	1	1	1	1	-	-	-	-	-	-	1	1	1	1
4	2	1	1	1	1	-	-	-	-	-	-	1	1	1	1
5	2	1	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	**V**	Course Category: **ES**			*End Semester Exam: **LE**			
Course Code	**U23ITPC03**	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**

Prerequisite	Basic Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping**
	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

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

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **PC**				*End Semester Exam: **LE**		
Course Code	**U23ECP506**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**COMMUNICATION NETWORKS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Basic Knowledge about circuits and their analysis		
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Demonstrate proficiency in identifying and utilizing different types of network cables	**K3**
	CO2	Comprehend and configure basic network devices	**K3**
	CO3	Design and implement IP addressing schemes	**K3**
	CO4	Configure and manage network devices and services	**K3**
	CO5	Utilize network diagnostic tools and commands	**K3**

List of Experiments:

1. Study of different types of Network cables
2. Study of following Network Devices
    a. Repeater
    b. Hub
    c. Switch
    d. Bridge
    e. Router
    f. Gate Way
3. Study of network IPV4.
4. Connect the computers in Local Area Network and utilize basic network command and Network configuration commands.
5. Implementing an IP Addressing Scheme.
6. Perform an initial switch and router configuration.
7. Using the Cisco IOS **"Show"** Commands
8. Configuring WEP on a Wireless Router.
9. Configuring a Cisco Router as a DHCP Server.
10. Configuring Static and Default Routes
11. Observing Static and Dynamic Routing.

Reference Books

1. Data Communications and Networking, Behrouz A. Forouzan, 6thEdition TMH.
2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI, 2022.

Web Reference

1. https://epxx.co/artigos/baseband1.html
2. https://www.salimwireless.com/2024/03/baseband-modulation-techniques.html
3. https://www.tutorialspoint.com/passband-transmission
4. https://www.tutorialspoint.com/what-is-pass-band-transmission-in-computer-networks
5. https://www.geeksforgeeks.org/difference-between-fdma-tdma-and-cdma/

*** 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	3	3	-	-	-	-	3	-	3	2	2	-
2	2	3	2	3	3	-	-	-	-	3	-	3	2	2	-
3	2	3	2	3	3	-	-	-	-	3	-	3	2	2	-
4	2	3	3	3	3	-	-	-	-	3	-	3	2	2	-
5	2	3	3	3	3	-	-	-	-	3	-	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	**Electronics and Communication Engineering**	Programme: **B.Tech**.						
Semester	**V**	Course Category: **PC**			*End Semester Exam: **LE**			
Course Code	**U23ECP507**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**DIGITAL COMMUNICATION LABORATORY**	**0**	**0**	2	1	50	50	100

Prerequisite			
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Understand sampling and Quantizing	**K1**
	CO2	Implement and understand passband transmission systems	**K2**
	CO3	Understand Digital modulation schemes	**K2**
	CO4	Understand Multiple Access Techniques	**K2**
	CO5	Implement and test Digital modulation schemes using Simulation	**K2**

List of Experiments:

1. Verification of Sampling Theorem and Nyquest rate.
2. Study and Verification of Unipolar NRZ, Polar NRZ, Unipolar RZ and Polar RZ line code.
3. Generation and detection of Pulse Code Modulation (PCM)
4. Generation and detection of Delta Modulation.
5. Generation and detection of Amplitude Shift Keying (ASK).
6. Generation and detection of Phase Shift Keying (PSK).
7. Generation and detection of Frequency Shift Keying (FSK).
8. Analysis of the process of Time Division Multiplexing and DE multiplexing.
9. Generation - Pseudo Random Binary Sequence (PRBS).
10. Simulation of ASK, PSK, FSK and PRBS

Reference Books

1. S. Haykin, “Digital Communications”, John Wiley, 2005
2. Kamilo Feher, Wireless Digital Communications: Modulation and Spread Spectrum Applications, Prentice Hall India Learning Private Limited,1998.
3. B. Sklar, “Digital Communication Fundamentals and Applications”, 2nd Edition, Pearson Education, 2009.

Web References

1. B. Sklar, “Digital Communication Fundamentals and Applications”, 2nd Edition, Pearson Education, 2009.
2. B.P.Lathi, “Modern Digital and Analog Communication Systems” 3rd Edition, Oxford University Press 2007.
3. J.G Proakis, “Digital Communication”, 4th Edition, Tata Mc Graw Hill Company, 2001.
4. Sam Shanmugham – Digital and Analog Communication systems, Wiley India.

*** 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	-	-	-	-	-	-	1	1	1	1
2	1	1	1	1	1	-	-	-	-	-	-	1	1	1	1
3	1	1	1	1	1	-	-	-	-	-	-	1	1	1	1
4	1	1	1	1	1	-	-	-	-	-	-	1	1	1	1
5	1	1	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
	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**V**	Course Category: **PA**			*End Semester Exam: -			
Course Code	**U23ECW501**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MICRO PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
ECE								
Prerequisite	Electronics, Communication							
	On completion of the course, the students will be able to							BT Mapping
Course Outcomes	**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 2 students during the third year, fifth semester. The aim of the micro project is that the student must 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 is using in the Project. The Micro-project is an application that should be formally initiated and should be developed and 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

Assessment method for Micro Project

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

*Project/ Demonstration/ presentation/ Report/ skill-based evaluation pattern shall be used during model Exam schedule

Department	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECC5XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - V**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **MC**			*End Semester Exam: **-**			
Course Code	**U23ECM505**	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
	CO1	Familiarize with the philosophy of Indian culture	**K1**
	CO2	Distinguish the Indian languages and literature	**K1**
	CO3	Learn the philosophy of ancient, medieval and modern India	**K1**
	CO4	Acquire the information about the fine arts in India	**K1**
	CO5	Know the contribution of scientists of different eras	**K1**

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

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

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)

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

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

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. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. 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 Method

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

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

VI- Semester

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECT610	Embedded Technology	PC	3	0	0	3	25	75	100
2	U23ECT611	Digital Signal Processing	PC	3	0	0	3	25	75	100
3	U23ECT612	Digital VLSI System Design	PC	3	0	0	3	25	75	100
4	U23ECE6XX	Professional Elective - III	PE	3	0	0	3	25	75	100
5	U23XXO6XX	Open Elective – II	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ECB603	Control System Engineering	PC	3	0	0	3	50	50	100
Practical										
7	U23ECP608	Embedded Systems Design Laboratory	PC	0	0	2	1	50	50	100
8	U23ECP609	Digital Signal Processing Laboratory	PC	0	0	2	1	50	50	100
9	U23ECP610	Digital VLSI System Design Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ECW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23ECC6XX	Certification Course – VI	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ECM606	Gender Equality	MC	2	0	-	-	100	-	100
Total							**22**	**625**	**575**	**1200**

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category: **PC**			End Semester Exam: **TE**			
Course Code	**U23ECT610**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**EMBEDDED TECHNOLOGY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Microcontroller**	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Analyze the components of an embedded system	**K2**
	CO2 Apply knowledge of various I/O types, serial and parallel communication devices,	**K3**
	CO3 Explain the ARM Cortex-M architecture and assembly programming	**K3**
	CO4 Interpret embedded C programming concepts and control structures for modular design	**K3**
	CO5 Write and execute basic C programs to control the microcontroller's peripherals	**K3**

UNIT-I	**INTRODUCTION TO EMBEDDED SYSTEMS**	**Periods: 09**
System - Embedded System - Processor Embedded into a System - Embedded Hardware Units and Devices in a System-Embedded Software in a System-Embedded System-On-Chip (SoC) - Complex Systems Design and Processors - Embedded Processor-Design Process in Embedded System – Challenges in Embedded System Design.		**CO1**
UNIT-II	**DEVICES AND COMMUNICATION BUSES FOR DEVICES NETWORK**	**Periods: 09**
I/O Types- Serial Communication Devices- RS232C - RS485 Communication-UART-SPI, SCI and SI Ports- parallel device ports - Timer cum Counting Device- watchdog timer- real time clock- I^2C Bus- CAN Bus- USB Bus-HDMI- ISA, PCI, PCI-X		**CO2**
UNIT-III	**INTRODUCTION TO THE ARM CORTEX-M PROCESSOR**	**Periods: 09**
Cortex-M Architecture - The Software Development Process - ARM Cortex - M Assembly Language - Addressing Modes and Operands - Memory Access Instructions - Logical Operations - Shift Operations - Arithmetic Operations.		**CO3**
UNIT-IV	**MODULAR PROGRAMMING**	**Periods: 09**
C Keywords and Punctuation - Modular Design using Abstraction - Making Decisions - While Loops - Do-while Loops - For Loops.		**CO4**
UNIT-V	**INTERPROCESS COMMUNICATION & SYNCHRONIZATION OF PROCESSES**	**Periods: 09**
Introduction to basic concepts of RTOS: Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing. **Inter process Communication:** synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.		**CO5**

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

Textbooks

1. Raj Kamal “Embedded Systems Architecture. Programming and Design” 2nd Edition
2. Jonathan Valvano” Introduction to ARM Cortex Embedded-Systems” by 5th edition ‘2014

Reference Books

1. Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier (auth.) - Introduction to Embedded Systems_ Using Microcontrollers and the MSP430-Springer-Verlag New York (2014)
2. Designing Embedded Hardware, John Catsoulis. 2nd edition. Shroff Publishers and Distributors. ISBN-10: 9788184042597
3. Embedded System Design: A Unified Hardware / Software Introduction. Tony Givargis and Frank Vahid. Wiley. ISBN-10: 812650837X
4. Cris Nagy, “Embedded Systems Design using the TI MSP430 series”, Newnes, Elsevier.
5. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinaly, PHI “The 8051 Microcontroller and Embedded systems-using assembly and C”, Pearson, 2006

Web References

1. Introduction to Embedded System Design - Course (nptel.ac.in)
2. Best Embedded Systems Courses Online with Certificates [2024] | Coursera
3. Top Embedded Systems Courses Online - Updated [August 2024] (udemy.com)
4. Online Embedded Systems Course with Placements in India (vectorindia.org)
5. https://www.ti.com/microcontrollers-mcus-processors/msp430-microcontrollers/overview.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	2	2	2	1	1	1	-	-	-	-	-	1	1	-	-
2	2	2	2	1	1	1	-	-	-	-	-	1	1	-	-
3	3	2	2	1	1	1	-	-	-	-	-	1	1	-	-
4	3	2	2	1	1	1	-	-	-	-	-	1	1	-	-
5	3	2	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VI**	Course Category: **PC**			End Semester Exam: **TE**			
Course Code	**U23ECT611**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL SIGNAL PROCESSING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Signal and Systems		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Illustrate the fundamentals of signal processing, including discrete-time signal manipulation, sampling, frequency analysis, and signal reconstruction.	**K2**
	CO2	Implement DTFT, DFT, and FFT techniques to efficiently compute and analyze signals and utilize these methods in linear filtering and signal correlation.	**K3**
	CO3	Design and implement FIR and IIR filters using various methods and apply frequency transformations in analog and digital domains.	**K3**
	CO4	Implement and analyze discrete-time system structures and number representations, addressing rounding errors and limit cycles oscillations.	**K3**
	CO5	Apply Multirate DSP methods and understand their applications in subband coding and filter design.	**K3**

UNIT – I	**REVIEW OF DISCRETE TIME SIGNALS AND SAMPLING OF CONTINUOUS TIME SIGNALS**	**Periods:09**
Signals, systems and signal processing, classification of signals, Simple Manipulations of Discrete Time signals, Correlation of Discrete-Time Signals, Concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples, Continuous Time Processing of Discrete Time signals		**CO1**
UNIT - II	**DISCRETE FOURIER TRANSFORM: ITS PROPERTIES AND EFFICIENT COMPUTATION**	**Periods:09**
Introduction to discrete time Fourier transform (DTFT), Discrete Fourier transform (DFT) definition; Properties of DFT; Linear and circular convolution using DFT; Efficient Computation of DFT: Fast-Fourier-transform (FFT) Algorithms: Direct computation of DFT; Radix-2 FFT algorithm for the computation of DFT and IDFT using decimation-in-time and decimation-in-frequency algorithms, Use of FFT algorithm in Linear filtering and Correlation		**CO2**
UNIT - III	**DESIGN OF DIGITAL FILTERS**	**Periods:09**
Design of Finite Impulse Response (FIR) filters, Symmetric and Antisymmetric FIR filters, Design of Linear phase FIR filters using Windows, Design of Linear phase FIR filters by the Frequency-Sampling Method, Design of Infinite Impulse Response (IIR) from Analog filters, IIR filter design by Impulse Invariance, IIR filter design by Bilinear Transformation, Frequency Transformations in Analog domain and Digital domain		**CO3**
UNIT - IV	**IMPLEMENTATION OF DISCRETE TIME SYSTEMS AND FINITE WORD LENGTH EFFECTS**	**Periods:09**
Structures for the realization of Discrete Time Systems, Structures for FIR systems, Direct form structure, Cascade form structure, Lattice structure, Structures for IIR systems, Direct form structure, Cascade form structure, Parallel form structure, Representation of numbers, Fixed point representation, Binary Floating-point representation, Errors resulting from rounding and truncation, Limit Cycle oscillations in Recursive systems, scaling to prevent overflow.		**CO4**
UNIT - V	**ADVANCED DSP TECHNIQUES AND APPLICATIONS**	**Periods:09**
Multirate Digital Signal Processing: Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by rational factor I/D, Sampling rate Conversion of Bandpass Signals, Applications of Multirate Signal Processing: Subband coding of speech signals, Quadrature Mirror Filters, Trans multiplexers		**CO5**

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

Textbooks

1. John G. Proakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Pearson Education, 4th edition, January 2014
2. Alan V. Oppenheim, “Discrete-Time Signal Processing”, Pearson Education, 3rd edition, January 2014
3. Sanjit K Mitra, “Digital signal processing, A computer base approach”, McGraw-Hill Higher Education, 4th Edition, 2011.

Reference Books

1. Li tan, “Digital signal processing: fundamentals and applications”, Elsevier Science &. Technology Books, 2nd Edition, 2008.
2. Robert J.schilling, Sandra. L.harris, “Fundamentals of Digital signal processing using MATLAB”, Thomson Engineering, 2nd Edition, 2005.
3. Salivahanan, Vallavaraj, Gnanapriya, “Digital signal processing”, McGraw-Hill Higher Education, 2nd Edition, 2009.

Web References

1. https://www.coursetalk.com/providers/coursera/courses/digital-signal-processing
2. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-1
3. https://www.mooc-list.com/course/digital-signal-processing-coursera
4. https://www.tutorialspoint.com/digital_signal_processing/index.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	-	-	-	-	-	-	2	3	1	1
2	3	3	2	2	2	-	-	-	-	-	-	3	3	1	1
3	3	3	2	3	2	-	-	-	-	-	-	3	3	3	1
4	3	3	3	3	2	-	-	-	-	-	-	3	3	3	2
5	3	2	3	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	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: **PC**				*End Semester Exam: **TE**		
Course Code	**U23ECT612**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL VLSI SYSTEM DESIGN**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Understand the basic principles of design and implementation of digital circuits**.**	**K2**
	CO2	Discuss about the different combinational and sequential logic blocks**.**	**K3**
	CO3	Describe the terms and keywords in Verilog HDL.	**K2**
	CO4	Identify the various levels of modeling of Verilog HDL**.**	**K2**
	CO5	Implement the various subsystem using Verilog HDL**.**	**K2**

UNIT-I	**HARDWARE DESIGN AND IMPLEMENTATION**	**Periods:09**
Digital Hardware, The Design Process, Design of Digital Hardware, Standard Chips, Programmable Logic Devices, Custom Chips, Standard Cells, and Gate Arrays, Implementation Details for SPLDs, CPLDs, and FPGAs.		**CO1**
UNIT-II	**DIGITAL CIRCUITS DESIGN**	**Periods:09**
Combinational Logic Design; Adders, Subtractor, Multiplier, Multiplexers, Demultiplexers, Decoders, Encoders, Code Converters. Sequential Logic Design- Flip-Flops, Registers, Counters, Finite State Machines-Mealy and Moore type, Serial Adder.		**CO2**
UNIT-III	**VERILOG HDL**	**Periods:09**
Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.		**CO3**
UNIT-IV	**LEVELS OF MODELING**	**Periods:09**
Gate Level Modeling: Array of Instances of Primitives, Dataflow Level Modeling Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vectors. Behavioral level Modeling: Initial and Always Construct, Assignments with Delays, Blocking and Non-Blocking Assignments, Procedural Statements, Functions and Tasks.		**CO4**
UNIT-V	**SUBSYSTEM DESIGN USING VERILOG HDL**	**Periods:09**
RTL coding for High-speed adders, multipliers, divider,8-bit Counters, Finite state machines, Parallel to Serial Converter, sequence detector, memories, ALU, clock divider, traffic light controller, Sequence generator, Test bench for Combinational Circuits and Sequential Circuits.		**CO5**

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

Textbooks

1. Stephen. Brown and Zvonko Vranesic “Fundamentals of Digital Logic Design with Verilog Design,” TMH, 2nd Edition,2017.
2. T. R. Padmanabhan, B. Bala Tripura Sundari “Digital through VLSI HDL” A John Wiley & Sons, Inc., Publication,2004.
3. M. Morris Mano Michael D Ciletti, Digital Design-Pearson Education, 5th Edition,2012.

