MOUNT ZION

COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE, Affiliated to Anna University & Accredited by NAAC with A+ Grade)
Lena Vilakku, Pilivalam P.O., Thirumayam TK., Pudukkottai - 622 507
E-mail: info@mzcet.in | www.mzcet.in

Curriculum and Syllabus Handbook

B.E – ELECTRONICS AND COMMUNICATION ENGINEERING

(Accredited by NBA)

[Regulation 2025]

[CHOICE BASED CREDIT SYSTEM]

Approved by Academic Council on 24.06.2026

INSTITUTE VISION AND MISSION	
VISION	• To be the preferred choice of students who aspire to become Engineers of the highest calibre.
MISSION	• Provide world-class physical and digital infrastructure and learning environment. • Develop the competencies of students to make them job-ready and entrepreneurs. • Facilitate mental, physical, emotional and spiritual development of students and ensure their holistic development. • Preserve the environment through the implementation of eco-friendly and sustainable practices. • Serve the community through skill development and other need-based services. • Establish sustainable partnerships with industries and R&D laboratories for mutual benefit.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING	
VISION	• To be a leading department in Electronics and Communication Engineering education, fostering innovation, research, and technological advancement while empowering students with the knowledge, skills, and ethical values to contribute to the development of society and the global technological landscape.
MISSION	• To provide a comprehensive education in electronics and communication engineering that blends theoretical knowledge, practical skills, and hands-on experience to prepare students for successful careers in industry and research. • To foster a culture of innovation and research by encouraging students and faculty to explore advanced technologies and contribute to solving real-world challenges in electronics, communication, and related fields. • To promote leadership, teamwork, and ethical responsibility, preparing students to be well-rounded professionals who can address the challenges of a rapidly evolving global technology landscape. • To establish strong partnerships with industry and research organizations, enhancing learning opportunities, promoting entrepreneurship, and creating solutions that address societal needs through electronics and communication.

PROGRAMME OUTCOMES (POs)

At the end of this programme the students will be able to

PO NO.	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
PO1	Engineering Knowledge	Apply math, science, and engineering fundamentals to complex problems.
PO2	Problem Analysis	Identify and analyze complex problems using research and sustainability principles.
PO3	Design Solutions	Design systems and processes considering health, safety, cost, culture, and environment.
PO4	Investigations	Use experiments, modelling, and data analysis to reach valid conclusions.
PO5	Engineering Tools	Apply modern tools for modelling and problem-solving, recognizing their limits.
PO6	Society and Environment	Assess societal, legal, and environmental impacts of engineering solutions.
PO7	Ethics	Commit to ethics, human values, diversity, and legal compliance.
PO8	Team work	Work effectively as an individual and in multidisciplinary teams.
PO9	Communication	Communicate clearly in reports, presentations, and documentation across diverse groups.
PO10	Management and finance	Apply management and economic principles in projects and teamwork.
PO11	Life-long learning	Engage in continuous learning, adapt to new technologies, and think critically.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	**The graduates of Electronics and Communication Engineering will** • **PEO1:**Develop a strong foundation in electronics and communication engineering, enabling them to solve complex engineering problems and contribute to the advancement of technology across various industries • **PEO2:**Engage in lifelong learning, furthering their education through advanced studies, research, and professional development to keep pace with emerging technologies and contribute to innovation in electronics and communication fields. • **PEO3:**Demonstrate leadership, effective communication, and ethical decision-making in their professional roles, working collaboratively to address societal challenges and contribute positively to the community.
PROGRAMME SPECIFIC OUTCOMES (PSOs)	**Students will be able to** • **PSO1:**Apply core principles of electronics and communication engineering to design, analyze, and implement electronic circuits, communication systems, and signal processing solutions. • **PSO2:**Utilize advanced technologies such as wireless communication, embedded systems, IoT, and VLSI design to develop innovative solutions for real-world challenges in electronics and communication. • **PSO3:**Possess effective communication, teamwork, and problem-solving skills, along with an understanding of ethical practices, enabling them to work responsibly in diverse professional environments.

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
CURRICULUM

SEMESTER – I

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY AND LAB INTEGRATED THEORY									
1.	MA25C01	Applied Calculus	T	BSC	3	1	0	4	4
2.	EN25C01	English Essentials – I	T	HSMC	2	0	0	2	2
3.	UC25H01	தமிழர் மரபு / Heritage of Tamils	T	HSMC	1	0	0	1	1
4.	EE25C04	Basic Electronics and Electrical Engineering	T	ESC	2	1	0	3	3
5.	PH25C01	Applied Physics – I	LIT	BSC	2	0	2	4	3
6.	CY25C01	Applied Chemistry – I	LIT	BSC	2	0	2	4	3
7.	CS25C01	Computer Programming: C	LIT	ESC	2	0	2	4	3
8.	UC25A01	Life Skills for Engineers – I*	---	HSMC	1	0	2	3	1
9.	UC25A02	Physical Education – I*	---	HSMC	0	0	4	4	1
PRACTICALS									
10.	ME25C04	Makerspace	L	ESC	0	0	4	4	2
NON-CREDIT COURSES									
11.	---	NCC / NSS / NSO	---	---	0	0	0	0	0
TOTAL					**15**	**2**	**16**	**33**	**23**

*Audit Course

SEMESTER II

S.NO.	COURS CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY AND LAB INTEGRATED THEORY									
1.	MA25C02	Linear Algebra	T	BSC	3	1	0	4	4
2.	UC25H02	தமிழர்களும் தொழில் நுட்பமும்/ Tamils and Technology	T	HSMC	1	0	0	1	1
3.	EN25C02	English Essentials – II	LIT	HSMC	1	0	2	3	2
4.	EC25C01	Electron Devices	T	ESC	3	0	0	3	3
5.	EC25C02	Circuits and Network Analysis	T	ESC	3	0	0	3	3
6.	CS25C05	Data Structures using C++	LIT	ESC	3	0	2	5	4
7.	UC25A03	Life Skills for Engineers – II*	---	HSMC	1	0	2	3	1
8.		Foreign Language^	LIT	HSMC	1	0	2	3	1
PRACTICALS									
9.	ME25C05	Re-Engineering for Innovation	L	ESC	0	0	4	4	2
10.	EC25C03	Devices and Circuits Laboratory	L	ESC	0	0	4	4	2
11.	UC25A04	Physical Education – II*	---	HSMC	0	0	4	4	1
TOTAL					**16**	**1**	**20**	**37**	**24**