Reference Books

1. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim “CMOS Digital Integrated Circuits: Analysis & Design” ,4th edition McGraw Hill Education,2013.
2. Ion Grout, “Digital Systems Design with FPGAs and CPLDs”, Elsevier, 2008.
3. Bob Zeidman, “Designing with FPGAs and CPLDs”, Elsevier, CMP Books, 2002.
4. Ming-Bo Lin, “Digital System Designs and Practices using Verilog HDL and FPGAs”, Wiley,2012.
5. L Wang, C.Wu and X. wen, VLSI Test Principles and Architecture, Morgan Kaufmann, San Francisco, 2006.

Web References

1. http://www.asic-world.com/verilog/veritut.html
2. https://www.coursera.org/courses?query=verilog
3. https://hackr.io/tutorials/learn-verilog
4. https://www.udemy.com/topic/verilog-hdl-programming/
5. https://www.maven-silicon.com/online-vlsi-design-verilog-hdl-course

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	3	2	1	1	-	-	-	-	-	-	-	3	-	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
5	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
	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: **PC**				*End Semester Exam: **TE & LE**		
Course Code	**U23ECB603**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CONTROL SYSTEM ENGINEERING**	**2**	**0**	**2**	**3**	**50**	**50**	**100**
Prerequisite	Basic Knowledge in Differential equation, Complex variables and Laplace transform.							

Course Outcome		On completion of the course, the students will be able to	BT Mapping
	CO1	Compute the transfer function of different physical systems	**K3**
	CO2	Analyze the time domain specification & stability using Routh and root locus techniques.	**K3**
	CO3	Illustrate the frequency response characteristics of open loop and closed loop system response & state space model of a physical system	**K3**
	CO4	Model and analyze simple physical systems and simulate the performance in analog platform.	**K3**
	CO5	Design compensators based on frequency domain specifications.	**K3**

UNIT-I	**SYSTEMS COMPONENTS AND THEIR REPRESENTATION**	**Periods: 10**
Basic elements in control systems – Open and closed loop systems – Transfer function –Electrical and mechanical systems – Analogous systems – Block diagram reduction techniques – Signal flow graphs.		**CO1**
UNIT-II	**TIME DOMAIN RESPONSE AND STABILITY ANALYSIS**	**Periods: 10**
Standard test inputs – Time response – Time domain specifications – P, PI, PD, PID modes of feedback control. Stability analysis: Concept of stability – Routh Hurwitz stability criterion– Root locus: Construction and Interpretation. Effect of adding poles and zeros		**CO2**
UNIT-III	**FREQUENCY AND STATE VARIABLE ANALYSIS**	**Periods: 10**
Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications – Lag and Lead compensator design using bode plots. Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability		**CO3**
I	**STABILITY ANALYSIS OF LTI SYSTEMS- TIME DOMAIN**	**Periods: 15**
1. Plot Unit Step Response of Given Transfer Function and find Peak Overshoot, Peak Time. 2. Process Simulation of a) First order system b) Second order systems 3. Stability analysis using routh- hurwitz method. 4. Plot root locus of given transfer function and to find out ζ, ω_d, ω_n at given root & to discuss stability.		**CO4**
II	**STABILITY ANALYSIS OF LTI SYSTEMS-FREQUENCY DOMAIN**	**Periods: 15**
1. Stability Analysis of Linear Time Invariant Systems using Bode plot. 2. Stability Analysis of Linear Time Invariant Systems using Polar plot. 3. Design of Lag and Lead Compensators using Bode plot. 4. State space model for analysis and design - Determine the controllability and observability.		**CO5**

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

Textbooks

1. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, Sixth edition, 2017.
2. A. Nagoor Kani,“Control Systems Engineering”, RBA Publications, 2017. 17th reprint
3. Cesar perez Lopez,” MATLAB Control Systems Engineering”, A press Academic, 2014
4. Katsuhiko Ogata,” MATLAB for Control Engineers”, Prentice Hall,2018

Reference Books

1. Dr.R.Anandanatarajan & Dr.P.Ramesh Babu, "Control Systems Engineering", SciTech publications (India) Pvt. Ltd, Fifth Edition,2018.
2. M. Gopal, "Control Systems, Principles & Design", Fourth edition, Tata McGraw Hill, New Delhi, 2012.
3. Jairath AK "Problems and Solutions of Control Systems: With Essential Theory", fourth edition, 2007, CBS Publishers & Distributors
4. Ogata.K, "Modern Control System Engineering" Fifth Edition, Pearsons, 2010.
5. D. RoyChaudhury, "Modern Control Engineering", 4th Edition, PHI. 2015

Web References

1. https://nptel.ac.in/courses/107106081/
2. http://www.nptelvideos.com/control_systems/
3. http://www.ewh.ieee.org/sb/iiee/new/tutorials/feedback.pdf
4. https://ledin.com/control-systems-basics/
5. https://upload.wikimedia.org/wikipedia/commons/e/e4/Control_Systems.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	1	1	-	-	-	-	-	-	-	1	2	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	2	-	-
3	3	2	1	1	-	-	-	-	-	-	-	1	2	-	-
4	3	2	1	1	2	-	-	-	-	-	-	1	2	-	-
5	3	2	1	1	2	-	-	-	-	-	-	1	2	-	-

***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
Conduction of Practical	15	End Semester Practical Conduction	15	
Report	10	Result	10	
Viva	5	Viva	5	
Total	30	Total	30	

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

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**.						
Semester	**VI**	Course Category: **PC**			*End Semester Exam: **LE**			
Course Code	**U23ECP608**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**EMBEDDED TECHNOLOGY LABORATORY**	-	-	2	1	50	50	100

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Learn TI Code Composer IDE for MSP-EXP430/432 LaunchPad development.	**K2**
	CO2	Analyze about the MSP430/432's GP Digital I/O pins and clock module.	**K3**
	CO3	Interface common peripherals like LCD displays, RFID readers, and analog sensors (ADC) with the MSP430/432 microcontroller.	**K3**
	CO4	Interrupts and PWM using the MSP430/432's Timer_A module.	**K3**
	CO5	Understand the UART communication protocol and its implementation on the MSP430/432 microcontroller, along with practical applications.	**K3**

List of Experiments:

1. Introduction to the MSP–EXP430/432 LaunchPad and Energia, setup to communicate with the MSP-EXP430/432 LaunchPad.
2. Introduction to TI Code Composer IDE, to begin with a “framework” program for C
3. Introduction to the GP Digital I/O Pins, look in depth at the input/output capabilities
4. Exploring the Basic Clock Module, for several different clock speeds and configurations
5. Interfacing a common 16x2 LCD display / RFID
6. Interfacing MSP430 ADC Module with another sensor’s
7. Introduction to Interrupts using Timer_A Module
8. Introduction to Pulse Width Modulation for Timer_A Module
9. Introduction to the Universal Asynchronous Receiver/Transmitter Serial Communication Interface (UART Mode)
10. Demonstrate some practical applications with above-mentioned process controller

Reference Books

1. James Kretzschmar · Jeffrey Anderson · Steven F. Barrett “MSP430 Microcontroller Lab Manual”
2. John H. Davies, "MSP430 Microcontroller Basics", Newnes, 2008
3. Adrian Fernandez and Dung Dang, "Getting Started with the MSP430 Launchpad", Newnes, 2015
4. MSP430 Design Workshop Student Guide - Texas Instruments, 2015
5. https://training.ti.com/msp430-workshop

Web References

1. https://www.ti.com/tool/MSP430-FUNCTION-CODE-EXAMPLES
2. https://www.referencedesigner.com/tutorials/msplaunchpad/msp430_lp_01.php
3. https://www.instructables.com/ADC10-Tutorial-for-MSP430-Launchpad/
4. https://embeddedtechnosolutions.com/wp-content/uploads/2016/11/MSP430-Tutorial.pdf
5. https://www.embeddedrelated.com/showarticle/420.php

*** 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	1	2	1	-	-	-	-	-	-	1	1	-	-
2	2	3	1	2	1	-	-	-	-	-	-	1	1	-	-
3	2	3	2	2	1	-	-	-	-	-	-	1	1	-	-
4	2	3	2	2	1	-	-	-	-	-	-	1	1	-	-
5	2	3	2	2	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

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

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category: **PC**				*End Semester Exam: **LE**		
Course Code	**U23ECP609**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL SIGNAL PROCESSING LABORATORY**	**-**	**-**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Signal and systems		
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Analyze sinusoidal signal sums and frequency responses using MATLAB or equivalent software.	**K2**
	CO2	Implement and verify linear and circular convolution, as well as autocorrelation and cross-correlation.	**K2**
	CO3	implement N-point DFT and FFT and analyze power density spectra and frequency responses.	**K3**
	CO4	Design and compare IIR and FIR filters using various methods	**K3**
	CO5	Perform decimation, interpolation, and implement FFT-Decimation-In-Time (DIT) algorithms.	**K3**

List of Experiments:

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Perform sampling and reconstruction of signals and verify the presence of aliasing by comparing the original and reconstructed signals.
2. Compute the sum of two sinusoidal signals, and analyze their frequency response, including both 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.
6. Implement and verify N-point FFT of a given sequence and find the frequency response (magnitude and phase).
7. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter / High Pass Filter)
8. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter / High Pass Filter).
9. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique using rectangular window and hamming window
10. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
11. Compute the decimation and interpolation of a given signal and analyze the effects of these processes on signal representation.

DSP PROCESSOR BASED IMPLEMENTATION

12. Study of architecture and various addressing modes of Digital Signal Processor
13. Generation and Analysis of Discrete-Time Signals
14. Implementation and Analysis of FFT-Decimation-In-Time (DIT) Algorithm

Reference Books

1. John G. Proakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Pearson Education, 4th edition, January 2014
2. Alan V. Oppenheim, “Discrete-Time Signal Processing”, Pearson Education, 3rd edition, January 2014
3. Sanjit K Mitra, “Digital signal processing, A computer base approach”, McGraw-Hill Higher Education, 4th Edition, 2011.

Web References

1. http://www.ece.iit.edu/~biitcomm/Yarmouk/Digital%20Signal%20Processing%20Using%20Matlab%20v4.0%20(John%20G%20Proakis).pdf
2. http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x_Matlab.pdf
3. https://www.mathworks.com/solutions/dsp.html
4. http://vlabs.iitkgp.ac.in/dsp/#

*** 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	1
2	3	3	3	2	-	-	-	-	-	1	-	1	3	1	1
3	3	3	2	3	-	-	-	-	-	1	-	1	3	3	1
4	3	3	2	3	-	-	-	-	-	1	-	1	3	3	2
5	3	3	3	1	-	-	-	-	-	1	-	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
	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	**Electronics and Communication Engineering**	Programme: **B.Tech**.						
Semester	**VI**	Course Category: **PC**			*End Semester Exam: **LE**			
Course Code	**U23ECP610**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**DIGITAL VLSI SYSTEM DESIGN LABORATORY**	-	-	2	1	50	50	100

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Design and simulate combinational circuits using Verilog HDL	
	CO2	Design and simulate sequential circuits using Verilog HDL.	
	CO3	Implement the logic modules into FPGA Boards.	
	CO4	Synthesize the Digital Logic using EDA tools.	
	CO5	Analyze the cost function using EDA Tool.	

List of Experiments:

1. Study of Simulation and Implementation procedure of FPGA.
2. Design & implement the following circuits using FPGA
   - Basic logic gates.
   - Half Subtractor and Full Subtractor.
   - 8-Bit Adders (Simple Adder & Ripple Carry Adder).
   - 4 Bit Multiplier (Simple Multiplier & Array Multiplier).
   - Code converters.
   - Decoder and Priority encoder.
   - 8 Bit Arithmetic logic unit.
   - Flip flops
   - 4 Bit Up and Down Counters.
   - Finite State Machine (Moore Machine & Mealy machine).
   - Sequence detector.

Reference Books

1. Bob Zeidman, Designing with FPGAs and CPLDs, Elsevier, CMP Books, 2002.
2. Samir Palnitkar, “Verilog HDL”, Pearson Education, 2nd Edition, 2004.
3. Kevin Skahill, “VHDL for Programmable Logic”, PHI/Pearson education, 2006.
4. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL”, Pearson (Prentice Hall).
5. Ming-Bo Lin, “Digital System Designs and Practices using Verilog HDL and FPGAs”, Wiley,2012.

Web References

1. http://www.asic-world.com/verilog/veritut.html
2. https://www.coursera.org/courses?query=verilog
3. https://hackr.io/tutorials/learn-verilog
4. https://www.udemy.com/topic/verilog-hdl-programming/
5. https://www.maven-silicon.com/online-vlsi-design-verilog-hdl-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	2	-	-	-	-	-	-	-	-	-	-	-	2	-	2
2	3	3	1	1	-	-	-	-	-	-	-	-	2	-	2
3	1	2	2	2	-	-	-	-	-	-	-	-	2	-	2
4	-	1	3	3	1	-	-	-	-	-	-	-	2	-	2
5	3	3	3	3	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
	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VI**	Course Category: **PA**			*End Semester Exam: -			
Course Code	**U23ECW602**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MINI PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
ECE								
Prerequisite	Electronics, Communication							
	On completion of the course, the students will be able to						BT Mapping	
Course Outcomes	**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 2 students during the third year, fifth semester. The aim of the micro project is that the student must 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 is using in the Project. The Micro-project is an application that should be formally initiated and should be developed and 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

Assessment method for Micro Project

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

*Project/ Demonstration/ presentation/ Report/ skill-based evaluation pattern shall be used during model Exam schedule

Department	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECC6XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - VI**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category: **MC**			*End Semester Exam: **-**			
Course Code	**U23ECM606**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**GENDER EQUALITY**	**2**	**0**	**-**	**-**	**100**	**-**	**100**

Prerequisite	**-**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping
	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.

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.

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.

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.

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.

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

Textbook

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 Book

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.
4. Iftikhar R. (2016). 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

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 Method

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

VII- Semester

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	U23ECT713	RF and Microwave Communication	PC	3	0	0	3	25	75	100
3	U23ECT714	Wireless Communication	PC	3	0	0	3	25	75	100
4	U23ECE7XX	Professional Elective - IV	PE	3	0	0	3	25	75	100
5	U23XXO7XX	Open Elective – III	OE	3	0	0	3	25	75	100
Practical										
7	U23ECPC01	Internet of Things Laboratory	PC	0	0	2	1	50	50	100
8	U23ECP711	High Frequency Communication Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ECW703	Project Phase – I	PA	0	0	4	2	50	50	100
11	U23ECW704	Industrial Training / Internship	PA	0	0	2	1	100	-	100
Total							**20**	**375**	**525**	**900**

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PC**			End Semester Exam: **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**

Prerequisite	Microcontroller	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Explain the fundamentals of IoT, its characteristics, protocols, and functional models.	**K2**
	CO2 Illustrate different IoT reference architectures, functional, deployment, and operational views.	**K4**
	CO3 Demonstrate IoT communication protocols (CoAP, MQTT, XMPP) for secure and efficient data communication.	**K3**
	CO4 Develop IoT applications by integrating device data storage, authentication, and cloud-based solutions.	**K3**
	CO5 Summarize 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:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Textbooks

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 OvldluVermesan, 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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **PC**			End Semester Exam: **TE**			
Course Code	**U23ECT713**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RF AND MICROWAVE COMMUNICATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Electromagnetic Fields Theory, Transmission Lines and Waveguides		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Understand the fundamental concepts of RF and microwave network theory	**K2**
	CO2	Justify the working principles and design techniques of passive RF and microwave devices	**K4**
	CO3	Interpret the characteristics of RF and microwave active semiconductor devices	**K4**
	CO4	Illustrate the design of RF amplifiers and matching network	**K4**
	CO5	Understand the characterization of microwave generators and measurements	**K2**

UNIT-I	**RF AND MICROWAVE NETWORK THEORY**	**Periods:09**
Importance of radio frequency design-–Frequency spectrum–RF behavior of passive components- Review of low frequency parameters- - Two port network - High frequency parameters- Scattering parameter – S-parameter conversion.		**CO1**
UNIT-II	**RF AND MICROWAVE PASSIVE DEVICES**	**Periods:09**
Microstrip transmission line - Power dividers- Wilkinson power divider – Microwave Coupler-Hybrid coupler, Coupled line coupler- Microwave filter –design by insertion loss method–Isolator–Phase shifter–Circulator-Resonator.		**CO2**
UNIT-III	**RF AND MICROWAVE ACTIVE DEVICES**	**Periods:09**
RF diode-Schottky diode, PIN diode, Varactor diode, IMPATT diode, Tunnel diode- High-frequency oscillator configuration- voltage controlled oscillator, Gunn element oscillator -Basic characteristics of mixers- Types of mixers.		**CO3**
UNIT-IV	**RF AMPLIFIERS AND MATCHING NETWORKS**	**Periods:09**
Characteristics of amplifiers-Stability Circle-Constant gain- Single stage transistor amplifier design-Low noise amplifier-Broadband Amplifiers-High power amplifier-Impedance Matching-Impedance matching using discrete components- Two-component matching networks.		**CO4**
UNIT-V	**MICROWAVE SIGNAL GENERATION AND MEASUREMENT**	**Periods:09**
Theory and application of two cavity klystron amplifiers-Reflex klystron oscillator-Traveling wave tube amplifier- VSWR meter Power meter, Spectrum analyzer, Network Analyzer-Measurement of impedance, Frequency, Power, VSWR, S-parameters.		**CO5**

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

Textbooks

1. Reinhold Ludwig and Gene Bogdanov, “RF Circuit Design: Theory and Applications”, Pearson Education Inc., 2011
2. D.Pozar, "Microwave Engineering", John Wiley & Sons, 4th Edition New York, 2012.
3. Collin R E, "Foundations of Microwave Engineering", John Wiley and Sons Inc., 2011.

Reference Books

1. Tomasi W, "Advanced Electronics communication System", Sixth Edition, Prentice Hall Inc, New Delhi, 2014.
2. Thomas H Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
3. Mathew M Radmanesh, “RF and Microwave Electronics”, Prentice Hall, 2000.
4. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2005.
5. Liao Y.S, "Microwave devices and circuits", New Delhi, 2008,

Web References

1. https://onlinecourses.nptel.ac.in/noc23_ee36/preview
2. https://archive.nptel.ac.in/courses/108/105/108105189/
3. https://archive.nptel.ac.in/courses/117/105/117105138/
4. http://kcl.digimat.in/nptel/courses/video/108105189/L09.html
5. https://archive.nptel.ac.in/courses/108/101/108101112/

***TE–TheoryExam,LE–LabExam**

COs/POs/PSOsMapping

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	-	-	-	-	-	-	1	3	-	-
2	3	3	3	2	2	-	-	-	-	-	-	1	3	-	-
3	3	3	2	2	3	-	-	-	-	-	-	1	3	-	-
4	3	3	3	3	3	-	-	-	-	-	-	1	3	-	-
5	3	2	1	1	3	-	-	-	-	-	-	1	3	-	-

CorrelationLevel: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

***Application-oriented/Problemsolving/Design/Analyticalincontentbeyondthesyllabus**

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **PC**			*End Semester Exam: **TE**			
Course Code	**U23ECT714**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**WIRELESS COMMUNICATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Describe wireless channel and evolve the system design specifications	**K2**
	CO2	Determine the modulation and diversity combining techniques	**K3**
	CO3	Estimate the cellular system design and its standards	**K3**
	CO4	Illustrate wireless networks, standards and its technologies	**K3**
	CO5	Demonstrate advanced wireless communication techniques	**K3**

UNIT-I	**BASICS OF WIRELESS COMMUNICATION**	**Periods:09**
History of Wireless Communication - General Model of Wireless Communication Link - Types of Signals -Wireless Channel and Radio Communication - Free Space Propagation Model - Channel Noise and Losses –Fading - Multipath Fading – Shadowing - Wireless Channel Modelling: AWGN Channel, Rayleigh Channel		**CO1**
UNIT-II	**MEDIUM ACCESS ALTERNATIVES FOR WIRELESS COMMUNICATION**	**Periods:09**
Spread Spectrum Modulation - Pseudo-Noise Sequences-DSSS and FHSS Systems - Time Hopping and Hybrid Spread Systems; Detection Strategies - Diversity Combining Techniques: Selection Combining - Threshold Combining - Equal Gain Combining - Maximum Ratio Combining.		**CO2**
UNIT-III	**CELLULAR SYSTEM DESIGN FUNDAMENTALS**	**Periods:09**
GSM system for mobile Telecommunication - Frequency reuse - Multiple Access Technologies - Cellular Processes - Call Setup, Handover -Tele traffic Theory - General Packet Radio Service – EDGE Technology - CDMA Based Standards: IS 95 to CDMA 2000 - Wireless Local Loop.		**CO3**
UNIT-IV	**WIRELESS LAN AND BLUETOOTH TECHNOLOGY**	**Periods:09**
Introduction to Mobile Ad hoc Networks – IEEE 802.11 Architecture and Services - Bluetooth – Bluetooth Protocol Stack - Wi-Fi Standards -WiMAX Standards – WLAN Technology – Requirements of WLAN –Infrared Communication - Li-Fi Communication.		**CO4**
UNIT-V	**LTE AND MIMO TECHNOLOGIES**	**Periods:09**
Ultra-Wideband Communication - Mobile data networks - Long Term Evolution (LTE) - Mobile Satellite Communication - Introduction to MIMO - MIMO Channel Capacity - MIMO Spatial Multiplexing – MIMO Diversity – MIMO -OFDM.		**CO5**

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

Textbooks

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson Publications, 2nd Edition, 2010.
2. Steve Rackley, Wireless Networking Technology, From Principles to Successful Implementation, Newnes; 1st edition,2011
3. Gottapu Sasibhushana Rao, “Mobile Cellular Communication”, Pearson Education, 2012

Reference Books

1. UpenaDalal and Manoj K. Shukla, “Wireless and Mobile Communication”, Oxford Press Publications, 2016.
2. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2012.
3. EzioBiglieri and Robert Calderbank, “MIMO Wireless Communications”, Cambridge University Press, 2015.
4. Kaveh Pah Laven and P. Krishna Murthy, “Principles of Wireless Networks”, Pearson Education, 2012
5. William Stallings, “Wireless Communication and Networking”, PHI, 2003.

Web References

1. http://nptel.ac.in/courses/117102062/
2. https://onlinecourses.nptel.ac.in/noc17_cs37/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-452-principles-of-wireless-communications-spring-2006/
4. https://jiscollege.ac.in/ece/Syllabus_MCNT_2018.pdf
5. https://learnengineering.in/ec8652-wireless-communication/

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	3	-	-
2	3	1	1	-	-	-	-	-	-	-	-	1	3	-	-
3	3	1	1	-	-	-	-	-	-	-	-	1	3	-	-
4	3	1	1	-	-	-	-	-	-	-	-	1	3	-	-
5	3	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
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***Application-oriented/Problemsolving/Design/Analyticalincontentbeyondthesyllabus**

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**.						
Semester	**VII**	Course Category: **PC**			*End Semester Exam: **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

Prerequisite			
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Demonstrate IoT hardware components such as Raspberry Pi, sensors, and actuators, and familiarize them with their interfacing and initialization.	**K3**
	CO2	Experiment 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	evaluate IoT-based automation and security by integrating mobile applications, actuator control, and threat analysis.	**K5**
	CO5	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.

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–TheoryExam,LE–LabExam**

COs/POs/PSOsMapping

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	1	1	3	-	-	-	-	-	-	-	-	1	-
2	2	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	-

CorrelationLevel: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/Analyticalincontentbeyondthesyllabus.**

Department	**Electronics and Communication Engineering**		Programme: **B.Tech.**					
Semester	**VII**		Course Category: **PC**			*End Semester Exam: **LE**		
Course Code	**U23ECP709**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**HIGH FREQUENCY COMMUNICATION LABORATORY**		**-**	**-**	**2**	**1**	**50**	**50**	**100**
Prerequisite	Electromagnetics, Microwave devices and RF applications							
Course Outcome	On completion of the course, the students will be able to							**BT Mapping**
	CO1	Understand signal generation at microwave frequencies and derive the performance characteristics						**K2**
	CO2	Comprehend the need for different microwave devices and select proper microwave components for engineering applications						**K3**
	CO3	Interpret and implementation of microwave devices in simulation software to model the devices						**K3**
	CO4	Evaluate and understand the performance of microwave devices in real - world applications using electromagnetic CAD tools						**K4**
	CO5	Analyze and understand measurement techniques involved in the microwave engineering						**K4**

List of Experiments:

Session-1: Characteristics Analysis of High Frequency Components using Microwave Test Bench.

1. Analyze the characteristics of microwave signal using Gunn diode test bench.
2. Determine the performance of multiport junctions – E-plane and H-plane Tee.
3. Analyze the characteristics of Magic Tee using the microwave test bench.
4. Demonstrate the characteristics of microwave circulator and analyze the performance using Gunn test bench.
5. Analyze the coupling characteristics of the directional coupler and determine its directivity and coupling factor
6. Measure the power reflection, reflection coefficient and VSWR using the microwave Gunn test bench.
7. Determine the gain and radiation pattern of a Horn antenna using direct comparison method.
8. Determination of mode characteristics of a Reflex Klystron oscillator

Session-2: High Frequency Components Design Using Simulation Software

9. Design and analyze the microwave filter characteristics using simulation software
10. Analyze the impedance matching network performance using Smith chart in simulation software.
11. Design and simulate the microstrip transmission line using simulation software.
12. Implement the microstrip patch antenna using simulation software and analyze the reflection and radiation characteristics.

Reference Books

1. Rohde, U. L. and Newkirk, D. P. RF/Microwave Circuit Design for Wireless Applications, John Wiley & Sons, 2000.
2. Pozar, David M. Microwave engineering: theory and techniques. John Wiley & Sons, 2021.
3. Ludwig, Reinhold. RF Circuit Design: Theory & Applications, 2/e. Pearson Education India, 2000.
4. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Edition, Pearson Education, 2013.
5. Balanis, C.A., 2015. Antenna theory: analysis and design. John Wiley & sons.

Web References

1. https://archive.nptel.ac.in/courses/108/103/108103141/
2. https://onlinecourses.nptel.ac.in/noc20_ee91/preview
3. https://archive.nptel.ac.in/courses/108/101/108101112/
4. https://archive.nptel.ac.in/courses/117/105/117105122/
5. https://archive.nptel.ac.in/courses/117/101/117101119/

***TE–TheoryExam,LE–LabExam**

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	1	1	1	-	-	-	-	-	-	1	3	2	1
2	3	3	3	2	1	-	-	-	-	-	-	1	3	2	1
3	3	3	3	3	2	-	-	-	-	-	-	1	3	2	1
4	3	3	3	3	2	-	-	-	-	-	-	1	3	2	1
5	3	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
	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/Analyticalincontentbeyondthe syllabus.**

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **PA**			*End Semester Exam: -			
Course Code	**U23ECW703**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROJECT PHASE – I**	**0**	**0**	**4**	**2**	**50**	**50**	**100**

Prerequisite	Electronics, Communication		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping
	CO1	Interpret the challenging problems in advanced engineering fields such as Wireless Communication, Embedded Systems, VLSI Design, or Image Processing, and establish well-defined project goals aligned with industry needs and emerging research trends.	K2
	CO2	Design innovative solutions by combining hardware and software technologies wherever needed to tackle real-world engineering challenges.	K3
	CO3	Relate modern engineering methodologies and tools to design, implement, and validate project outcomes, ensuring functionality, efficiency, and performance optimization.	K4
	CO4	Evaluate system performance using appropriate metrics to improve reliability, energy efficiency, and scalability.	K5
	CO5	Develop a technical concepts effectively while upholding ethical, societal, and environmental responsibilities in engineering design.	K6

Students will work in teams of up to four members, focusing on developing a hardware/software solution relevant to real-world applications. Each team must select a problem statement, conduct a thorough literature survey, and identify an appropriate methodology and technology stack. The project must be formally initiated, and progress will be documented through multiple review stages. Deliverables include a project proposal, system design, and an initial prototype. The work done in Project Work Phase–I should serve as the foundation for Phase–II, ensuring a smooth transition for further development. The final submission should include a detailed report and a hardware/software prototype, which will be evaluated and approved by the department's internal evaluation committee.

Students are required to submit a project proposal report detailing the problem statement, objectives, and proposed solution. A system design document describing the architecture, components, and workflow must also be provided. If applicable, an initial prototype demonstrating proof of concept should be included. The final project report must comprehensively document all aspects of Phase–I work, and students must participate in presentation and review meetings evaluated by the internal committee.

The department internal evaluation committee, comprising a faculty coordinator, project supervisor, and a senior faculty member, will monitor and assess the project throughout the semester. Students must maintain a progress log to track their work and evaluations. Approval of Project Work Phase–I, is mandatory for students to proceed to Project Work Phase–II, ensuring they have a strong foundation for final implementation.

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
4	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
5	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3

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

Assessment method for Micro Project

*Project/ Demonstration/ presentation/ Report/ skill-based evaluation pattern shall be used during model Exam

Assessment	Continuous Assessment Marks						End Semester Mark		
	Review 1		Review 2		Review 2		Evaluation of Phase - I Report and Viva-voce		
	Review Committee#	Supervisor	Review Committee#	Supervisor	Review Committee#	Supervisor	Report	Presentation and Viva	Demonstration
Marks	10	5	10	5	15	5	15	20	15
	15		15		20		50		
	50						**50**		
	100								

Department	**Electronics and Communication Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **AEC**			End Semester Exam : **-**			
Course Code	**U23ECW704**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRIAL TRAINING / INTERNSHIP**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
Prerequisite	**-**							

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 internship shall be for a period of 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 in the college before undertaking the internship and need to submit a detailed report after completion for the purpose of assessment. The internship marks will be given in the 7th semester mark sheet.

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Report	**Presentation**	
Marks	50	50	100

Professional Elective –I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23ECE401	Transmission Lines and Waveguides
2	U23ECE402	Computer Architecture
3	U23ECE403	Industry 4.0 Technology
4	U23ECE404	Biomedical Electronics
5	U23ECE405	Electronic Measurement and Instrumentation

Department	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE401**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**TRANSMISSION LINES AND WAVEGUIDES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Basics of Electromagnetic Field Theory		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Understand the characteristics of signal propagation through transmission lines and its losses	**K2**
	CO2	Analyze the line parameters and various losses in transmission lines	**K3**
	CO3	Apply smith chart for line parameters and impedance calculations.	**K3**
	CO4	Analyse rectangular waveguides for EM wave propagation	**K3**
	CO5	Interpret the characteristics of Circular waveguides	**K3**

UNIT-I	**TRANSMISSION LINE THEORY**	**Periods:09**
General theory of Transmission lines - Types of transmission lines - General solution – Characteristic impedance, propagation constant, attenuation and phase constants-The infinite line - Wavelength, velocity of propagation - Distortion in transmission line- The distortion less line – The terminated lossy line - Reflection coefficient - Input and transfer impedance - Open and short-circuited lines.		**CO1**
UNIT-II	**HIGH-FREQUENCY TRANSMISSION LINES**	**Periods:09**
Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation less line, Standing Waves, Standing Wave Ratio - Input impedance of the dissipation less line - Reflection losses - Measurement of VSWR and wavelength-High frequency transmission lines: Coaxial line, Strip line and Microstrip line.		**CO2**
UNIT-III	**IMPEDANCE MATCHING IN HIGH-FREQUENCY LINES**	**Periods:09**
Impedance matching: Quarter wave transformer, One Eighth wave line, half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart – Application of Smith chart, Analysis of Transmission Line performance using Admittance and impedance Smith chart, VWSR and impedance measurement using Smith chart, Single and double stub matching using Smith chart.		**CO3**
UNIT-IV	**RECTANGULAR WAVEGUIDES**	**Periods:09**
Concept of Waveguide, Transverse Magnetic waves, Transverse Electric waves and Transverse Electromagnetic waves between parallel plates- Introduction to Rectangular Waveguides, TEmn & TMmn Modes in Rectangular Waveguides, impossibility of TEM waves in rectangular wave guides, Waveguide Parameters — Cut-off wavelength, Guide wavelength, Free space Wavelength, Phase velocity, Group velocity.		**CO4**
UNIT-V	**CIRCULAR WAVEGUIDES**	**Periods:09**
Introduction to Circular waveguides, solutions of a field equations in cylindrical coordinates, TE_{mn} & TM_{mn} Modes in Circular Waveguides, Waveguide Parameters — Cut-off wavelength, Guide wavelength, Free space Wavelength, Phase velocity, Group velocity, Dominant and Degenerated Modes.		**CO5**

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

Textbooks

1. Nathan Ida, 'Engineering Electromagnetics", Springer International, 2nd Ed., 2008
2. Reinhold Ludwig, Pavel Bretchko, "RF Circuit Design Theory and Applications", Prentice Hall, 2000.