^ Deutsch / Japanese / Korean *Audit Course

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY AND LAB INTEGRATED THEORY									
1.	MA25304	Applied Transform Techniques	T	BSC	3	1	0	4	4
2.	EC25301	Electromagnetic Fields	T	PCC	3	0	0	3	3
3.	EC25302	Signals and Systems	T	PCC	3	1	0	4	4
4.	EC25303	Digital Systems Design	LIT	PCC	2	0	2	4	3
5.	EC25304	Electronic Circuits and Analysis	T	PCC	3	0	0	3	3
6.	EC25305	Communication Systems	T	PCC	3	0	0	3	3
PRACTICALS									
7.	EC25306	Electronic Circuits Laboratory	L	PCC	0	0	4	4	2
8.	EC25307	Communication Systems Laboratory	L	PCC	0	0	4	4	2
TOTAL					**17**	**2**	**10**	**29**	**24**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY AND LAB INTEGRATED THEORY									
1.	MA25402	Probability and Random Processes	T	BSC	3	1	0	4	4
2.	EC25401	Linear Integrated Circuits	T	PCC	3	0	0	3	3
3.	EC25402	Control Systems	T	PCC	3	0	0	3	3
4.	EC25403	Digital Signal Processing	T	PCC	3	0	0	3	3
5.	EC25404	Computer Communication Networks	LIT	PCC	2	0	2	4	3
6.	CY25401	Environmental Sciences and Sustainability	T	BSC	3	0	0	3	3
PRACTICALS									
7.	EC25405	Digital Signal Processing Laboratory	L	PCC	0	0	4	4	2
8.	EC25406	Linear Integrated Circuits Laboratory	L	PCC	0	0	4	4	2
TOTAL					**17**	**1**	**10**	**28**	**23**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY AND LAB INTEGRATED THEORY									
1.	EC25501	VLSI Design	T	PCC	3	0	0	3	3
2.	EC25502	Antennas and Microwave Engineering	T	PCC	3	0	0	3	3
3.	EC25503	Wireless Communication	LIT	PCC	2	0	2	4	3
4.	***	Open Elective– I	T	OEC	3	0	0	3	3
5.	EC25P**	Professional Elective I	T	PEC	3	0	0	3	3
6.	EC25P**	Professional Elective II	T	PEC	3	0	0	3	3
7.	MX255**	Mandatory Course I	T	MC	3	0	0	3	Non Credit Course
PRACTICALS									
8.	EC25504	VLSI Design Laboratory	L	PCC	0	0	4	4	2
9.	EC25505	Antenna and Microwave Engineering Laboratory	L	PCC	0	0	4	4	2
10.	EN25501	Technical Seminar	L	EEC	0	0	2	2	1
TOTAL					**20**	**0**	**12**	**32**	**23**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY AND LAB INTEGRATED THEORY									
1.	EC25601	5G Communication Networks	T	PCC	3	0	0	3	3
2.	EC25602	Embedded Systems and IoT	T	PCC	3	0	0	3	3
3.	EC25603	Optical Communication	LIT	PCC	2	0	2	4	3
4.	***	Open Elective– II	T	OEC	3	0	0	3	3
5.	EC25P**	Professional Elective III	T	PEC	3	0	0	3	3
6.	EC25P**	Professional Elective IV	T	PEC	3	0	0	3	3
7.	MX256**	Mandatory Course II	T	MC	3	0	0	3	Non Credit Course
PRACTICALS									
8.	EC25604	5G Communication Networks Laboratory	L	PCC	0	0	4	4	2
9.	EC25605	Embedded Systems and IoT Laboratory	L	PCC	0	0	4	4	2
10.	EN25601	Professional Communication	L	EEC	0	0	2	2	1
TOTAL					**20**	**0**	**12**	**32**	**23**

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY									
1.	MG25701	Principles of Management	T	HSMC	3	0	0	3	3
2.	MG25702	Human Values and Ethics	T	HSMC	2	0	0	2	2
3.	***	Open Elective – III	T	OEC	3	0	0	3	3
4.	***	Open Elective – IV	T	OEC	3	0	0	3	3
5.	EC25P**	Professional Elective V	T	PEC	3	0	0	3	3
6.	EC25P**	Professional Elective VI	T	PEC	3	0	0	3	3
PRACTICALS									
7.	EC25701	Mini Project	L	EEC	0	0	4	4	2
8.	EC25702	Summer Internship		EEC	0	0	0	0	2
TOTAL					**17**	**0**	**4**	**21**	**21**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
PRACTICALS									
1.	EC25801	Project Work	L	EEC	0	0	16	16	8
TOTAL					**0**	**0**	**16**	**16**	**8**

TOTAL CREDITS: 169

MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY									
1.	MX25501	Introduction to Women and Gender Studies	T	MC	3	0	0	3	0
2	MX25502	Elements of Literature	T	MC	3	0	0	3	0
3.	MX25503	Film Appreciation	T	MC	3	0	0	3	0
4.	MX25504	Disaster Risk Reduction and Management	T	MC	3	0	0	3	0

MANDATORY COURSES II

S. NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
THEORY									
1.	MX25601	Well Being with Traditional Practices Yoga, Ayurveda and Siddha	T	MC	3	0	0	3	0
2	MX25602	History of Science and Technology in India	T	MC	3	0	0	3	0
3.	MX25603	Political and Economic Thought for a Humane Society	T	MC	3	0	0	3	0
4.	MX25604	State, Nation Building and Politics in India	T	MC	3	0	0	3	0
5.	MX25605	Industrial Safety	T	MC	3	0	0	3	0

PROFESSIONAL ELECTIVE COURSES

Domain	V Semester		VI Semester		VII Semester	
	Professional Elective I	**Professional Elective II**	**Professional Elective III**	**Professional Elective IV**	**Professional Elective V**	**Professional Elective VI**
Semiconductor Chip Design and Testing	Wide Bandgap Devices	Validation Testing and Technology	Low Power IC Design	VLSI Testing and Design For Testability	Mixed Signal IC Design Testing	Analog IC Design
Signal Processing	Advanced Digital Signal Processing	Image Processing	Speech Processing	Video Processing	DSP Architecture and Programming	Computer Vision
RF Technologies	Electromagnetic Compatibility	Signal Integrity	Transmission lines and RF Systems	MICs and RF System Design	Advanced Radiation Systems	RF Testing and Measurement Systems
Bio Medical Technologies	Wearable Devices	Human Assist Devices	Therapeutic Equipment	Medical Imaging Systems	Brain Computer Interface and Applications	Body Area Networks
Underwater Technologies	Underwater Instrumentation System	Underwater Imaging Systems and Image Processing	Underwater Communication	Ocean Observation Systems	Underwater Navigation Systems	Ocean Acoustics
Sensor Technologies and IoT	IoT Processors	IoT Based System Design	Wireless Sensor Network Design	Artificial Intelligence and Machine Learning	MEMS	Fundamentals of Nano Electronics
Space Technologies	Radar Technologies	Avionics Systems	Positioning and Navigation Systems	Satellite Communication	Remote Sensing	Rocketry and Space Mechanics
High Speed Communications	Ad-hoc and Vehicular Networks	Wireless Broad Band Networks	Software Defined Networks	Massive MIMO Networks	Advanced Wireless Communication Techniques	Network Security in High-Speed Systems