Reference Books

1. Annapurna Das, Sisir K Das, "Microwave Engineering", Tata McGraw Hill, 2nd Ed., 2006,
2. David M. Pozar, "Microwave Engineering" John Wiley & Sons, 4th Ed, 2011
3. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 1st Ed, 2005.
4. E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2nd Ed, 2006.
5. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson Education, 3rd Ed., 2003.

Web References

1. https://archive.nptel.ac.in/courses/117/101/117101056/
2. https://archive.nptel.ac.in/courses/108/102/108102119/
3. https://onlinecourses.nptel.ac.in/noc24_ee42/preview
4. https://link.springer.com/chapter/10.1007/978-1-4615-6459-1_28
5. https://innovationspace.ansys.com/product/basic-transmission-line-structures/

*** 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	3		
2	3	3	1	1	1							1	3		
3	3	3	2	2	1							1	3		
4	3	3	2	2	1							1	3		
5	3	3	2	2	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	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	**IV**	Course Category **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE402**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**COMPUTER ARCHITECTURE**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**A basic introduction to computers and the functions of their various parts is necessary**		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Infer the concepts of organization and design of a digital computer	**K2**
	CO2	Illustrate the concept of Pipelining and Speed Processing	**K2**
	CO3	Discusses the techniques computers use to communicate with input and output devices	**K3**
	CO4	Infer the concepts of memory hierarchy	**K3**
	CO5	Discusses the characteristics of multiprocessors	**K3**

UNIT-I	**COMPUTER ORGANIZATION AND DESIGN**	**Periods:09**
Instruction Codes – Computer Registers – Computer Instructions – Timing and Control – Instruction Cycle: Fetch and Decode, Determine the type of Instruction, Register-Reference Instructions – Memory Reference Instructions – Input Output and Interrupt: Input-Output Configurations, Instructions, Program Interrupt, Interrupt Cycle.		
UNIT-II	**PIPELINING AND PROCESSING**	**Periods:09**
Parallel Processing – Pipe lining – Arithmetic Pipeline – Instruction Pipeline: Four Segment Instruction Pipeline – RISC Pipeline: Three Instruction Pipeline – Vector Processing: Operations, Interleaving, Supercomputers – Array Processors: Attached Array Processor, SIMD Array Processor		
UNIT-III	**INPUT-OUTPUT ORGANIZATION**	**Periods:09**
Peripheral Devices – Input Output Interface: I/O Bus and Interface Modules, I/O versus Memory Bus, isolated versus Mapped I/O – Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt – Direct memory Access – Input Output Processor: CPU-IOP Communication, IBM 370 I/O Channel.		
UNIT-IV	**MEMORY ORGANIZATION**	**Periods:09**
Memory Hierarchy – Main Memory: RAM and ROM Chips, Memory Address Map, Memory Connection to CPU – Auxiliary Memory: Magnetic Disks, Magnetic Tape – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware.		
UNIT-V	**MULTIPROCESSORS**	**Periods:09**
Characteristics of Multiprocessors – Interconnection Structures: Time Shared Common Bus, Multiport Memory, Crossbar Switch, Multistage Switching Network – Interprocessor Arbitration: System Bus, Serial, Parallel Arbitration Algorithms – Interprocessor Communication and Synchronization – Cache Coherence		

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

Textbooks

1. Morris Mano, “Computer System Architecture”, 3rd edition, Prentice Hall India, 2016
2. W. Stallings,” Computer Organization and Architecture Designing for Performance”, 11th edition, Pearson, 2022.

Reference Books

1. John P Hays, “Computer architecture and organization”, 2015.
2. J. L. Hennessy and D. A. Patterson, “Computer Architecture A Quantitative Approach”, Morgan Kauffman,2011.
3. Jim Ledin, “Modern Computer Architecture and Organization”, 1st edition, Packet Publishing, 2020.
4. Linda Null, “The Essentials of Computer Organization and Architecture”, Jones & Barlett Learning, 2023.

Web References

1. https://www.computersciencedegreehub.com/faq/what-is-computer-architecture/
2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
3. https://www.oreilly.com/library/view/designing-embedded-hardware/0596007558/ch01.html
4. https://www.researchgate.net/publication/329191354_Lecture_Notes_on_Computer_Architecture
5. http://www.cs.iit.edu/~virgil/cs470/Book/

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	2	1	1
2	2	1	1	-	-	-	-	-	-	-	-	1	2	1	1
3	2	1	1	-	-	-	-	-	-	-	-	1	2	1	1
4	2	1	1	-	-	-	-	-	-	-	-	1	2	1	1
5	2	1	1	-	-	-	-	-	-	-	-	1	2	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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE403**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRY 4.0 TECHNOLOGY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Fundamental concepts of computer networking		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Analyze Industry 4.0's impact and propose data-driven strategies for transformation.	**K2**
	CO2	Interpret basic of IIoT, and smart technologies for Industry 4.0.	**K2**
	CO3	Learners with skills in systems and technologies for Industry 4.0.	**K2**
	CO4	Explores the role of data, knowledge in future organizations.	**K2**
	CO5	Explores the opportunities, challenges, and strategies for Industry 4.0.	**K3**

UNIT-I	**FUNDAMENTALS OF INDUSTRY**	**Periods:09**
Introduction to Industry 4.0 The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation		**CO1**
UNIT-II	**ROAD TO INDUSTRY**	**Periods:09**
Road to Industry 4.0 - Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities Predictive Analytics		**CO2**
UNIT-III	**RELATED DISCIPLINES, SYSTEM, TECHNOLOGIES FOR ENABLING INDUSTRY**	**Periods:09**
System, Technologies for enabling Industry 4.0–Cyber Physical Systems - Robotic Automation and Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Cyber Security		**CO3**
UNIT-IV	**ROLE OF INDUSTRY IN FUTURE ORGANIZATIONS**	**Periods:09**
Role of data, information, knowledge and collaboration in future organizations - Resource- based view of a firm - Data as a new resource for organizations - Harnessing and sharing knowledge in organizations - Cloud Computing Basics -Cloud Computing and Industry 4.0		**CO4**
UNIT-V	**BUSINESS ISSUES IN INDUSTRIAL APPLICATION**	**Periods:09**
Industry 4.0 IIoT - Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world – Society 5.0		**CO5**

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

Textbooks

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress, 2017
2. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
3. abina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, "Industrial Internet of Things: Cyber manufacturing Systems" (Springer)

Reference Books

1. Arsheep Bahga, Internet of Things: A Hands-On Approach
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”,1st Edition, VPT, 2014
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
4. CunoPfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1- 4493-9357-1
5. Olivier Hersent, David Boswarthick, Omar Elloumi “The Internet of Things – Key• applications and Protocols”, Wiley, 2012

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1. https://nptel.ac.in/courses/106/105/106105195/
2. https://global.hitachi-solutions.com/blog/industry-4-0-technologies
3. https://www.i-scoop.eu/industry-4-0/
4. https://ottomotors.com/blog/5-industry-4-0-technologies
5. https://www.machinemetrics.com/blog/industry-4-0-technologies

*** 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	2	-	1
2	2	1	-	-	-	-	-	-	-	-	-	1	2	-	1
3	2	1	-	-	-	-	-	-	-	-	-	1	2	-	1
4	2	1	-	-	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	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	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	**IV**	Course Category**: PE**			*End Semester Exam**: TE**			
Course Code	**U23ECE404**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BIOMEDICAL ELECTRONICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Fundamental knowledge of electronic circuits, signals, and system		
Course Outcome	On completion of the course, the students will be able to		**BT Mapping**
	CO1	Understand the electro-physiological parameters and recording of bio-potentials	**K1**
	CO2	Comprehend the non-electrical physiological parameters and their measurement	**K2**
	CO3	Understand the Auditory and vision system	**K2**
	CO4	Interpret the various assist devices used in the hospitals	**K3**
	CO5	Understand modern methods of imaging techniques	**K2**

UNIT-I	**ELECTROPHYSIOLOGY AND BIO-POTENTIAL RECORDING**	**Periods:09**
Sources of biomedical signals, Bio-potentials, Bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms, and signal characteristics		CO1
UNIT-II	**BIOCHEMICAL AND NON-ELECTRICAL PARAMETER MEASUREMENT**	**Periods:09**
pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, Photo Plethysmography, Body Plethysmography respiratory, blood pressure, temperature and pulse measurement, and Blood Cell Counters.		CO2
UNIT-III	**AUDITORY AND VISION SYSTEM**	**Periods:09**
Mechanism of hearing, sound conduction system, basic audiometer, pure tone audiometer, Evoked response audiometer system, hearing aids. Anatomy of eye, visual acuity, slit lamp, tonometer, ophthalmoscope, perimeter.		CO3
UNIT-IV	**ASSIST DEVICES**	**Periods:09**
Cardiac pacemakers, finger-tip oximeters, DC Defibrillators, Dialyzer, Lithotripsy, ICCU patient monitoring systems, Ventilators, Diathermies types and applications, LASER applications in ophthalmology		CO4
UNIT-V	**IMAGING SYSTEMS**	**Periods:09**
X-rays, image intensifiers, CT scanners, ultrasound scanners, nuclear methods, thermography, MRI, Ultrasonic Imaging Systems, fusion imaging		CO5

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

Textbooks

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi,2007.
2. M.Arumugam, “Bio-Medical Instrumentation”, Anuradha Agencies, 2003.
3. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2 Edition, 2003.

Reference Books

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and Sons, NewYork, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Handbook, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012

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1. https://www.udemy.com/course/electronics-with-applications-on-biomedical-engineering/?couponCode=NVDPRODIN35
2. https://onlinecourses.nptel.ac.in/noc21_ee105/preview
3. https://www.coursera.org/courses?query=biomedical

***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	1	2	2	1	-	-	-	-	-	-	2	1	-
2	2	2	1	2	2	1	-	-	-	-	-	-	2	1	-
3	2	2	1	2	2	1	-	-	-	-	-	-	2	1	-
4	2	2	1	2	2	1	-	-	-	-	-	-	2	1	-
5	2	2	1	2	2	1	-	-	-	-	-	-	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	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	**IV**	Course Category: **PE**			*End Semester Exam: **TE**			
Course Code	**U23ECE405**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONIC MEASUREMENT AND INSTRUMENTATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Discuss the operation of different instruments.	**K2**
	CO2	Identify the industrial and laboratory applications of instruments.	**K2**
	CO3	Distinguish between the analog and digital meters.	**K3**
	CO4	Discuss the experiments to determine various types of errors in measurements.	**K2**
	CO5	Use of testing and measuring setup for electronic systems.	**K4**

UNIT-I	**MEASUREMENT SYSTEMS**	**Periods:09**
Generalized Measurement systems – Concepts of direct and indirect measurement systems - Static characteristics, accuracy, resolution, precision, expected value, error, and sensitivity. Errors in measurement and dynamic characteristics: speed of response, fidelity, lag, and dynamic error. Voltmeters: Multirange, range extension, solid state, and differential voltmeters. Ammeters: Shunt and thermocouple type ammeter. Ohmmeters: Series type, shunt type, and multimeter for voltage, current, and resistance measurements. Digital multimeters: Block diagram and specifications.		**CO1**
UNIT-II	**SIGNAL GENERATORS & ANALYZERS**	**Periods:09**
Fixed and variable, AF oscillators, AF sine and square wave signal generators, function generators, types - square pulse, random noise, and sweep. Wave Analyzers: Harmonic distortion analyzers, spectrum analyzers, and digital Fourier analyzers.		**CO2**
UNIT-III	**DISPLAY DEVICES**	**Periods:09**
CRT features, vertical amplifiers, a horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, dual beam CRO, and measurement of amplitude and frequency. Dual trace oscilloscope, sampling oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO (active and passive), attenuator type.		**CO3**
UNIT-IV	**AC BRIDGES**	**Periods:09**
Measurement of inductance: Maxwell's bridge, Anderson bridge. Measurement of capacitance: Schearing bridge. Kelvin's bridge, Wheatstone bridge, and Wien Bridge. Errors and precautions and related problems. Q - Meter.		**CO4**
UNIT-V	**ACTIVE AND PASSIVE TRANSDUCERS**	**Periods:09**
Resistance, capacitance, inductance, strain gauges, LVDT, piezoelectric transducers, resistance thermometers, thermocouples, thermistors and sensistors. Basic Hall Effect sensors. Calibration and standards and data acquisition systems		**CO5**

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

Textbooks

1. H.S.Kalsi, "Electronic instrumentation" Tata McGraw Hill Education Pvt LTD, 2010,
2. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2013.
3. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990

Reference Books

1. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2013
2. Robert A.Witte, "Electronic Test Instruments, Analog, and Digital Measurements", Pearson Education, 2014
3. Electronics Instruments and Instrumentation Technology – Anand, PHI 4. Elements of Electronics Instrumentation and Measurement-3rd Edition by JosephJ. Carr. Pearson Education.
4. A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpath Rai & Co (P) Ltd, 2004.

Web References

1. https://www.researchgate.net/publication/288177357_Instrument_Types_and_Performance_Characteristics
2. https://www.gwinstek.com/en-global/products/layer/Signal_Generator
3. https://electronicscoach.com/difference-between-active-and-passive-transducer.html
4. https://eceschool.blogspot.com/p/electronic-measuring-instrumentation.html
5. https://www.docsity.com/en/subjects/electronics-measurement-and-instrumentation

*** 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	1	-	-	-	-	-	1	-	3	2	-
2	3	1	2	1	2	-	-	-	-	-	2	1	3	2	-
3	3	1	2	1	-	-	-	-	-	-	2	1	3	2	-
4	3	2	2	1	-	-	-	-	-	-	1	-	3	2	-
5	3	1	2	1	1	-	-	-	-	-	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**

V- Semester

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECE5XX	Professional Elective – II	PE	3	0	0	3	25	75	100

Professional Elective – II (Offered in Semester V)		
Sl. No	**Course Code**	**Course Title**
1	U23ECE506	Cloud Computing Techniques
2	U23ECE507	Introduction to MEMS
3	U23ECE508	Real-time operating system
4	U23ECE509	Hardware Description Languages
5	U23ECE510	Network Information Security

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**V**	Course Category: **PE**				End Semester Exam: **TE**		
Course Code	**U23ECE506**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CLOUD COMPUTING TECHNIQUES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Any Programming Knowledge		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Understand the fundamentals of cloud computing	**K2**
	CO2	Familiarize the architecture and management of cloud	**K2**
	CO3	Familiarize the virtualization and its types	**K2**
	CO4	Outline the data storage in cloud	**K2**
	CO5	Familiarize security in cloud computing	**K2**

UNIT – I	**FOUNDATIONS**	**Periods:09**
Motivations for Cloud Computing – The Need for Cloud Computing – Defining Cloud Computing – NIST definition of cloud computing – Cloud Computing Is a service – Cloud computing Is a Platform – 5-4-3 Principles of Cloud Computing: – Cloud Ecosystems – Requirements for Cloud Services – Cloud Applications.		**CO1**
UNIT - II	**ARCHITECTURE AND MANAGEMENT**	**Periods:09**
Cloud Architecture – Layers – Anatomy of the Cloud – Network Connectivity in Cloud Computing – Public Cloud Access Networking, Private Cloud Access Networking, Public Intracloud Networking for Cloud Services, Private Intracloud Networking for Cloud Services - Managing the Cloud Infrastructure, Applications		**CO2**
UNIT - III	**VIRTUALIZATION**	**Periods:09**
Virtualization Opportunities: Storage Virtualization, Network Virtualization, Data Virtualization, Applications to Virtualization - Approaches to Virtualization: Full Virtualization, Para Virtualization, Hardware Assisted Virtualization – Hypervisors, its Types, Security Issues and Recommendations.		**CO3**
UNIT - IV	**DATA STORAGE**	**Periods:09**
Cloud Storage – Overview of Cloud Storage – Data Management for Cloud Storge, Cloud Storage Requirements – Provisioning Cloud Storage – Data Intensive Technologies for Cloud Computing - System Architecture – Cloud Characteristic – Distributed Data Storage		**CO4**
UNIT - V	**CLOUD COMPUTING SECURITY**	**Periods:09**
Cloud in Information Technology, Cloud Challenges – Security Aspects – Platform-Related Security – Security Issues in Cloud Service Models – Disaster Recovery – Privacy and Integrity.		**CO5**

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

Textbooks

1. K. Chandrasekaran, “Essentials of Cloud Computing”, CRC Press, Taylor & Francis Group, A Chapman & Hall Book, 2015. (Unit 1, 2, 3, 5)
2. A. Srinivasan and J. Suresh, “Cloud Computing A Practical Approach for Learning and Implementation”, Pearson, Dorling Kindersley (India) Pvt. Ltd, 2014. (Unit 4)

Reference Books

1. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Coputing, A Practical Approach” McGraw-Hill Osborne Media, 2009.
2. Danielle Ruest, Nelson Ruest, “Virtualization: A Beginner’s Guide”, McGraw-Hill Osborne Media, 2009.
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.
4. Ray J Rafaels, “Cloud Computing: From Beginning to End”, CreateSpace Independent Publishing Platform, 2015
5. Sunilkumar Manvi and Gopal K. Shyam, “Cloud Computing Concepts and Technologies”, CRC Press, Taylor & Francis Group, LLC, 2021.

Web References

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs18/preview
3. https://cloud.google.com/learn
4. https://aws.amazon.com/training/aws-cloud-institute/?nc2=sb_aci
5. https://shorturl.at/scNsl

*** 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	-	-	-	-	-	2	3	2	2
2	2	2	2	2	2	2	-	2	-	-	3	3	3	2	2
3	2	2	2	2	3	3	-	2	2	-	2	3	3	2	3
4	2	2	2	3	2	3	-	2	2	-	3	3	3	2	2
5	2	2	3	3	3	3	-	2	2	2	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
	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	**V**	Course Category: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE507**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTION TO MEMS**	3	0	0	3	25	75	100

Prerequisite	**Basics of Engineering Physics, Solid State Physics**		
Course Outcome	On completion of the course, the students will be able to		BT Mapping
	CO1	Acquire the knowledge about the operations of micro devices, micro systems.	**K2**
	CO2	Design the micro devices, micro systems using the MEMS fabrication process.	**K2**
	CO3	Apply scaling laws that are used extensively in the conceptual design of micro sensors.	**K2**
	CO4	Design Micro actuators for various applications.	**K3**
	CO5	Exploring the applications of MEMS in various systems.	**K3**

UNIT-I	**FUNDAMENTALS OF MICRO DEVICES**	**Periods:09**
Basic definitions – evolution of Micro fabrication – Micro systems and Microelectronics, scaling laws: Scaling in Electrostatic force, Electromagnetic force, Rigidity of structures, Fluid mechanics and Heat transfer, Materials for MEMS: Silicon, Silicon Compounds, Polymers, Metals.		**CO1**
UNIT-II	**FABRICATION AND MANUFATURING TECHNOLOGIES**	**Periods:09**
Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining		**CO2**
UNIT-III	**MICRO SENSORS**	**Periods:09**
Introduction, Force and Pressure Microsensors, Position and Speed Microsensors, Acceleration Microsensors, Chemical Sensors, Biosensors, Temperature Sensors, Flow Sensors, Micro accelerometers, Microfluidics		**CO3**
UNIT-IV	**MICRO ACTUATORS**	**Periods:09**
Introduction, Electrostatic Micro actuators, Motion Principle and Its Properties, Concepts and Prototypes of Electrostatic Micro actuators, Piezoelectric Micro actuators, Motion Principle and Its Properties, Concepts and Prototypes of Piezoelectric Micro actuators, Magneto strictive Micro actuators, Electromagnetic Micro actuators.		**CO4**
UNIT-V	**APPLICATIONS Of MEMS**	**Periods:09**
Polymer MEMS: Polymers in MEMS-Polyimide, Liquid Crystal Polymer (LCP), PDMS, PMMA, Representative Applications-Acceleration Sensors, Pressure Sensors. Optical MEMS: Passive MEMS Optical Components-Lenses, Mirrors, Actuators for Active Optical MEMS Actuators for Small Out-of-Plane Translation		**CO5**

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

Textbooks

1. Tai Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata McGraw Hill, 2002.
2. Cheng Liu, “Foundations of MEMS”, Pearson education India limited, 2006.
3. S. Fatikow U. Rembold, “Microsystem Technology and Micro robotics”, Springer-Verlag Berlin Heidelberg New York in 1997

Reference Books

1. Marc Madou, “Fundamentals of Micro fabrication”, CRC press 1997.
2. Stephen D Senturia, Microsystem Design, Springer Publication, 2000.
3. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures” CRC Press, 2002
4. M.H.Bao “Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes”, Elsevier, Newyork, 2000.
5. Mohamed Gad-el-Hak “MEMS Handbook”.

Web References

1. https://nptel.ac.in/courses/1081061652.
2. https://www.me.iitb.ac.in/~gandhi/me645/05L1_coursecontents_mtvn.pdf.
3. https://archive.nptel.ac.in/courses/117/105/117105082/
4. https://www.mems-exchange.org/MEMS/what-is.html
5. https://www.wieweb.com/ie/1_1-introduction-to-mems.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	3	2	3	3	3	2	3	1	-	2	-	2	2	-	-
2	2	3	3	2	3	2	-	-	-	-	2	3	3	-	-
3	3	3	2	2	3	2	3	-	-	-	2	3	2	-	-
4	3	3	3	3	3	3	3	-	-	-	2	3	2	3	3
5	3	3	3	3	3	2	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
	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	**V**	Course Category: **PE**			*End Semester Exam: **TE**			
Course Code	**U23ECE508**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**REAL-TIME OPERATING SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Basic knowledge of operating systems, programming skills		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Understand models of real-time system and real-time scheduling algorithms.	**K2**
	CO2	Understand the capabilities for handling resource sharing and dependencies among real-time tasks.	**K2**
	CO3	Analyze real-time task scheduling in multiprocessor and distributed systems.	**K2**
	CO4	Understand real-time operating systems and databases	**K2**
	CO5	Learn fault tolerance and reliability evaluation technique	**K2**

UNIT-I	**REAL-TIME SYSTEMS INTRODUCTION**	**Periods:09**
A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, Events in Real time system, classification of Timing constraints, Examples of different type of Timing constraints, Modeling timing constraints.		**CO1**
UNIT-II	**TASK AND SCHEDULING**	**Periods:09**
Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling.		**CO2**
UNIT-III	**RATE MONOTONIC ALGORITHM (RMA) AND RESOURCE MANAGEMENT**	**Periods:09**
Rate Monotonic Algorithm (RMA), Issues Associated with RMA, in Practical situations, Handling Resource Sharing Among Real-Time Tasks, Priority Inversion, Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP) Priority Ceiling Protocol (PCP) Different Types of Priority Inversions under PCP Important Features of PCP		**CO3**
UNIT-IV	**TIME SCHEDULING IN MULTIPROCESSOR AND DISTRIBUTED SYSTEMS**	**Periods:09**
Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization, Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix - based Real-time operating systems		**CO4**
UNIT-V	**DATABASES AND COMMUNICATION**	**Periods:09**
Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Basic concepts, Examples of applications requiring Real-time Communication, Real-time communication in a LAN and Real-time communication over packet switched networks.		**CO5**

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

Textbooks

1. Rajib Mall - Real-Time Systems: Theory and Practice, Pearson Education, 2019
2. Krishna C. M. & Kang Shin G., Real Time Systems, Mc Graw Hil, 1997
3. Hermann Kopetz - Real-Time Systems: Design Principles for Distributed Embedded Applications, Springer, 2024

Reference Books

1. Jane W.S. Liu - Real-Time Systems, Cambridge University Press, 2021
2. Stuart Bennett, Real time computer control, phI 1997
3. Alan C. Shaw, Real-Time Systems and Software, Wiley, 2001.
4. Colin walls, "Building a Real Time Operating System: RTOS from the Ground Up", Newness, 2020
5. Phillip A. Laplante, “Real Time System Design and Analysis”, John Wiley & Sons Publications, 2004.

Web References

1. https://nptel.ac.in/courses/106105172
2. https://ebooks.inflibnet.ac.in/csp13/chapter/rtos-basic-concept/
3. https://www.digikey.in/en/maker/projects/what-is-a-realtime-operating-system rtos/28d8087f53844decafa5000d89608016
4. http://web.iiit.ac.in/~bezawada/CN.html
5. https://www.tutorialspoint.com/Real-Time-Embedded-Systems

*** 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	-	1	1	-	-	-	-	-	-	1	2	1	-
2	2	1	-	1	1	-	-	-	-	-	-	1	2	1	-
3	3	2	1	1	1	-	-	-	-	-	-	1	2	1	-
4	2	1	-	1	1	-	-	-	-	-	-	1	2	1	-
5	2	2	-	1	1	-	-	-	-	-	-	1	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	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	**V**	Course Category: **PE**			*End Semester Exam: **TE**			
Course Code	**U23ECE509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**HARDWARE DESCRIPTION LANGUAGES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcome	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Comprehend the purpose, significance, and application of HDLs in digital system design.	**K2**
	CO2	Demonstrate the design and analyze of low-level circuit behavior at the gate and switch levels.	**K2**
	CO3	Describe complex digital systems at a higher level of abstraction, focusing on functionality rather than structure.	**K3**
	CO4	Implement user-defined primitives and comprehend the scheduling semantics for customizing and optimizing digital designs.	**K3**
	CO5	Utilize packages effectively in VHDL and use synthesis process for optimization high-level designs.	**K3**

UNIT-I	**INTRODUCTION TO HDL**	**Periods:09**
Evolution of CAD Design – Emergence of HDL – Typical design flow – Design Methodologies – Modules- Ports -Lexical conventions - Data types – Expressions -Continuous Assignments-Procedural assignments - Tasks and Functions-Compiler directives		**CO1**
UNIT-II	**GATE AND SWITCH-LEVEL MODELLING**	**Periods:09**
Modeling and its Types - Gate and switch declaration syntax – Logic gates - buf, not, bufif1, bufif0, notif1, and notif0 gates – MOS, Bidirectional pass and CMOS switches - pullup and pulldown sources - Strengths and values of combined signals - Strength reduction by resistive, no resistive devices - Strengths of net types - Gate and net delays		**CO2**
UNIT-III	**BEHAVIORAL MODELING**	**Periods:09**
Behavioral model overview - Procedural assignments - Procedural continuous assignments - Conditional statement- Case statement- Looping statements- Procedural timing controls- Block statements- Structured procedures		**CO3**
UNIT-IV	**GENERICS, CONFIGURATIONS AND SUBPROGRAMS**	**Periods:09**
Generics - Configuration Specification - Configuration Declaration – Subprograms – Functions – Procedures – Declarations - Subprogram Overloading - Operator Overloading		**CO4**
UNIT-V	**PACKAGES AND LIBRARIES**	**Periods:09**
Package Declaration - Package Body - Design Libraries -Design File -Order of Analysis - Implicit Visibility - Explicit Visibility - Attributes - User-Defined Attributes - Predefined Attributes - Aggregate Targets		**CO5**

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

Textbooks

1. Dr.Cherry Sarma Bhargava, Dr. Rajkumar “Hardware Description Language Demystified”, BPB Publications, 2020.
2. Samir Palnitkar “Verilog HDL A Guide to Digital Design and Synthesis”, Prentice Hall PTR, 2nd edition February 2003
3. Jayaram Bhasker “A VHDL Primer”, Prentice Hall PTR,4th Edition, July 2002

Reference Books

1. Stuart Sutherland “The Verilog PLI Handbook: A User’s Guide and Comprehensive Reference on the Verilog Programming Language Interface”, United States, Springer US, 2013.
2. Dr.Cherry Sarma Bhargava, Dr. Rajkumar “Hardware Description Language Demystified”, Publication: BPB Publications, 2020.
3. Donald E., and Moorby, Philip R. United States “The Verilog® Hardware Description Language Thomas”,Springer US, 2013.
4. Kenneth L. Short VHDL for Engineers, Prentice Hall, 2009
5. Volnei A. Pedroni "Circuit Design with VHDL”, The MIT Press,2020

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1. https://www.coursera.org/learn/fpga-hardware-description-languages
2. https://www.udemy.com/course/hardware-description-languages-for-logic-design/
3. https://onlinecourses.nptel.ac.in/noc20_cs63/preview
4. https://learning.intel.com/developer/learn/courses/235/verilog-hdl-basics
5. https://nptel.ac.in/courses/106105165

*** 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	2	-	-	-	-	-	-	1	1	2	2
2	3	1	2	1	2	-	-	-	-	-	-	1	1	2	2
3	3	1	2	1	2	-	-	-	-	-	-	1	1	2	2
4	3	2	3	2	2	-	-	-	-	-	-	1	1	2	2
5	3	2	3	3	2	-	-	-	-	-	-	1	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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE510**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NETWORK INFORMATION SECURITY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Random numbers, Number theory, finite fields**		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping
	CO1	Identify risks related to Computer security and Information hazard in various situations.	**K2**
	CO2	Apply user identification and authentication methods.	**K2**
	CO3	Apply cryptographic algorithms and protocols to maintain Computer Security.	**K2**
	CO4	Apply measures to prevent attacks on network using firewall.	**K2**
	CO5	Maintain secured networks and describe Mobility Security standards.	**K3**

UNIT-I	**Fundamentals of Computer and Information Security**	**Periods:09**
Definitions- Security, Computer Security, Confidentiality, Integrity, Availability, Accountability, Non-repudiation, Reliability. Attacks and Attackers, Security Management: Security Policies, Measuring Security, Standards. Risk and Threat Analysis: Assets, Threats, Vulnerabilities, Attacks, Common Vulnerability Scoring System, Quantitative and Qualitative Risk Analysis.		**CO1**
UNIT-II	**User Authentication and Access Control**	**Periods:09**
Username and Password, Bootstrapping Password Protection, Guessing Passwords, Phishing, Spoofing, and Social Engineering. Authentication and Authorization, Access Operations, Access Modes, Access Rights of the Bell–LaPadula Model, Administrative Access Rights, Access Control Structures, Access Control Matrix.		**CO2**
UNIT-III	**Cryptography**	**Periods:09**
Symmetric Cipher Model, Substitution Techniques: Caesar's Cipher, Modified Caesar's Cipher, Transposition Techniques: Rail fence technique, Simple Columnar Transposition**.** Cryptography in Computer Security, Digital Signatures, One-Time Signatures, ElGamal Signatures and DSA, RSA Signatures, Encryption, Data Encryption Standard (DES), RSA Encryption.		**CO3**
UNIT-IV	**Network Security**	**Periods:09**
Firewalls: Packet Filters, Stateful Packet Filters, Circuit-Level Proxies, Application-Level Proxies, Firewall Policies, Perimeter Networks, Limitations and Problems, Intrusion Detection: Vulnerability Assessment, Misuse Detection, Anomaly Detection, Network-Based IDS, Host-Based IDS.		**CO4**
UNIT-V	**Communication and Mobility Security**	**Periods:09**
IP Security: Authentication Header, Encapsulating Security Payloads, Security Associations, Internet Key Exchange Protocol, Denial of Service. Mobility: GSM- Components, Temporary Mobile Subscriber Identity, Cryptographic Algorithms, Subscriber Identity Authentication, Encryption, Location-Based Services.		**CO5**

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

Textbooks (Please Match the unit content with textbook (reference) book content)

1. Dieter Gollmann, Computer Security, Wiley 3rd Edition.
2. William Stallings, Cryptography and Network Security, Principles and Practice, Fifth Edition, Pearson.
3. Thomas S, Cover M and Joy A T, "Elements of Information Theory", 2nd Edition, John Wiley & Sons, 2006.

Reference Books

1. Michael Whitman and Herbert Mattord, Principles of Information Security, Fifth Edition, Cengage Learning, 2015.
2. Harold F. Tipton, Information Security Management Handbook, Sixth edition, CRC Press, 2012.
3. Atul Kahate, Cryptography and Network Security, Mc Graw Hill Education, New Delhi.