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVES – I

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25P01	Wide Bandgap Devices	T	PEC	3	0	0	3	3
2.	EC25P02	Advanced Digital Signal Processing	T	PEC	3	0	0	3	3
3.	EC25P03	Electromagnetic Compatibility	T	PEC	3	0	0	3	3
4.	EC25P04	Wearable Devices	T	PEC	3	0	0	3	3
5.	EC25P05	Underwater Instrumentation System	T	PEC	3	0	0	3	3
6.	EC25P06	IoT Processors	T	PEC	3	0	0	3	3
7.	EC25P07	Radar Technologies	T	PEC	3	0	0	3	3
8.	EC25P08	Ad-hoc and Vehicular Networks	T	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES – II

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25P09	Validation Testing and Technology	T	PEC	3	0	0	3	3
2.	EC25P10	Image Processing	T	PEC	3	0	0	3	3
3.	EC25P11	Signal Integrity	T	PEC	3	0	0	3	3
4.	EC25P12	Human Assist Devices	T	PEC	3	0	0	3	3
5.	EC25P13	Underwater Imaging Systems and Image Processing	T	PEC	3	0	0	3	3
6.	EC25P14	IoT Based System Design	T	PEC	3	0	0	3	3
7.	EC25P15	Avionics Systems	T	PEC	3	0	0	3	3
8.	EC25P16	Wireless Broad Band Networks	T	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES – III

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25P17	Low Power IC Design	T	PEC	3	0	0	3	3
2.	EC25P18	Speech Processing	T	PEC	3	0	0	3	3
3.	EC25P19	Transmission lines and RF Systems	T	PEC	3	0	0	3	3
4.	EC25P20	Therapeutic Equipment	T	PEC	3	0	0	3	3
5.	EC25P21	Underwater Communication	T	PEC	3	0	0	3	3
6.	EC25P22	Wireless Sensor Network Design	T	PEC	3	0	0	3	3
7.	EC25P23	Positioning and Navigation Systems	T	PEC	3	0	0	3	3
8.	EC25P24	Software Defined Networks	T	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES – IV

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25P25	VLSI Testing and Design For Testability	T	PEC	3	0	0	3	3
2.	EC25P26	Video Processing	T	PEC	3	0	0	3	3
3.	EC25P27	MICs and RF System Design	T	PEC	3	0	0	3	3
4.	EC25P28	Medical Imaging Systems	T	PEC	3	0	0	3	3
5.	EC25P29	Ocean Observation Systems	T	PEC	3	0	0	3	3
6.	EC25P30	Artificial Intelligence and Machine Learning	T	PEC	3	0	0	3	3
7.	EC25P31	Satellite Communication	T	PEC	3	0	0	3	3
8.	EC25P32	Massive MIMO Networks	T	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES – V

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25P33	Mixed Signal IC Design Testing	T	PEC	3	0	0	3	3
2.	EC25P34	DSP Architecture and Programming	T	PEC	3	0	0	3	3
3.	EC25P35	Advanced Radiation Systems	T	PEC	3	0	0	3	3
4.	EC25P36	Brain Computer Interface and Applications	T	PEC	3	0	0	3	3
5.	EC25P37	Underwater Navigation Systems	T	PEC	3	0	0	3	3
6.	EC25P38	MEMS	T	PEC	3	0	0	3	3
7.	EC25P39	Remote Sensing	T	PEC	3	0	0	3	3
8.	EC25P40	Advanced Wireless Communication Techniques	T	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES – VI

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25P41	Analog IC Design	T	PEC	3	0	0	3	3
2.	EC25P42	Computer Vision	T	PEC	3	0	0	3	3
3.	EC25P43	RF Testing and Measurement Systems	T	PEC	3	0	0	3	3
4.	EC25P44	Body Area Networks	T	PEC	3	0	0	3	3
5.	EC25P45	Ocean Acoustics	T	PEC	3	0	0	3	3
6.	EC25P46	Fundamentals of Nano Electronics	T	PEC	3	0	0	3	3
7.	EC25P47	Rocketry and Space Mechanics	T	PEC	3	0	0	3	3
8.	EC25P48	Network Security in High-Speed Systems	T	PEC	3	0	0	3	3

OPEN ELECTIVES

OPEN ELECTIVES – I

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	AI25X01	Generative AI	T	OEC	3	0	0	3	3
2.	AI25X02	Fuzzy Logic and Expert Systems	T	OEC	3	0	0	3	3
3.	CE25X01	Air and Noise Pollution Control Engineering	T	OEC	3	0	0	3	3
4.	CE25X02	Prefabricated Structures	T	OEC	3	0	0	3	3
5.	CS25X01	Information Retrieval	T	OEC	3	0	0	3	3
6.	CS25X02	Business Intelligence and its Applications	T	OEC	3	0	0	3	3
7.	EE25X01	Measurements and Instrumentation	T	OEC	3	0	0	3	3
8.	EE25X02	Smart System Automation	T	OEC	3	0	0	3	3
9.	ME25X01	Hydraulics and Pneumatics	T	OEC	3	0	0	3	3
10.	ME25X02	Sustainable Manufacturing	T	OEC	3	0	0	3	3
11.	IT25X01	Human Computer Interaction	T	OEC	3	0	0	3	3
12.	IT25X02	Video Creation and Editing	T	OEC	3	0	0	3	3
13.	MG25X01	Project Management	T	OEC	3	0	0	3	3
14.	MG25X02	Retail Marketing	T	OEC	3	0	0	3	3

OPEN ELECTIVES – II

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	AI25X03	Reinforcement Learning	T	OEC	3	0	0	3	3
2.	AI25X04	Genetic Algorithms	T	OEC	3	0	0	3	3
3.	CE25X03	Airports and Harbours	T	OEC	3	0	0	3	3
4.	CE25X04	Industrial Wastewater Management	T	OEC	3	0	0	3	3
5.	CS25X03	Information Security	T	OEC	3	0	0	3	3
6.	CS25X04	Digital Marketing Analytics	T	OEC	3	0	0	3	3
7.	EE25X03	Electric Vehicle Architecture	T	OEC	3	0	0	3	3
8.	EE25X04	Intelligent Control of Electric Vehicles	T	OEC	3	0	0	3	3
9.	ME25X03	Manufacturing Process	T	OEC	3	0	0	3	3
10.	ME25X04	Power Plant Engineering	T	OEC	3	0	0	3	3
11.	IT25X03	Multimedia and Animation	T	OEC	3	0	0	3	3
12.	IT25X04	Multimedia Data Compression and Storage	T	OEC	3	0	0	3	3
13.	MG25X03	International Human Resource Management	T	OEC	3	0	0	3	3
14.	MG25X04	Product and Brand Management	T	OEC	3	0	0	3	3