4. Mark Stamp, Information Security Principles and Practice, Willy India Edition.
5. Forouzan, Mukhopadhyay, Cryptography & Network Security, McGrawHill.

Web References

1. http://nptel.ac.in/courses/106105162/
2. https://www.tutorialspoint.com//computer_security/computer_security_quick_guide.html
3. http://learnthat.com/introduction-to-network-security/
4. https://freevideolectures.com/course/3027/cryptography-and-network-security
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858- computer-systems-security-fall-2014/video-lectures/

* 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	-	2	2	-	-	1	2	2	1	-	2	2	-	-
2	1	-	2	2	-	-	1	2	2	1	-	2	2	-	-
3	1	-	2	2	-	-	1	2	2	1	-	2	2	-	-
4	1	-	2	2	-	-	1	2	2	1	-	2	2	-	-
5	1	-	2	2	3	-	1	2	2	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**

VI- Semester

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECE6XX	Professional Elective – III	PE	3	0	0	3	25	75	100

Professional Elective –III (Offered in Semester VI)		
Sl. No	**Course Code**	**Course Title**
1	U23ICEC02	Soft Computing Techniques
2	U23BMEC02	Wearable Technology
3	U23ECE611	Satellite Communication
4	U23ECE612	Antennas and Wave Propagation
5	U23ECE613	Fog Computing

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VI**	Course Category: **PE**			End Semester Exam: **TE**			
Course Code	**U23ICEC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SOFT COMPUTING TECHNIQUES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Any Programming Knowledge		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Familiarize in the neural network architecture.	**K2**
	CO2	Impart knowledge on various training algorithm of neural network and its application	**K3**
	CO3	Illustrate the fuzzy sets and the properties of fuzzy logic	**K2**
	CO4	Comprehend fuzzy logic controllers and their applications.	**K2**
	CO5	Understand the concepts of optimization algorithms.	**K2**

UNIT – I	**Introduction to Neural Network**	**Periods:09**
Introduction to neural networks – Biological neural networks, Artificial Neural network: Single and Multi-layer feed forward network- Activation function, types (step and sigmoid function), threshold function- Classification of learning: Supervised, Unsupervised and Reinforced. McCulloh Pitts neuron: architecture, algorithm and applications.		**CO1**
UNIT - II	**Neural Networks Control**	**Periods:09**
Back propagation neural net: standard architecture, algorithm -Hopfield net: architecture and algorithm- Kohonnen's Self Organizing map- Adaptive Resonance Theory ART 1: Architecture and operation- Neural networks for control: Schemes of neuro control - Applications of neuro controller.		**CO2**
UNIT - III	**Introduction to Fuzzy Logic**	**Periods:09**
Classical sets - Fuzzy sets – properties of fuzzy sets – operations on fuzzy sets, Cartesian Product, Fuzzy relations linguistic variables – Linguistic approximation. Fuzzy statements: Assignments, Conditional and Unconditional statements.		**CO3**
UNIT - IV	**Fuzzy Logic Control System**	**Periods:09**
Introduction to Fuzzy logic controller: Architecture – Fuzzification, Membership functions: Triangular, Trapezoidal, Gaussian. Inference Mechanism, knowledge base, fuzzy rule base, Inference method: Mamdani, Sugeno and TSK models, Defuzzification - Applications of Fuzzy logic controller.		**CO4**
UNIT - V	**Optimization**	**Periods:09**
Optimization - Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton"s Method – Step Size Determination – Derivative-free Optimization – Genetic Algorithm – Simulated Annealing – Random Search – Downhill Simplex Search.		**CO5**

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

Textbooks

1. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2019
2. Rajasekaran. S, Pai. G.A.V. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice-Hall
3. Jang J.S.R., Sun C.T. and Mizutani E, & quot; Neuro-Fuzzy and soft computing & quot; Pearson Education 2007

Reference Books

1. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2019
2. Rajasekaran. S, Pai. G.A.V. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice-Hall
3. Jang J.S.R., Sun C.T. and Mizutani E, & quot; Neuro-Fuzzy and soft computing & quot;, Pearson Education 2007
4. W.T.Miller, R.S.Sutton and P.J.Webrose, Neural Networks for Control, MIT Press, 2001.
5. S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Networks using MATLAB 6.0", Tata McGraw Hill Education, 1st Edition, 2017.

Web References

1. https://lecturenotes.in/subject/922.
2. https://www.ifi.uzh.ch/dam/jcr:00000000-2826-155d-0000-00005e4763e3/fuzzylogicscript.pdf.
3. https://nptel.ac.in/courses/106/105/106105173/.

*** 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	1
2	3	3	-	3	3	2	-	-	-	-	-	-	2	2	1
3	3	3	2	3	3	2	-	-	-	-	-	-	2	2	1
4	3	2	3	3	3	2	-	-	-	-	-	-	2	2	1
5	3	3	3	2	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	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: **PE**				End Semester Exam: **TE**		
Course Code	**U23BMEC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**WEARABLE TECHNOLOGY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Acquire knowledge about sensors in wearable systems.	**K2**
	CO2	Gain knowledge on signal processing for wearable systems	**K3**
	CO3	Elucidate the usage of energy techniques for wearable devices	**K2**
	CO4	Gain knowledge about wireless health technology	**K2**
	CO5	Analyse the applications of wearable systems	**K3**

UNIT – I	**INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS**	**Periods:09**
Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, E-Textiles		**CO1**
UNIT - II	**SIGNAL PROCESSING**	**Periods:09**
Wearability issues -physical shape and placement of sensor, technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information,		**CO2**
UNIT - III	**ENERGY HARVESTING FOR WEARABLE DEVICES**	**Periods:09**
Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.		**CO3**
UNIT - IV	**WIRELESS HEALTH TECHNOLOGY**	**Periods:09**
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture, Wireless communication techniques.		**CO4**
UNIT - V	**APPLICATIONS OF WEARABLE SYSTEMS**	**Periods:09**
Medical Diagnostics - Medical monitoring of patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording.		**CO5**

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

Textbooks

1. Helena Jelinkova, “Lasers for medical applications: Diagnostics, Therapy and Surgery”, 1st edition, Woodhead Publishing, 2013.
2. Markolf. H.Neimz, “Laser tissue interactions-Fundamentals and applications”, 3rd edition, Springer, 2014.
3. Subhas Chandra Mukhopadhyay and Tarikul Islam, “Wearable Sensors Applications, design and implementation”, IOP Publishing Ltd, 2017.

Reference Books

1. Orazio Svelto and David C. Hanna, “Principles of lasers”, 5th edition, Springer, 2010.
2. William T. Silfvast, “Laser fundamentals”, 2nd edition, Cambridge University Press, 2009.
3. Bonfiglio, Annalisa, De Rossi, Danilo, “Wearable Monitoring Systems”, 1st Edition, Springer US, 2011.
4. Hang, Yuan-Ting, “wearable medical sensors and systems” , Springer – 2013.
5. Mehmet R. Yuce, Jamil Y. Khan, “Wireless Body Area Networks Technology, Implementation and Applications”, Pan Standard Publishing, Singapore, 2012.

Web References

1. https://en.wikipedia.org/wiki/Smart_wearable_system
2. https://www.ncbi.nlm.nih.gov/pubmed/15227552
3. https://www.researchgate.net/publication/232811306_Smart_wearable_systems_Currentstatus_and_future_challenges
4. https://m.youtube.com/watch?v=Mj1aH7CkNCw
5. https://youtu.be/tpTnraEagw4

*** 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	3	2	2
2	3	3	2	2	3	-	-	-	-	-	-	3	3	2	2
3	3	3	2	3	2	-	-	-	-	-	-	3	3	2	2
4	3	3	2	3	3	-	-	-	-	-	-	3	3	2	2
5	3	3	2	3	3	-	-	-	-	-	-	3	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
	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: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE611**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SATELLITE COMMUNICATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Communication systems**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Explain the basics of satellite orbits.	**K2**
	CO2 Summarize the satellite segment and earth segment.	**K2**
	CO3 Analyse the satellite Link design.	**K3**
	CO4 Interpret the working principle of various methods of satellite access.	**K2**
	CO5 Discuss the various satellite applications.	**K2**

UNIT-I	**SATELLITE ORBITS**	**Periods: 09**
Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geostationary and non-Geo-stationary orbits – Look Angle Determination- Limits of visibility –Eclipse -Sub satellite point –Sun transit Outage-Launching Procedures - launch vehicles.		**CO1**
UNIT-II	**SPACE SEGMENT AND EARTH SEGMENT**	**Periods:09**
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and Command-Transponders-The Antenna Subsystem - earth segment- Transmit-Receive Earth Station.		**CO2**
UNIT-III	**SATELLITE LINK DESIGN**	**Periods:09**
The space link, Equivalent Isotropic Radiated Power, transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, intermodulation noise, inter satellite links. interference between satellite		**CO3**
UNIT-IV	**SATELLITE ACCESS AND CODING METHODS**	**Periods:09**
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.		**CO4**
UNIT-V	**SATELLITE APPLICATIONS**	**Periods:09**
INTELSAT Series, INSAT, VSAT, Mobile satellite services : GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigation System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH). Role of Satellite in future network.		**CO5**

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

Textbooks

1 Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd, 2017, ISBN: 978-81-265-0833-4
2 M.Richharia, Satellite Communication Systems-Design Principles, Macmillan 2003
3 Dennis Roddy, Satellite Communication, 4th Edition, Mc Graw Hill International, 2006.

Reference Books

1. Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.
2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, Satellite Communication Systems Engineering, Prentice Hall/Pearson, 2007.
3. Tri T. Ha, Digital Satellite Communication, Second Edition, 2017.
4. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, Satellite Communication Systems Engineering, Prentice Hall/Pearson, 2007.
5. Gerard Maral, Michel Bousquet, Zhili Sun, Satellite Communications Systems: Systems, Techniques and Technology, 5th Edition, Wiley India Pvt. Ltd., 2020

Web References

1. https://nptel.ac.in/courses/117/105/117105131/
2. https://www.managementstudyguide.com/satellite-communication-system.htm
3. https://www.tutorialspoint.com/satellite_communication/satellite_communication_introduction.htm
4. https://www.intelsat.com/resources/tools/satellite-101/
5. https://www.sciencedirect.com/topics/engineering/satellite-communication-system

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	3	2	1	-	-	1	-	-	-	-	-	1	3	-	-
4	3	2	1	-	-	1	-	-	-	-	-	1	3	-	-
5	3	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	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: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE612**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ANTENNAS AND WAVE PROPAGATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Engineering Electromagnetic, Transmission Lines and waveguides		
Course Outcome's	**On completion of the course, the students will be able to**		BT Mapping
	CO1	Examine the radiation mechanism of electromagnetic fields and identify the various antenna parameters	**K2**
	CO2	Analyze design concepts of wire and loop antennas	**K3**
	CO3	Design and analyze wire and aperture antennas	**K3**
	CO4	Analyze antenna arrays system of different antennas	**K3**
	CO5	Understand the radio wave propagation in the atmosphere	**K2**

UNIT-I	**ANTENNA FUNDAMENTALS & RADIATION FIELDS OF ANTENNAS**	**Periods:09**
Historical Advancement-Types of Antennas-Radiation Mechanism-Current Distribution on a Thin Wire Antenna-Basic Antenna Parameters –Radiation Resistance, Antenna Polarization, Radiation Patterns, Beam Width, Radiation Intensity. Beam Area, Directivity, Gain, Antenna Aperture, Effective length, antenna efficiency, Bandwidth, Input impedance, Relation between Directivity and Maximum Effective Aperture, Friis Transmission Formula, Antenna Temperature.		**CO1**
UNIT-II	**LINEAR AND LOOP ANTENNAS**	**Periods:09**
Linear Wire Antennas: Infinitesimal Dipole, The Short Electric Dipole, The Fields of a Short Dipole, Radiation Resistance of Short Electric Dipole, Radiation Resistance of $\lambda/2$ Antenna, Folded dipole- **Loop Antennas**: Small Circular Loop, Radiation Resistance of Loops, Circular Loop of Constant Current, Circular Loop with Non-Uniform Current, Ferrite Loop, Square Loops.		**CO2**
UNIT-III	**APERTURE AND SPECIAL ANTENNAS**	**Periods:09**
Aperture Antennas: Slot Antenna-Waveguide Horn Antenna: E-plane and H-plane Horn, Pyramidal Horn- Reflector Antennas: Plane reflector, Corner Reflectors, Parabolic Reflector-Lens Antennas - Dielectric Lenses, Metal-plate Lens. **Special Antennas:** Travelling Wave Antenna, Yagi-Uda Arrays, Rhombic Antennas, Helical Antenna, Log-Periodic Antenna, Microstrip Patch Antenna, Smart antennas.		**CO3**
UNIT-IV	**ANTENNA ARRAY**	**Periods:09**
Two-Element Array- Pattern Multiplication- *N*-Element Linear Array Uniform Amplitude and Spacing- Broadside and End Fire Array- Phased array- Directivity and Pattern Characteristics of Linear Uniform Array- *N*-Element Linear Array: Uniform Spacing, Non-Uniform Amplitude- binomial Array- Planar array.		**CO4**
UNIT-V	**RADIO EAVE PROPAGATION**	**Periods:09**
Guided Waves - Unguided Waves - Classification of Electromagnetic Waves - Different Modes of Wave Propagation- Plane Earth Reflection - Space Wave and Surface Wave - Transition Between Surface and Space Wave - Tilt of Wave Front due to Ground Losses - Impact of Imperfect Earth - Reduction Factor and Numerical Distance - Earth's Behavior at Different Frequencies - Electrical Properties of the Earth - Shadowing Effect of Hills and Buildings - Absorption by Atmospheric Phenomena- Variation of Field Strength with Height- Scattering Phenomena		**CO5**

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

Textbook

1. C.A. Balanis, "Antenna Theory", John Wiley and Sons, 2nd Edition,2001
2. John D. Kraus and Ronald J.Marhefka, "Antennas and Wave Propagation", 3rd Edition, TMH, 2003

Reference Books

1. K.D. Prasad, Satya Prakashan, “Antennas and Wave Propagation”, Tech India Publications, New Delhi, 2001.
2. E.C. Jordan and K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, PHI, 2nd ed., 2000
3. Warren L. Stutzman, Gary A. Thiele,” Antenna Theory and Design”, e, John Wiley & Sons, 3rd edition. 2013
4. Harish AR and Sachidananda M, “Antenna and Wave Propagation”, Oxford University Press, 2007
5. Simon R Saunders, “Antennas and Propagation for wireless communication system”, John Wiley Publications, 3rd Edition, 2001.

Web References

1. https://archive.nptel.ac.in/courses/117/107/117107035/
2. https://archive.nptel.ac.in/courses/117/107/117107035/
3. https://www.antenna-theory.com/
4. https://www.keysight.com/in/en/products/accessories/antennas.html
5. https://tutorai.me/module/antennas-and-wave-propagation

*** 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	3	2	1	-	-	-	-	-	-	1	3	-	-
3	3	2	3	2	1	-	-	-	-	-	-	1	3	-	-
4	3	2	3	2	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	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: **PE**			*End Semester Exam: **TE**			
Course Code	**U23ECE613**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**FOG COMPUTING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Basics of Networking, Cloud Computing**	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Understand the concept of mobile fog computing	**K2**
	CO2 Familiarize the architecture of edge and fog computing	**K2**
	CO3 Outline the process of data flow in fog computing	**K1**
	CO4 Understand the concept of machine learning algorithms in fog computing	**K2**
	CO5 Familiarize data analytics in fog computing	**K2**

UNIT-I	**MOBILE FOG COMPUTING**	**Periods:09**
Mobile Fog Computing and Related Models – The Needs of Mobile Fog Computing – Infrastructural Mobile Fog Computing: Road Crash Avoidance, Marine data acquisition, Forest Fire Detection, Mobile Ambient Assisted Living – Communication Technologies – Non-Functional Requirements – Open Challenges.		**CO1**
UNIT-II	**EDGE AND FOG COMPUTING ARCHITECTURE**	**Periods:09**
Edge Computing - Edge Computing Architecture - Fog Computing - Fog Computing Architecture – Fog and Edge Use cases: Smart Home, Smart Traffic Light System – Smart Pipeline Monitoring System – Future Challenges: Resource Management – Network Management.		**CO2**
UNIT-III	**DATA MANAGEMENT IN FOG COMPUTING**	**Periods:09**
Fog Data Management: Data Life Cycle, Data Characteristics, Data Preprocessing and analytics – Data Privacy – Data Storage and Data Placement – e-Health Case Study – Future Research Directions.		**CO3**
UNIT-IV	**MACHINE LEARNING FOR SECURITY AND PRIVACY**	**Periods:09**
Introduction – Machine Learning for Fog Computing and Security – ML in Industry, ML in Retail - Fog Computing for Self-Driving Cars – Other Machine Learning Algorithms: linear regression, Support Vector Machine, Decision Trees, Random Forest – Challenges and Issues.		**CO4**
UNIT-V	**FOG COMPUTING REALIZATION FOR DATA ANALYTICS**	**Periods:09**
Data Analytics in the Fog – Prototypes and Evaluation: Architecture, Configurations, Fog Engine as a Broker, Fog Engine as a Data Analytics Engine, Fog Engine as a Server, Communication with Fog Engine Versus the Cloud – Case Studies: Future Research Directions.		**CO5**

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

Textbooks

1. Assad Abbas, Samee U. Khan, Albert Y. Zomaya, “Fog Computing Theory and Practice”, John Wiley & Sons, 2020. (Unit 1, 2)
2. Ravi Tomar, Avita katal, Susheela Dahiya, Niharika Singh, Tanupriya Choudhury, “Fog Computing Concepts, Frameworks and Applications” CRC Press Taylor & Francis Group, A Chapman & Hall Book, 2023. (Unit 4)
3. Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, Wiley Series on Parallel and Distributed Computing, 2019. (Unit 3, 4, 5)

Reference Books

1. Stojan Kitanov, “Introduction to Fog Computing” IGI Global Publication.
2. Amir Vahid Dastjerdi and Rajkumar Buyya, “Fog Computing: Helping the Internet of Things Realize its Potential”.
3. Sudeep Tanwar, “Fog Computing for Healthcare 4.0 Environments Technical, Societal and Future Implications”, Springer International Publishing, 2021.
4. A. Srinivasan and J. Suresh, “Cloud Computing A Practical Approach for Learning and Implementation”, Pearson, Dorling Kindersley (India) Pvt. Ltd, 2014.
5. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013.

Web References

1. https://www.classcentral.com/course/fog-2731
2. https://cse.iitkgp.ac.in/~smisra/theme_pages/fog/index.html
3. https://www.coursera.org/learn/iot-wireless-cloud-computing
4. https://www.coursera.org/learn/cloud-app
5. https://learning.linkedin.com/resources/learning-tech/edge-vs-cloud-computing

*** 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	2	3	2	2
2	2	2	2	-	-	2	-	-	-	-	3	2	3	2	2
3	2	2	2	2	3	3	-	-	-	-	2	3	3	2	3
4	2	2	3	3	2	3	-	-	3	3	3	3	3	2	2
5	2	2	3	3	3	3	-	-	2	2	2	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
	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**

VII- Semester

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECE6XX	Professional Elective – IV	PE	3	0	0	3	25	75	100

Professional Elective –IV (Offered in Semester VII)		
Sl. No	**Course Code**	**Course Title**
1	U23ICEC03	Intelligence Robotics Systems
2	U23ECEC01	Digital Image Processing
3	U23ECE714	Optical Communication
4	U23ECE715	Aircraft Communication and Navigation Systems
5	U23ECE716	Body Area Network

Department	**Instrumentation and Control Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PE**			*End Semester Exam: **TE**			
Course Code	**U23ICEC03**	Periods/Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**INTELLIGENCE ROBOTICS SYSTEMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Fundamentals of Electronics and Control	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Infer the fundamental concepts and structure of robotic systems.	**K2**
	CO2 Identify and analyze various sensors, actuators, and perception systems used in robotics.	**K2**
	CO3 interpret and analyze control strategies and path planning algorithms for robotic navigation.	**K2**
	CO4 Demonstrate AI and ML techniques in robotics, including reinforcement learning and SLAM.	**K3**
	CO5 Determine advanced robotics applications and assess ethical considerations in human-robot interactions.	**K3**

UNIT-I	**Introduction to Robotics**	**Periods:09**
History of robotics, evolution of robotics, Classification, Anatomy, links, joints, and degrees of freedom (DOF), mechanical structure of robotic systems Kinematics and Dynamics, Trajectory Planning		**CO1**
UNIT-II	**Sensors, Actuators, and Perception**	**Periods:09**
Sensors –proximity sensors, tactile sensors, vision sensors, IMU (Inertial Measurement Unit), GPS, and LIDAR. – **Actuators** –DC motors, servo motors, stepper motors, hydraulic actuators, and pneumatic actuators -robotic motion. – **Sensor Fusion** – **Calibration** – **Vision-Based Perception**		**CO2**
UNIT-III	**Control and Path Planning**	**Periods:09**
Control Systems –PID control, adaptive control, and Nonlinear control- (**Sliding Mode Control (SMC))**. – **Path Planning** – Techniques like A*, Dijkstra's algorithm, probabilistic roadmaps (PRM), and rapidly-exploring random trees (RRT) – **Obstacle Avoidance** – **Trajectory Tracking** implementation.		**CO3**
UNIT-IV	**Artificial Intelligence and Machine Learning in Robotics**	**Periods:09**
AI in Robotics – **Machine Learning** – **Supervised** learning- SVM, Random Forest and **unsupervised learning**- k-mean clustering, PCA, **Reinforcement Learning** Deep Q-Networks (DQN)**, SLAM** – Simultaneous Localization and Mapping (SLAM)		**CO4**
UNIT-V	**Advanced Robotics and Human-Robot Interaction**	**Periods:09**
Multi-Robot Systems – **Human-Robot Interaction**. – **Ethics** – **Case Studies** – Real-world applications in autonomous vehicles, industrial robots, and medical robots are discussed to provide practical insights into intelligent robotics.		**CO5**

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

Textbooks

1. John J. Craig, "Introduction to Robotics: Mechanics and Control", 4th Edition, 2018.
2. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics: Control, Sensing, Vision, and Intelligence", 1st Edition, 1987.
3. Sebastian Thrun, Wolfram Burgard and Dieter Fox, "Probabilistic Robotics", 1st Edition, 2005.

Reference Books

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 4th Edition, 2020.
2. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, “Robot Modeling and Control”, 1st Edition, 2005.
3. Nikolaus Correll, Bradley Hayes, and Bradley Pierson, “Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms”, 3rd Edition, 2022.
4. Kevin M. Lynch and Frank C. Park, “Modern Robotics: Mechanics, Planning, and Control”, 1st Edition, 2017.
5. Bruno Siciliano and Oussama Khatib, “Springer Handbook of Robotics”, 2nd Edition, 2016.

Web References

1. https://onlinecourses.nptel.ac.in/noc24_me117/preview
2. https://archive.nptel.ac.in/courses/112/107/112107289/
3. https://onlinecourses.nptel.ac.in/noc22_cs97/preview
4. https://www.coursera.org
5. https://www.ros.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	1	2	2	-	-	-	-	-	-	-	-	2	2	2
2	2	1	2	2	-	-	-	-	-	-	-	-	2	2	2
3	2	1	2	2	-	-	-	-	-	-	-	-	2	2	2
4	2	1	2	2	-	-	-	-	-	-	-	-	2	2	2
5	2	1	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VII**	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**

Prerequisite	Any Programming Knowledge		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Infer the basics of digital image processing, including acquisition and sampling.	K2
	CO2	Explain image transforms like Fourier, Walsh, and Discrete Cosine Transform.	K2
	CO3	Illustrate the spatial and frequency domain methods for image enhancement.	K3
	CO4	Interpret the techniques for image restoration and segmentation.	K2
	CO5	Describe compression methods, including error-free and lossy techniques.	K2

UNIT – I	**DIGITAL IMAGE FUNDAMENTALS**	**Periods:09**
Digital Image Fundamentals: Origins of Digital Image Processing- Fundamental Steps in Digital Image Processing- Components of an Image Processing System- Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels.		**CO1**
UNIT - II	**IMAGE TRANSFORMS**	**Periods:09**
2-D Fourier Transform-Walsh Transform-Hadamard Transform- Discrete Cosine Transform-Haar transform- Slant transform-Hotelling transform.		**CO2**
UNIT - III	**IMAGE ENHANCEMENT**	**Periods:09**
Enhancement in Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Filters. Enhancement in Frequency Domain: **Introduction to Fourier Transform:** Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.		**CO3**
UNIT - IV	**IMAGE RESTORATION AND SEGMENTATION**	**Periods:09**
Image Restoration- Model of the Image Degradation/Restoration Process, Noise Models, Inverse Filtering. **Image Segmentation** - Edge linking and boundary detection - Thresholding: Global and Optimal Thresholding.		**CO4**
UNIT - V	**IMAGE COMPRESSION**	**Periods:09**
Fundamentals: Coding, Fidelity Criteria – Image Compression Models- Error Free Compression: Arithmetic coding, Huffman coding-JPEG 2000 Standards		**CO5**

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

Textbooks

1. Kenneth R. Castleman, Digital Image Processing Pearson, Second edition, 2020.
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing Pearson, Fourth Edition, 2018.
3. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, Second Edition, PHI Learning Pvt. Ltd., 2019.

Reference Books

1. D.E.Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
2. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
3. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999
4. John C. Russ, F. Brent Neal-The Image Processing Handbook, Seventh Edition, The Kindle edition (2016), CRC Press, Taylor & Francis Group.

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/
3. https://nptel.ac.in/courses/117/105/117105135/
4. https://www.csie.nuk.edu.tw/

*** 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	2	2	-	-	-	-	-	-	-	-	3	-	-
3	3	2	2	3	-	-	-	-	-	-	-	-	3	-	-
4	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
5	3	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **PE**				End Semester Exam: **TE**		
Course Code	**U23ECE714**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**OPTICAL COMMUNICATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite			
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Infer the fundamental concept of optical fiber modes and their configurations	**K2**
	CO2	Discuss various optical sources and optical detectors and their use in the optical communication system.	**K2**
	CO3	Describe the techniques required to measure the optical fiber systems	**K2**
	CO4	Describe the optical measurements and coupling techniques	**K2**
	CO5	Determine the Digital Transmission and its associated parameters on system performance	**K3**

UNIT – I	**OPTICAL FIBER STRUCTURES**	**Periods:09**
Optical Fiber Modes and Configurations, Single mode fibers, Fiber Materials, Attenuation and Dispersion: Attenuation, Absorption, Scattering Losses, Bending Loss, Signal Dispersion.		**CO1**
UNIT - II	**OPTICAL SOURCES AND DETECTORS**	**Periods:09**
Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diode (Basics). Photodetectors: pin Photodetector, Avalanche Photodiodes. WDM Concepts: Overview of WDM, Isolators and Circulators.		**CO2**
UNIT - III	**OPTICAL AMPLIFIERS**	**Periods:09**
Amplification Mechanism, Semiconductor Optical Amplifiers-Construction, SOA parameters. Erbium-Doped Fiber Amplifier (EDFA)-EDFA configurations, EDFA Pump Lasers, EDFA Noise. Wavelength Conversion.		**CO3**
UNIT - IV	**OPTICAL MEASUREMENTS AND COUPLING**	**Periods:09**
Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wavelength Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber connectors.		**CO4**
UNIT - V	**OPTICAL COMMUNICATION SYSTEMS AND NETWORKS**	**Periods:09**
System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM –Passive DWDM Components-Elements of optical networks-SONET/SDH Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.		**CO5**

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

Textbooks

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India)Private Limited, 2016.
2. Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.
3. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

Reference Books

1. John M.Senior, "Optical fiber communication", Pearson Education, second edition.2007.
2. Rajiv Ramaswami, "Optical Networks ", Second Edition, Elsevier, 2004.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
4. Kumar Sivarajan & Rajiv Ramaswamy, Galen Sasaki, "Optical Networks: A practical perspective", 3rd Edition,2010.

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3. https://youtu.be/AEkIPwP0YI8
4. https://youtu.be/aralHQ33PB4
5. https://youtu.be/9oYuk66fjiY

*** 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	-	-
2	3	2	1	1	-	-	-	-	-	-	-	1	1	-	-
3	3	2	1	-	-	1	-	-	-	-	-	1	1	-	-
4	3	3	1	1	-	-	-	-	-	-	-	-	1	-	-
5	3	2	-	-	-	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	**Electronics and Communication Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category: **PE**			*End Semester Exam: **TE**			
Course Code	**U23ECE715**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AIRCRAFT COMMUNICATION AND NAVIGATION SYSTEMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	**Communication systems**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Infer the fundamentals of radio frequency communication	**K2**
	CO2 Discuss VHF and HF communication systems	**K2**
	CO3 Interpret the traditional radio-based navigation techniques and ADF systems and their role in navigation.	**K2**
	CO4 Differentiate the radio navigation techniques	**K2**
	CO5 Illustrate air traffic control (ATC) and collision avoidance systems	**K3**

UNIT-I	**INTRODUCTION**	**Periods: 09**
Radio frequency spectrum, the ionosphere, silent zone and skip distance, Antennas, isotropic radiators, SWR, transmitters and receivers, TRF, Super heterodyne receivers, double super heterodyne receivers, design examples		**CO1**
UNIT-II	**VHF AND HF COMMUNICATION AND EMERGENCY LOCATION TRANSMITTERS**	**Periods:09**
VHF range and propagation, DSB modulation, channel spacing, depth of modulation, compression, squelch, data modes, ACARS, VHF radio equipment's, HF range and propagation, SSB modulation, SELCAL, HF data link, HF radio equipment, HF antenna and coupling unit Emergency location transmitters: Types of ELT, Maintenance and testing of ELT, ELT mounting requirements, typical ELT, Cospas-Sarsat satellites		**CO2**
UNIT-III	**AIRCRAFT NAVIGATION AND AUTOMATIC DIRECTION FINDER**	**Periods:09**
The earth and navigation, Dead reckoning, Position fixing, Maps and charts, ADF principles, ADF equipment, Operational aspects of ADF		**CO3**
UNIT-IV	**RADIO NAVIGATION**	**Periods:09**
Hyperbolic radio navigation, Hyperbolic position fixing, Loran overview, Doppler navigation, The Doppler effect, Doppler navigation principles, Area navigation, RNAV overview, Inertial navigation systems, Inertial navigation principles, Global navigation satellite system, GPS overview		**CO4**
UNIT-V	**AIR TRAFFIC CONTROL SYSTEM, ALERT AND COLLISION AVOIDANCE SYSTEM**	**Periods:09**
ATC overview, ATC transponder modes, Airborne equipment System operation, Automatic dependent surveillance-broadcast, Communications, navigation and surveillance/air traffic management Airborne collision avoidance systems, TCAS overview, TCAS equipment System operation.		**CO5**

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

Textbooks

1. Mike Tooley and David Wyatt, "Aircraft Communications and Navigation Systems" 2nd Edition, Elsevier, 2007
2. Chris Binns, "Aircraft Systems: Instruments, Communications, Navigation, and Control", Wiley, 2006
3. Dale Stacey, "Aeronautical Radio Communication Systems and Networks" 2nd Edition, 2009

Reference Books

1. Donald S. Bond, “Radio direction finders”, McGraw-Hill Book Company, 2004
2. M.I. Skolnik: Introduction to Radar Systems, Tata McGraw-Hill, 2007.
3. M. Kayton and W. Fried: Avionics Navigation System, Wiley Inter science, second edition, 2008
4. Pallett, and Abolfazl Mazloomi Aircraft Electrical Systems, Pitman Publishing Limited, 2017.