OPEN ELECTIVES – III

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	AI25X05	Explainable AI	T	OEC	3	0	0	3	3
2.	AI25X06	Web Intelligence	T	OEC	3	0	0	3	3
3.	CE25X05	Geographical Information System	T	OEC	3	0	0	3	3
4.	CE25X06	Construction Equipment and Machinery	T	OEC	3	0	0	3	3
5.	CS25X05	Intelligent Systems	T	OEC	3	0	0	3	3
6.	CS25X06	Predictive Data Analytics	T	OEC	3	0	0	3	3
7.	EE25X05	Energy Management and Auditing	T	OEC	3	0	0	3	3
8.	EE25X06	Substation Engineering and Automation	T	OEC	3	0	0	3	3
9.	ME25X05	Non-traditional Machining Processes	T	OEC	3	0	0	3	3
10.	ME25X06	Non-Destructive Testing	T	OEC	3	0	0	3	3
11.	IT25X05	Green Computing	T	OEC	3	0	0	3	3
12.	IT25X06	Serverless Computing	T	OEC	3	0	0	3	3
13.	MG25X05	Management Concepts and Organizational Behaviour	T	OEC	3	0	0	3	3
14.	MG25X06	Quality Management	T	OEC	3	0	0	3	3

OPEN ELECTIVES – IV

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	AI25X07	Stream Data Analytics	T	OEC	3	0	0	3	3
2.	AI25X08	Computational Neuroscience	T	OEC	3	0	0	3	3
3.	CE25X07	Advanced Construction Techniques	T	OEC	3	0	0	3	3
4.	CE25X08	Solid and Hazardous waste Management	T	OEC	3	0	0	3	3
5.	CS25X07	Distributed Computing	T	OEC	3	0	0	3	3
6.	CS25X08	Decision Support Systems	T	OEC	3	0	0	3	3
7.	EE25X07	Protection and Switchgear	T	OEC	3	0	0	3	3
8.	EE25X08	Underground Cable Engineering	T	OEC	3	0	0	3	3
9.	ME25X07	Additive Manufacturing	T	OEC	3	0	0	3	3
10.	ME25X08	Lean Manufacturing	T	OEC	3	0	0	3	3
11.	IT25X07	E- Learning Techniques	T	OEC	3	0	0	3	3
12.	IT25X08	Edge and Fog Computing	T	OEC	3	0	0	3	3
13.	MG25X07	Marketing Management	T	OEC	3	0	0	3	3
14.	MG25X08	Supply Chain and Logistics Management	T	OEC	3	0	0	3	3

OPEN ELECTIVES OFFERED TO OTHER DEPARTMENT

S.NO.	COURSE CODE	COURSE TITLE	COURSE TYPE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
					L	T	P		
1.	EC25X01	IoT Processors	T	OEC	3	0	0	3	3
2.	EC25X02	Image Processing	T	OEC	3	0	0	3	3
3.	EC25X03	Wearable Devices	T	OEC	3	0	0	3	3
4.	EC25X04	Satellite Communication	T	OEC	3	0	0	3	3
5.	EC25X05	MEMS	T	OEC	3	0	0	3	3
6.	EC25X06	DSP Architecture and Programming	T	OEC	3	0	0	3	3
7.	EC25X07	Medical Imaging Systems	T	OEC	3	0	0	3	3
8.	EC25X08	Underwater Communication	T	OEC	3	0	0	3	3

SUMMARY

Name of the Programme: B.E. Electronics and Communication Engineering										
S. No.	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	5	6	-	-	-	-	5	-	16
2	BSC	10	4	4	7	-	-	-	-	25
3	ESC	8	14	-	-	-	-	-	-	22
4	PCC	-	-	20	16	13	13	-	-	62
5	PEC	-	-	-	-	6	6	6	-	18
6	OEC	-	-	-	-	3	3	6	-	12
7	EEC	-	-	-	-	1	1	4	8	14
Total		23	24	24	23	23	23	21	8	169

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

•A student may optionally register for additional courses totalling 18 credits and become eligible for the award of a B.E. / B.Tech. (Honours) or a Minor Degree.

•For B.E. / B.Tech. (Honours), a student shall register for the additional courses (18 credits) from Semester V onwards. These courses shall be selected from the same domain or from a combination of different domains within the same programme of study.

•For a Minor Degree, a student shall register for the additional courses (18 credits) from Semester V onwards. All these courses shall be from a specific domain of any one of the other programmes of study.

III SEMESTER

MA25304	APPLIED TRANSFORM TECHNIQUES	L	T	P	C
		3	1	0	4
Course Objectives:	• To provide a strong foundation in Fourier series, Laplace, Fourier and Z– Transforms. • To develop the ability to analyze and solve engineering problems in continuous–time and discrete–time domains using appropriate transform techniques.				

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Apply Laplace and inverse Laplace transforms to solve ordinary differential equations arising in engineering problems.	**K3**
CO2	Apply Z–transform techniques to solve difference equations in discrete–time systems.	**K3**
CO3	Analyze periodic functions using Fourier series and related identities.	**K4**
CO4	Apply Fourier transform techniques in the analysis of engineering and physical systems.	**K3**
CO5	Formulate and solve engineering problems involving differential equations using transform methods.	**K4**

Unit I – LAPLACE TRANSFORM	**9+3**
Existence conditions–Properties of Laplace transform – Laplace transform of standard functions – derivatives and integrals – Unit step function and Dirac delta function – Laplace transform of periodic functions – Inverse Laplace transform – Partial fraction technique – Convolution theorem.	
Unit II – Z TRANSFORM	**9+3**
Z–transform of standard functions–properties – Inverse Z – transform of Standard functions – Partial fraction technique – Convolution theorem.	
Unit III – FOURIER SERIES	**9+3**
Dirichlet's conditions – General Fourier series – Convergence of Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Root Mean Square value – Parseval's identity.	
Unit IV – FOURIER TRANSFORM	**9+3**
Complex Fourier transform – Properties – Relation between Fourier and Laplace transform – Fourier sine and cosine transforms – Parseval's identity – Convolution theorem.	
Unit V– APPLICATIONS OF TRANSFORMS	**9+3**
Solution of second order ordinary differential equations using Laplace transform– Solution of differential equation using Z–transform – Solution of one–dimensional wave equation – Solution of one–dimensional heat equation – Steady state temperature distribution – Steady state solution of two-dimensional heat conduction equations (Cartesian coordinates only).	
TOTAL (L:45, T:15): 60 PERIODS	
TEXT BOOKS	

1.Grewal B. S., Higher Engineering Mathematics, Khanna Publications, 2021.
2.Kreyszig G. E., Advanced Engineering Mathematics, John Wiley and Sons Ltd, 2018.