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2. https://doi.org/10.1201/9781315858982
3. https://www.sciencedirect.com/book/9780128154052/short-range-wireless-communication
4. https://www.routledge.com/Aircraft-Communications-and-Navigation-Systems/Tooley-Wyatt/p/book/9780415827751
5. http://infocom.uniroma1.it/rrsn/wiki/uploads/TelecomunicazioniPerLAerospazio/testi/acnsprelims.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	-	-	-	-	-	-	-	-	-	1	3	-	-
2	3	2	-	-	-	-	-	-	-	-	-	1	3	-	-
3	3	2	-	-	-	-	-	-	-	-	-	1	3	-	-
4	3	2	-	-	-	-	-	-	-	-	-	1	3	-	-
5	3	2	-	-	-	-	-	-	-	-	-	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	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	**VII**	Course Category: **PE**				*End Semester Exam: **TE**		
Course Code	**U23ECE716**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BODY AREA NETWORK**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Engineering Electromagnetic, Transmission Lines and waveguides	
Course Outcome's	**On completion of the course, the students will be able to**	BT Mapping
	CO1 Infer the fundamentals of BAN Architecture	**K2**
	CO2 Illustrate the Models and gain knowledge on BAN Requirements	**K2**
	CO3 Demonstrate the Network and MAC protocols on WBAN	**K3**
	CO4 Determine the Antenna Design, Propagation factors for WBAN Applications	**K3**
	CO5 Explain the role of UWB in WBAN applications	**K2**

UNIT-I	**BAN Architecture**	**Periods:09**
Pervasive Healthcare - Architecture- Hardware, Network Topology, Communication Technology, Software, Deployment, Physical Environment, Energy Source, Applications, Middleware for a BAN based pervasive health monitoring system		**CO1**
UNIT-II	**BAN Models and Requirements**	**Periods:09**
Principal Requirements – Cyber physical nature of BANs – Regulatory Issues: Safety approaches – Model Based Engineering of BANs – Need of Information Security – Securing a BAN as a cyber physical system – The energy perspective – Ensuring sustainability		**CO2**
UNIT-III	**Network and MAC Protocols**	**Periods:09**
Network Topologies - Basics of MAC Protocols: Traffic Characteristics, Scheduled Protocols - Random Access Protocols - Hybrid MAC Protocols - Energy Management - Patient Monitoring Network Design - Performance Analysis		**CO3**
UNIT-IV	**Antenna Design, Propagation and Interferes for WBAN Applications**	**Periods:09**
Antenna Gain, Return Loss, Efficiency, Reciprocity, Miniatured Antennas - Implanted Antennas - Analysis of Interferers - Effects of Transmission - Countermeasures.		**CO4**
UNIT-V	**Implanted Wireless Communication**	**Periods:09**
In body communications – Applications – MICS and ISM Bands – RFID techniques – Propagation through body, changes – Implant Power Constraints – Battery considerations – Error Corrections.		**CO5**

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

Textbook

1. Sandeep K. S. Gupta, Tridib Mukherjee, Krishna Kumar Venkatasubramanian – Body Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013.
2. Mehmet R. Yuce, Jamel Y. Khan – Wireless Body Area Networks Technology, Implementation and Applications, CRC Press Taylor & Francis Group, LLC 2012.
3. Phillip Olla and Joseph Tan – Mobile Health Solutions for Biomedical Applications, Medical Information Science Reference (an imprint of IGI Global), 2009.

Reference Books

1. Giancarlo Fortino, Raffaele Gravina and Stefano Galzarano – Wearable Computing from Modelling to Impleentation of Wearable Systems based on Body Sensor Networks, IEEE Press, Wiley Publications, 2018.
2. Zhang, Yuan-Ting – Wearable Medical Sensors and Systems, Springer, 2013.
3. Guang-Zhong Yang (Ed) – Body Sensor Networks, Springer 2006
4. Annalisa Bonfigilo, Daniel De Rossi – Wearable Monitoring Systems, Springer 2011.

Web References

1. https://telcomaglobal.com/p/smart-ban-training
2. https://www.tonex.com/training-courses/wireless-body-area-network-training-wban/
3. https://opas.peppi.oulu.fi/en/course/521389S/10678?period=2021-2022
4. https://www.etsi.org/technologies/smart-body-area-networks

*** 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	2	1	-	-	-	-	-	-	-	-	2	1	-	1
2	1	2	1	-	-	-	-	-	-	-	-	2	1	-	1
3	1	2	2	-	-	-	-	-	-	-	-	2	2	-	1
4	1	2	2	-	-	-	-	-	-	-	-	2	2	-	2
5	1	2	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	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**

V / VI - Semester

S. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECOC0x	Open Elective – I / II	OE	3	0	0	3	25	75	100

Open Elective – I / Open Elective – II (Offered in Semester V / VI)		
Sl. No	**Course Code**	**Course Title**
1	U23ECOC01	Engineering Computation with MATLAB
2	U23ECOC02	Consumer Electronics

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VI**	Course Category: **OE**			End Semester Exam: **TE**			
Course Code	**U23ECOC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING COMPUTATION WITH MATLAB**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Any Programming Knowledge		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	State the basics of MATLAB	**K1**
	CO2	Explain how to work with matrices, and their operations	**K2**
	CO3	Use the MATLAB functions relevant to communication engineering	**K3**
	CO4	Demonstrates various file operations in MATLAB	**K3**
	CO5	Applying the plotting capabilities of MATLAB effectively to various systems.	**K3**

UNIT – I	**INTRODUCTION TO MATLAB**	**Periods:09**
Menus & Tool bars, Variables - Matrices and Vectors - initializing vectors - Data types- Functions – User defined functions - passing arguments - writing data to a file-reading data from a file - using functions with vectors and matrices- cell arrays & structures - Strings - 2D strings-String comparing - Concatenation - Input and Output statements - Script files.		**CO1**
UNIT - II	**LOOPS& CONTROL STATEMENTS**	**Periods:09**
Introduction: Relational & Logical operations - Example programs - Operator precedence - Control & Decision statements- IF - IF ELSE - NESTED IF ELSE - SWITCH - TRY & CATCH - FOR -WHILE - NESTED FOR - FOR with IF statements, MATLAB program organization, debugging methods - Error trapping using eval & lastern commands.		**CO2**
UNIT - III	**PLOTS IN MATLAB & GUI**	**Periods:09**
Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG, SEMILOG-POLARCOMET, Grid axis, labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface – Polyfit - 3D plots – Mesh - Contour - Example programs. GUI - Creation Fundamentals – Capturing mouse actions		**CO3**
UNIT - IV	**MISCELLANEOUS TOPICS**	**Periods:09**
File & Directory management - Native Data Files - Data import & Export - Low Level File I/O – Directory management - FTP File Operations - Time Computations -Date & Time – Format Conversions - Date & Time, Functions - Plot labels - Optimization - zero Finding - Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1D & 2D Data Interpolation		**CO4**
UNIT - V	**SIMULINK & APPLICATIONS**	**Periods:09**
How to create & run Simulink, Simulink Designing - Using SIMULINK Generating an AM signal & 2nd order systems - Designing of FWR & HWR using Simulink - Creating a subsystem in Simulink. Applications Programs -Frequency response of filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration.		**CO5**

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

Textbooks

1. RudraPratap, Getting Started with MATLAB 6.0 ,1st Edition, Oxford University Press-2004.
2. Duane Hanselman, Bruce LittleField, “Mastering MATLAB 7”, Pearson Education Inc, 2005
3. William J.Palm, “Introduction to MATLAB 6.0 for Engineers”, McGraw Hill & Co, 2001.

Reference Books

1. M.Herniter, “Programming in MATLAB”, Thomson Learning, 2001
2. John OkyereAltla, “Electronics and circuit analysis using MATLAB”, CRC press, 1999
3. K.K.Sharma, “MATLAB Demustifyied”, Vikas Publishing House Pvt Ltd. 2004

Web References

1. https://www.mathworks.com/products/matlab.html
2. https://www.tutorialspoint.com/matlab/index.htm
3. https://www.cmu.edu/computing/software/all/matlab/
4. https://ctms.engin.umich.edu/CTMS/index.php?aux=Home

*** 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	3	-	-	-	-	-	-	-			-
2	2	2	-	2	3	-	-	-	-	-	-	-			-
3	2	2	-	2	3	-	-	-	-	-	-	-			-
4	2	2	-	2	3	-	-	-	-	-	-	-			-
5	2	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	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VI**	Course Category: **OE**			End Semester Exam: **TE**			
Course Code	**U23ECOC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CONSUMER ELECTRONICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Describe the fundamental audio characteristics and measurements, operating principles of microphone and loudspeaker	**K1**
	CO2	Explain the working of digital console, digital FM tuner and troubleshoot the audio systems	**K2**
	CO3	Distinguish the salient features of colour TV and Monochrome and troubleshoot TV camera	**K2**
	CO4	Demonstrate various interfaces in digital TV, the working of DTH receiver, CD/DVD players	**K3**
	CO5	Explain the working of FAX, Microwave oven, Washing machine, Air conditioner, Refrigerators and camera	**K2**

UNIT – I	**AUDIO FUNDAMENTALS AND DEVICES**	**Periods:09**
Basic characteristics of sound signal, Microphone- working principle, sensitivity, nature of response. Types of Microphones, Loudspeaker- working principle, Woofers and Tweeters, characteristics. Types of Loudspeakers. Sound recording		**CO1**
UNIT - II	**AUDIO SYSTEMS**	**Periods:09**
Introduction to audio system, Digital Console- Block diagram, working principle, applications, FM tuner- concepts of digital tuning, ICs used in FM tuner TD702IT, PA address system- Planning, speaker impedance matching, characteristics, Power amplifier specification		**CO2**
UNIT - III	**TELEVISION SYSTEMS**	**Periods:09**
Monochrome TV standards, Components of TV system, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution. Composite video single-color TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera.		**CO3**
UNIT - IV	**TELEVISION RECEIVERS AND VIDEO STANDARDS**	**Periods:09**
Colour TV receiver- block diagram, Digital TVs- LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI, Digital Video Interface, CD and DVD player: working principles, interfaces		**CO4**
UNIT - V	**HOME AND OFFICE APPLIANCES**	**Periods:09**
Microwave Oven: Types, technical specifications. Washing Machine: hardware and software. Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices, picture processing, picture storage		**CO5**

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

Textbooks

1. Bali S.P., 'Consumer Electronics', copyright 2008, Pearson Education India
2. Bali R and Bali S.P. 'Audio video systems: principal practices & troubleshooting', Khanna Book Publishing Co. (P) Ltd
3. Gulati R.R., 'Modern Television practices', 5th edition, 2015, New Age International Publication (P) Ltd

Reference Books

1. Gupta R.G., 'Audio video systems', 2nd edition,2017, Tata Mcgraw Hill, New Delhi, India
2. Whitaker Jerry & Benson Blair, 'Mastering Digital Television', McGraw-Hill Professional, 2006
3. Whitaker Jerry & Benson Blair, 'Standard handbook of Audio engineering', 2nd edition,2002, McGraw-Hill Professional

Web References

1. http://www.scientificamerican.com/article.cfm?id = experts.bluetooth-work
2. http://www.cosc.brocku.ca/Offerings/3P92/seminars/HDTV.ppt
3. http://www.circuitstoday.com/blu-ray-technology-working
4. http://www.freevideolectures.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	-	2	1	-	1	-	-	-	-	-	-			
2	2	-	2	1	-	1	-	-	-	-	-	-			
3	2	-	2	1	-	1	-	-	-	-	-	-			
4	2	-	2	1	-	1	-	-	-	-	-	-			
5	2	-	2	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**

VII - Semester

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ECOC0X	Open Elective – III	OE	3	0	0	3	25	75	100

Open Elective –II (Offered in Semester V / VI)		
Sl. No	**Course Code**	**Course Title**
1	U23ECOC03	IIoT and its Applications
2	U23ECOC04	RFID System Design and Testing

Department	**Electronics and Communication Engineering**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **OE**			End Semester Exam: **TE**			
Course Code	**U23ECOC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IIOT AND ITS APPLICATIONS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Any Programming Knowledge		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Infer internet of Things and its hardware and software components.	**K2**
	CO2	Explain about Interface I/O devices, sensors & communication modules.	**K2**
	CO3	Illustrate the concepts of remotely monitor data and control devices.	**K3**
	CO4	Demonstrate various architecture with their elements.	**K3**
	CO5	Examine real time IoT based projects	**K3**

UNIT – I	**INTRODUCTION TO INTERNET OF THINGS**	**Periods:09**
The technology of the internet of things, making the internet of things, Elements of an IoT ecosystem, design principles for connected devices, Web thinking for connected devices.		**CO1**
UNIT - II	**ARCHITECTURE OF IoT**	**Periods:09**
Architectural Overview, Design principles and needed capabilities, Sensing, Actuation, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT,		**CO2**
UNIT - III	**ELEMENTS OF IoT**	**Periods:09**
Hardware Components- Communication, Sensing, Actuation, I/O interfaces. **Software Components-** Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.		**CO3**
UNIT - IV	**IoT APPLICATION DEVELOPMENT**	**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	**IoT APPLICATIONS**	**Periods:09**
Future Factory Concepts, Four Aspects in Business to Master IoT, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.		**CO5**

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

Textbooks

1. Vijay Madisetti, Arshdeep Bahga, "İnternet of Things, A Hands-on Approach", University Press ,3rd/e, Aug 2018.
2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill ISBN: 9789352605224, 9789352605224,2nd edition, May 2017
3. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs 2014.

Reference Books

1. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi, 2012
2. Adrian McEwen, “Designing the Internet of Things”, Wiley, 2007
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
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

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	3	2	-	1	-	-	-	-	-	-			
2	3	1	3	2	-	1	-	-	-	-	-	-			
3	2	3	2	1	-	1	-	-	-	-	-	-			
4	2	2	2	1	-	1	-	-	-	-	3	-			
5	2	3	2	1	3	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	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	**VII**	Course Category: **OE**			End Semester Exam: **TE**			
Course Code	**U23ECOC04**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RFID SYSTEM DESIGN AND TESTING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	-		
Course Outcomes	**On completion of the course, the students will be able to**		**BT Mapping**
	CO1	Explain the fundamental principles of RFID technology, including near-field and far-field RFID systems, and analyze different modulation techniques and frequency-based properties.	**K2**
	CO2	Illustrate RFID industry standards and protocols such as EPC Global, ISO 15693, ISO 14443, and NFC for RFID-based implementations.	**K3**
	CO3	Demonstrate data integrity and security mechanisms in RFID, including checksum procedures, multiaccess techniques, and cryptographic protections.	**K3**
	CO4	Estimate RFID-enabled sensor integration, including antenna design challenges, IC design, power consumption, and link budget.	**K3**
	CO5	Examine RFID-based solutions for applications such as contactless smart cards, electronic passports, industrial automation, and medical applications while addressing challenges and opportunities.	**K3**

UNIT – I	**UNDERSTANDING RFID TECHNOLOGY**	**Periods:09**
RFID Principles: Near-field based RFID – Properties of Magnetic field – Far-field based RFID - Properties of Backscatter RF Systems – Modulation techniques – Frequency based property comparison of RFID Systems		**CO1**
UNIT - II	**RFID STANDARDS AND PROTOCOLS**	**Periods:09**
RFID Industry standards: EPC global – ISO 15693 Vicinity cards and RFID – ISO 14443 Proximity cards and RFID – The NFC forum – Reading collocated RFID tags: Query Tree protocol – Query Slot protocol		**CO2**
UNIT - III	**DATA INTEGRITY AND SECURITY**	**Periods:09**
The checksum procedure – Multiaccess procedures – Attacks on RFID Systems – Protection by Cryptographic measures		**CO3**
UNIT - IV	**RFID ENABLED SENSORS**	**Periods:09**
RFID enabled Sensors: Antenna design challenges – IC design – Integration of sensors and RFID – Power consumption and Link budget		**CO4**
UNIT - V	**APPLICATIONS**	**Periods:09**
Applications: Contactless smart cards – Access control – Electronic passport – Industrial Automation – Medical applications – Challenges and opportunities.		**CO5**

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

Textbooks

1. Roy Want, RFID Explained, Springer 2022.
2. Amin Rida, Li Yang, Manos M. Tentzeris, RFID Enabled Sensor Design and Applications, Artech House, 2010
3. Klaus Finkenzeller, RFID Handbook, 3rd Edition, Wiley, 2010

Reference Books

1. Paris Kitsos, Security in RFID and Sensor Networks, CRC Press, 2016.
2. Syed Ahson, Mohammad Ilyas, RFID Handbook, CRC Press, 2008
3. Rao K.V.S. – Introduction to RFID Systems (McGraw-Hill, 2015).

Web References

1. Klaus Finkenzeller – RFID Handbook: Fundamentals and Applications in Contactless Smart Cards, Radio Frequency Identification, and Near-Field Communication (3rd Edition, Wiley, 2010).
2. Simson Garfinkel & Beth Rosenberg – RFID: Applications, Security, and Privacy (Addison-Wesley, 2005).
3. Daniel M. Dobkin – The RF in RFID: Passive UHF RFID in Practice (2nd Edition, Elsevier/Newnes, 2012).
4. Stefan Mangard, Elisabeth Oswald & Thomas Popp – Power Analysis Attacks: Revealing the Secrets of Smart Cards (Springer, 2007).

*** 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	1	-	-	-	-	-			
2	2	2	2	1	-	1	1	-	-	-	-	-			
3	2	2	2	1	-	1	1	-	-	-	-	-			
4	2	2	2	1	-	1	1	-	-	-	-	-			
5	2	2	2	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**