REFERENCES

1.Zill D. G., Advanced Engineering Mathematics, Jones and Bartlett India Ltd, 2022.
2.Wylie C. R., and Barrett L. C., Advanced Engineering Mathematics, Tata McGraw–Hill, 2019.
3.Duffy D. G., Advanced engineering mathematics with MATLAB, CRC Press, 2017.

Mapping of COs with POs / PSOs														
	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	–	2	–	–	–	–	–	–	3	–	–
2	3	2	–	–	2	–	–	–	–	–	–	3	2	–
3	3	3	–	2	–	–	–	–	–	–	–	3	–	–
4	3	3	–	2	2	–	–	–	–	–	–	3	2	–
5	3	3	2	2	2	–	–	–	–	–	2	3	2	2
Avg.	**3.0**	**2.6**	**2.0**	**2.0**	**2.0**	**–**	**–**	**–**	**–**	**–**	**2.0**	**3.0**	**2.0**	**2.0**

EC25301	ELECTROMAGNETIC FIELDS	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart knowledge on the basics of static electric field and the associated laws.
- To impart knowledge on the basics of static magnetic field and the associated laws.
- To give insight into coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations.
- To gain the behaviour of the propagation of EM waves.
- To study the significance of Time varying fields.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Apply the fundamentals of vector algebra and coordinate systems to analyze and interpret electromagnetic field concepts.	**K3**
CO2	Analyze the characteristics of Electrostatic field.	**K4**
CO3	Apply magnetostatic field laws and material properties to analyze magnetic fields, inductance, energy, and boundary value problems.	**K3**
CO4	Understand Maxwell's equations in integral, differential and phasor forms and explain their physical meaning.	**K2**
CO5	Analyze electromagnetic wave propagation, power flow, and reflection characteristics in lossless and lossy media.	**K4**

UNIT I INTRODUCTION	**9**
Electromagnetic Model-Units and Constants-Review of Vector Algebra-Rectangular Coordinate System- Cylindrical Coordinate System-Spherical Coordinate System-Line Integrals-Surface Integrals-Volume Integrals - Gradient of a Scalar Field-Divergence of a Vector Field-Divergence Theorem-Curl of a Vector Field-Stokes' Theorem-Null Identities-Helmholtz's Theorem-Verification of Theorems for Different Paths, Surfaces and Volumes.	
UNIT II ELECTROSTATICS	**9**
Electric Field - Coulomb's Law - Gauss's Law and Applications - Electric Potential - Conductors in Static Electric Field - Dielectrics in Static Electric Field - Electric Flux Density and Dielectric Constant - Boundary Conditions - Electrostatic Boundary Value Problems – Capacitance: Parallel Capacitors , Cylindrical Capacitors, Spherical Capacitors - Electrostatic Energy - Poisson's Equation - Laplace's Equation - Uniqueness of Electrostatic Solutions - Current Density and Ohm's Law - Electromotive Force and Kirchhoff's Voltage Law - Equation of Continuity and Kirchhoff's Current Law.	
UNIT III MAGNETOSTATICS	**9**
Lorentz Force Equation - Ampere's Law - Vector Magnetic Potential - Biot-Savart Law and Applications - Magnetic Field Intensity and Relative Permeability - Calculation of Magnetic Field Intensity for Various Current Distributions - Magnetic Circuits - Behaviour of Magnetic Materials - Boundary Conditions - Inductance and Inductors - Magnetic Energy - Magnetic Forces and Torques.	
UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS	**9**
Faraday's Law - Displacement Current and Maxwell-Ampere Law - Maxwell's Equations - Potential Functions - Electromagnetic Boundary Conditions - Wave Equations and Solutions	

- Time-Harmonic Fields - Observation of Wave Propagation using Maxwell's Equations.	
UNIT V PLANE ELECTROMAGNETIC WAVES	**9**
Plane Waves in Lossless Media - Plane Waves in Lossy Media (Low-Loss Dielectrics and Good Conductors) - Group Velocity - Electromagnetic Power Flow and Poynting Vector - Normal Incidence at a Plane Conducting Boundary - Normal Incidence at a Plane Dielectric Boundary.	
TOTAL : 45 PERIODS	

TEXT BOOKS

1. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 7th Edition, Oxford (Asian Edition), 2022.

REFERENCES

1.Edward C. Jordan and Keith G. Balmain, Electromagnetic waves and Radiating Systems, 2nd Edition, Prentice-Hall Electrical Engineering Series, 2012.

2. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 9th Edition. McGraw-Hill (India), 2019.

3. B.M. Notaros, Electromagnetics, 1st Edition, Pearson: New Jersey, 2011.

Mapping of COs with POs / PSOs

	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	-	-	-	-	-	-	-	-	2	3	-	-
2	3	3	-	2	-	-	-	-	-	-	2	3	-	-
3	3	3	2	2	-	-	-	-	-	-	2	3	2	-
4	3	2	-	2	-	-	-	-	-	-	2	3	-	-
5	3	3	2	2	2	-	-	-	-	-	2	3	2	-
Avg.	**3.0**	**2.6**	**2.0**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**2.0**	**-**

EC25302	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

Course Objectives:	• To understand the basic properties of signal and systems. • To know the methods of characterization of LTI systems in time domain. • To analyze continuous time signals and system in the Fourier and Laplace domain. • To analyze discrete time signals and system in the Fourier and Z transform domain.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Determine if a given system is linear/causal/stable.	**K4**
CO2	Determine the frequency components present in a deterministic signal.	**K4**
CO3	Characterize continuous LTI systems in the time domain and frequency domain.	**K4**
CO4	Characterize discrete LTI systems in the time domain and frequency domain.	**K4**
CO5	Compute the output of an LTI system in the time and frequency domains.	**K3**

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS	**9+3**
Standard signals: Step, Ramp, Pulse, Impulse-Real and complex exponentials and Sinusoids-Classification of signals: Continuous time (CT) and Discrete Time (DT) signals, Periodic and Aperiodic signals, Deterministic and Random signals, Energy and Power signals-Classification of systems: CT systems and DT systems, Linear and Nonlinear, Time-variant and Time-invariant, Causal and Non-causal, Stable and Unstable.	
UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS	**9+3**
Fourier series for periodic signals: Trigonometric Form of Fourier series, Exponential Form of Fourier Series, Fourier Coefficients -Fourier Transform and properties-Inverse Fourier Transform-Laplace Transforms and Properties-Inverse Laplace Transforms.	
UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	**9+3**
Impulse response-Convolution integrals-Differential Equation-Fourier and Laplace transforms in analysis of CT systems-Systems connected in series/ parallel.	
UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS	**9+3**
Baseband signal Sampling-Fourier Transform of discrete time signals (DTFT)-Properties of DTFT-Inverse Fourier Transform of discrete time signals-Z Transform and Properties-Inverse Z Transform.	
UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	**9+3**
Impulse response-Difference equations-Convolution sum-Discrete Fourier Transform and Z Transform- Analysis of Recursive and Non-Recursive systems-DT systems connected in series and parallel.	
TOTAL (L:45 , T:15) : 60 PERIODS	

TEXT BOOKS:

1.Oppenheim, Willsky and Hamid, Signals and Systems, 2nd Edition, Pearson Education, Delhi, 2015.

2. Simon Haykin, Barry Van Veen, Signals and Systems, 2nd Edition, John Wiley and Sons, 2003.

REFERENCES :

1. B. P. Lathi, Principles of Linear Systems and Signals, 3rd Edition, Oxford, 2018.

2. M. J. Roberts, Signals and Systems Analysis using Transform methods and MATLAB, 2nd Edition, McGraw- Hill Education, 2018.

3. John Alan Stuller, An Introduction to Signals and Systems, 1st Edition, Thomson, 2007.

Mapping of COs with POs / PSOs														
	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	–	2	-	–	–	–	–	–	2	3	-	-
2	3	3	–	2	2	–	–	–	–	–	2	3	2	-
3	3	3	2	2	2	–	–	–	–	–	2	3	2	2
4	3	3	2	2	2	–	–	–	–	–	2	3	2	2
5	3	3	2	3	2	–	–	–	–	–	2	3	3	2
Avg.	**3.0**	**3.0**	**2.0**	**2.2**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**2.2**	**2.0**

EC25303	DIGITAL SYSTEMS DESIGN	L	T	P	C
		2	0	2	3
Course Objectives:	• To present the fundamentals of digital circuits and simplification methods. • To practice the design of various combinational digital circuits using logic gates. • To analyze and design synchronous and asynchronous sequential circuits. • To learn integrated circuit families. • To introduce semiconductor memories and related technology.				

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Apply number systems and Boolean techniques for digital logic design and simplification.	**K3**
CO2	Apply the knowledge of digital electronics to design and implement combinational logic circuits.	**K3**
CO3	Apply the principles of digital electronics to design synchronous sequential circuits.	**K3**
CO4	Apply hazard and race-free techniques in asynchronous circuits.	**K3**
CO5	Apply logic family characteristics and implement PLDs.	**K3**

UNIT I BASIC CONCEPTS	**6**
Review of number systems-Review of Boolean algebra-Theorems-Sum of product and product of sum- Simplification- Canonical forms: min term and max term-Simplification of Boolean expressions: Karnaugh map-Completely and incompletely specified functions-Implementation of Boolean expressions using universal gates-Tabulation methods.	
UNIT II COMBINATIONAL LOGIC CIRCUITS	**6**
Problem formulation and design of combinational circuits-Code converters-Half and Full Adders-Binary Parallel Adder-Carry look ahead Adder-BCD Adder-Magnitude Comparator-Decoder-Encoder-Priority Encoder-Mux/Demux-Case study: Digital trans-receiver / 8 bit Arithmetic and logic unit, Parity Generator/Checker.	
UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS	**6**
Latches, Flip flops: SR, JK, T, D, Master/Slave FF-Triggering of FF-Analysis and design of clocked sequential circuits-Moore/Mealy models-State minimization-State assignment-Lock-out condition circuit implementation-Counters: Ripple Counters, Ring Counters-Shift registers-Universal Shift Register.	
UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS	**6**
Stable and Unstable states-Output specifications-Cycles and races-State reduction-Race free assignments- Hazards-Essential Hazards-Fundamental and Pulse mode sequential circuits-Design of Hazard free circuits.	
UNIT V LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES	**6**
Logic families-Propagation Delay, Fan-In and Fan-Out - Noise Margin - RTL ,TTL,ECL, CMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic	

design using standard ICs-PROM- PLA and PAL-Basic memory: Static ROM,PROM,EPROM,EEPROM, EAPROM.

TOTAL : 30 PERIODS

PRACTICAL EXERCISES : **TOTAL : 30 PERIODS**

1. Design and analysis of adders and subtractors.
2. Design and analysis of code converters.
3. Design and analysis of Multiplexers and Demultiplexers.
4. Design and analysis of Encoders and Decoders.
5. Design and analysis of Magnitude Comparators.
6. Design and analysis of counters using flip-flops.
7. Design and analysis of shift registers.

HARDWARE / SOFTWARE REQUIRED:

HARDWARE: -

- IC Trainer Kit.
- Digital ICs.

SOFTWARE:

- Xilinx

TEXTBOOKS :

1. M. Morris Mano and Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, Pearson, 6th Edition, 2024.

REFERENCES :

1. Charles H. Roth, Jr, Fundamentals of Logic Design, Jaico Books, 4th Edition, 2002.
2. William I. Fletcher, An Engineering Approach to Digital Design, Prentice- Hall of India, , 1 Edition,1980.
3. Floyd T.L., Digital Fundamentals, Charles E. Merril publishing company, 1st Edition,1982.
4. John. F. Wakerly, Digital Design Principles and Practices, Pearson Education, 4th Edition, 2

Mapping of COs with POs / PSOs

	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	-	1	–	–	2	2	–	2	3	-	-
2	3	3	3	2	2	–	–	2	2	–	2	3	2	-
3	3	3	3	2	2	–	–	2	2	–	2	3	2	2
4	3	3	2	3	2	–	–	2	2	–	2	3	2	2
5	3	2	2	2	3	–	–	2	2	–	2	3	3	2
Avg.	**3.0**	**2.6**	**2.5**	**2.2**	**2.0**	**-**	**-**	**2.0**	**2.0**	**-**	**2.0**	**3.0**	**2.2**	**2.0**

EC25304	ELECTRONIC CIRCUITS AND ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:	• To understand the structure, characteristics and operation of semiconductor devices. • To analyze and design biasing circuits for BJT, JFET and MOSFET. • To study small signal models and frequency response of amplifiers. • To analyze multistage, differential and feedback amplifiers. • To understand oscillators, power amplifiers and power supply circuits. • To perform analysis and design of DC–DC converters.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Explain the structure, operation and V–I characteristics of semiconductor devices (BJT, JFET, MOSFET) and describe biasing techniques for stable operation.	**K2**
CO2	Apply small signal models to determine gain, input/output impedance and frequency response of BJT and MOSFET amplifiers.	**K3**
CO3	Apply circuit principles to determine performance parameters of multistage and differential amplifiers such as bandwidth and CMRR.	**K3**
CO4	Apply feedback concepts to determine gain and conditions for oscillations in amplifier and oscillator circuits.	**K3**
CO5	Apply circuit analysis techniques to design power amplifiers, power supplies and basic DC–DC converters.	**K3**

UNIT I –BIASING	**9**
BJT biasing methods: Fixed bias and voltage divider bias, Thermal stability and stability factors-JFET and MOSFET: Structure and characteristics-FET biasing methods.	
UNIT II – SMALL SIGNAL ANALYSIS OF AMPLIFIERS	**9**
BJT small signal models (Hybrid-π model): Analysis of CE, CB and CC amplifiers-MOSFET small signal model: Analysis of CS, CG and CD amplifiers-Miller effect-Frequency response of BJT and MOSFET amplifiers- Bandwidth and cut-off frequencies.	
UNIT III – MULTISTAGE AND DIFFERENTIAL AMPLIFIER	**9**
RC coupled amplifier: Bootstrap technique, Cascade and Cascode configurations-Differential amplifier using BJT: Common mode and differential mode analysis-Differential amplifier using MOSFET-Tuned amplifiers.	
UNIT IV – FEEDBACK AMPLIFIERS AND OSCILLATORS	**9**
Concept of feedback: Advantages of negative feedback, Voltage and current feedback amplifiers-Positive feedback: Condition for oscillations, RC phase shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator.	
UNIT V – POWER AMPLIFIERS AND POWER SUPPLIES	**9**

Power amplifiers: Class A, Class B, Class AB and Class C amplifiers-Power MOSFET amplifiers-Switched Mode Power Supplies (SMPS)-DC/DC Converters: Buck, Boost and Buck-Boost converters.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill Education, 4th Edition, 2010.
2. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 5th Edition, 2010.

REFERENCES :

1. Thomas L. Floyd, Electronic Devices, Pearson Education, 10th Edition, 2017.
2. D.Schilling and C.Belove, Electronic Circuits, McGraw Hill, 3rd Edition, 1989
3. Muhammad H.Rashid, Power Electronics: Circuits, Devices and Applications, 4th Edition, Pearson Education, 2014.

Mapping of COs with POs / PSOs

	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	2	2	–	–	–	–	–	2	3	1	–
2	3	3	2	2	2	–	–	–	–	–	2	3	2	–
3	3	3	3	2	2	–	–	–	–	–	2	3	2	–
4	3	3	3	2	2	–	–	–	–	–	2	3	2	–
5	3	3	3	3	2	–	–	–	–	–	2	3	3	2
Avg.	**3.0**	**2.8**	**2.7**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**2.0**	**2.0**

EC25305	COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce Analog Modulation Schemes.
- To impart knowledge in random process.
- To study various Digital techniques.
- To introduce the importance of sampling and quantization.
- To impart knowledge in demodulation techniques.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Understand the fundamentals of amplitude modulation methods and techniques.	**K2**
CO2	Explain the effects of noise in amplitude and frequency modulation systems and the process of quantization.	**K2**
CO3	Analyze digital modulation techniques and evaluate noise considerations in PCM.	**K4**
CO4	Understand digital modulation schemes and their applications in communication systems.	**K2**
CO5	Apply optimum digital demodulation in band-limited channels and evaluate effectiveness.	**K3**

UNIT I AMPLITUDE MODULATION	**9**
Review of signals and systems-Time and Frequency domain representation of signals-Principles of Amplitude Modulation Systems-DSB, SSB and VSB modulations-Angle Modulation-Representation of FM and PM signals-Spectral characteristics of angle modulated signals-SSB Generation: Filter and Phase Shift Methods-VSB Generation: Filter Method-Hilbert Transform-Pre-envelope and complex envelope AM techniques-Superheterodyne Receiver.	
UNIT II RANDOM PROCESS AND SAMPLING	**9**
Review of probability and random process-Gaussian and white noise characteristics-Noise in amplitude modulation systems-Noise in Frequency modulation systems-Pre-emphasis and De-emphasis-Threshold effect in angle modulation-Low pass sampling -Aliasing- Signal Reconstruction-Quantization: Uniform and non-uniform quantization, quantization noise -Nyquist criterion- Logarithmic Companding-PAM, PPM, PWM,PCM ,TDM, FDM.	
UNIT III DIGITAL TECHNIQUES	**9**
Pulse modulation: Differential pulse code modulation, Delta modulation-Noise considerations in PCM-Digital Multiplexers-Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.	
UNIT IV DIGITAL MODULATION SCHEME	**9**
Geometric Representation of signals: Generation, detection-IQ representation-PSD and BER of Coherent BPSK, BFSK, and QPSK-QAM - Carrier Synchronization - Structure of Non-coherent Receivers-Synchronization and Carrier Recovery for Digital modulation-Spectrum Analysis – Occupied bandwidth – Adjacent channel power- EVM-Principle of DPSK.	
UNIT V DEMODULATION TECHNIQUES	**9**
Elements of Detection Theory-Optimum detection of signals in noise-Coherent communication with waveforms-Probability of Error evaluations-Baseband Pulse Transmission-Inter symbol Interference- Optimum demodulation of digital signals over band-limited channels.	
TOTAL : 45 PERIODS	

TEXT BOOKS:

1. Simon Haykins, Communication Systems, Wiley, 5th Edition, 2009.

REFERENCES:

1. Wayner Tomasi, Electronic Communication System, 5th Edition, Pearson Education, 2008.
2. D.Roody, J.Coolen, Electronic Communications, 4th edition PHI 2006.
3. A. Papoulis and S. U. Pillai, Probability, Random Variables and Stochastic Processes, 4th Edition, McGraw-Hill, 2002.
4. B.Sklar, Digital Communications Fundamentals and Applications, 2nd Edition Pearson Education 2007.
5. Couch.L, Modern Communication Systems, Pearson, 4th Edition, 2001.

Mapping of COs with POs / PSOs														
	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	2	2	–	–	–	–	–	2	3	-	-
2	3	3	–	2	2	–	–	–	–	–	2	3	-	-
3	3	3	2	2	2	–	–	–	–	–	2	3	2	-
4	3	2	2	2	2	–	–	–	–	–	2	3	2	2
5	3	3	3	2	2	–	–	–	–	–	2	3	3	2
Avg.	**3.0**	**2.6**	**2.3**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**2.3**	**2.0**

EC25306	ELECTRONIC CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:	• To design and analyze BJT and FET biasing circuits. • To study frequency response of amplifiers. • To analyze feedback amplifiers and oscillators. • To understand waveform generation circuits. • To perform circuit simulation using EDA tools.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Design and verify BJT and MOSFET biasing circuits.	**K3**
CO2	Analyze gain and bandwidth of single and multistage amplifiers.	**K4**
CO3	Implement feedback and oscillator circuits.	**K3**
CO4	Apply the principles of tuned and power amplifiers to analyze frequency response and performance characteristics.	**K3**
CO5	Simulate and validate electronic circuits using EDA tools.	**K3**

LIST OF EXPERIMENTS:

1. Design and Analysis of BJT Biasing Circuits.
2. Frequency Response Characteristics of a MOSFET Amplifier.
3. Analysis of Frequency Response of Single-Stage and Multistage BJT Amplifiers.
4. Design and Analysis of RC and LC Oscillators.
5. Performance Analysis of Cascode and Cascade Amplifiers.
6. Frequency Response Analysis of Feedback Amplifiers.
7. Frequency Response Analysis of Tuned Amplifiers.
8. Design and Analysis of Class A and Class B Power Amplifiers.
9. Performance Analysis of Voltage Regulators.

HARDWARE / SOFTWARE REQUIRED:

HARDWARE: -

- Breadboard.
- DC Power Supply.
- Digital Multimeter.
- Function Generator.
- CRO / DSO.
- Required electronic components.

SOFTWARE:

- PSPICE / Multisim.

TOTAL: 60 PERIODS

Mapping of COs with POs / PSOs														
	POs											PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	3	2	–	–	–	–	–	–	–	3	2	–
2	3	3	2	2	–	–	–	–	–	–	–	3	2	–
3	3	2	2	2	2	–	–	2	–	–	–	3	3	–
4	3	3	2	2	2	–	–	-	–	–	–	3	3	–
5	2	2	2	3	3	–	–	2	2	–	2	2	3	2
Avg.	**2.8**	**2.4**	**2.2**	**2.2**	**2.3**	**-**	**-**	**2.0**	**2.0**	**-**	**2.0**	**2.8**	**2.6**	**2.0**

EC25307	COMMUNICATION SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:	• To visualize the effects of sampling and TDM. • To Implement AM andFM modulation and demodulation. • To implement PCM and DM. • To simulate Digital Modulation schemes. • To simulate Error control coding schemes.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Use AM, FM and Digital Modulators for specific applications.	**K3**
CO2	Compute the sampling frequency for digital modulation.	**K3**
CO3	Simulate and validate the various functional modules of Communication system.	**K3**
CO4	Demonstrate their knowledge in base band signalling schemes through implementation of digital modulation schemes.	**K3**
CO5	Apply various channel coding schemes and demonstrate their capabilities towards the improvement of the noise performance of Communication system.	**K3**

LIST OF EXPERIMENTS:

DESIGN AND ANALYSIS

1. AM- Modulator and Demodulator.
2. FM - Modulator and Demodulator.
3. Pre-Emphasis and De-Emphasis.
4. Signal sampling and TDM.
5. Pulse Code Modulation and Demodulation.
6. Pulse Amplitude Modulation and Demodulation.
7. Pulse Position Modulation and Demodulation and Pulse Width Modulation and Demodulation.
8. Delta Modulation and Demodulation.
9. Line coding schemes.
10. Digital Modulation - ASK, PSK, FSK.
11. BPSK, DPSK, QPSK and QAM Generation and Detection Schemes.
12. Linear Block and Cyclic Error Control coding Schemes.

HARDWARE / SOFTWARE REQUIRED:

HARDWARE:

- VCT-06 Trainer Kit.
- CRO.
- AFO.

SOFTWARE:

- MATLAB.

TOTAL: 60 PERIODS

Mapping of COs with POs / PSOs														
	POs											PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	3	3	2	–	–	2	2	-	–	3	2	-
2	3	3	2	2	2	–	–	2	2	-	–	3	-	-
3	3	2	2	3	3	–	–	2	2	2	2	3	3	2
4	3	3	3	3	2	–	–	2	2	2	2	3	2	2
5	3	3	3	3	2	–	–	2	2	-	2	3	2	2
Avg.	**3.0**	**2.6**	**2.6**	**2.8**	**2.2**	**-**	**-**	**2.0**	**2.0**	**2.0**	**2.0**	**3.0**	**2.2**	**2.0**

IV SEMESTER

MA25402	PROBABILITY AND RANDOM PROCESS	L	T	P	C
		3	1	0	4
Course Objectives:	• To provide the fundamental concepts of probability and random processes for applications involving random signals and communication systems. • To understand the basic concepts of probability, one- and two-dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon. • To understand the basic concepts of random processes which are widely used in communication and signal processing applications.				

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Explain the concepts of probability, random variables, and standard probability distributions used in engineering applications.	**K2**
CO2	Apply the concepts of one–dimensional and two–dimensional random variables in engineering applications.	**K3**
CO3	Apply the concepts of random processes in engineering disciplines.	**K3**
CO4	Analyze correlation functions and spectral density characteristics of random processes.	**K4**
CO5	Analyze the response of random inputs to linear time invariant systems.	**K4**

Unit I – PROBABILITY AND RANDOM VARIABLES	**9+3**
Probability – Axioms of probability – Conditional probability – Bayes' theorem – Discrete and continuous random variables – Mathematical expectation – Mean and variance – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.	
Unit II – TWO DIMENSIONAL RANDOM VARIABLES	**9+3**
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central Limit Theorem for independent and identically distributed random variables.	
Unit III – RANDOM PROCESS	**9+3**
Classification of stochastic processes – Discrete and continuous time processes – Strict sense and wide sense stationary – Markov process – Markov chain – Transition probabilities – Chapman–Kolmogorov equations – Poisson process: Properties and applications – Random telegraph process: Basic concepts and applications.	
Unit IV – CORRELATION AND SPECTRAL DENSITIES	**9+3**
Auto correlation functions – Cross correlation functions – Properties of correlation functions – Ergodic processes – Power spectral density and energy spectral density – Wiener–Khinchin theorem – Cross spectral density – Relationship between correlation and spectral density – White noise and its characteristics –Applications in signal processing and	

communication systems.	
Unit V– LINEAR SYSTEMS WITH RANDOM INPUTS	**9+3**
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation function of input and output – Cross correlation functions of input and output – Power spectral density of input and output –Relationship between input and output spectra.	
TOTAL (L:45, T:15): 60 PERIODS	

TEXT BOOKS

1.Veerarajan T., Probability, Statistics and Random Processes with Queueing theory and Queueing Networks,
Tata McGraw Hill Education (India) Pvt Ltd, New Delhi, 4th Edition, 2017.

REFERENCES

1.Ibe, O.C., Fundamentals of Applied Probability and Random Processes, 1st Indian Reprint, Elsevier 2007.

2.Peebles, P.Z., Probability, Random Variables and Random Signal Principles, Tata McGraw Hill, 4th Edition, New Delhi, 2002.

3.Miller. S.L. and Childers. D.G., Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.

Mapping of COs with POs / PSOs														
	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	–	–	–	–	–	–	–	–	3	–	–
2	3	3	–	2	–	–	–	–	–	–	–	3	2	–
3	2	3	2	2	2	–	–	–	–	–	–	3	2	–
4	3	3	2	3	2	–	–	–	–	–	2	3	3	–
5	3	3	3	2	2	–	–	–	–	–	2	3	3	2
Avg.	**3.0**	**2.8**	**2.3**	**2.2**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**2.5**	**2.0**

EC25401	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives:	• To study the basic principles, configurations and practical limitations of op-amp. • To understand the various linear and non-linear applications of op-amp. • To analyze and deign op-amp oscillators, single chip oscillators and frequency generators. • To analyze, design and explain the characteristics and applications of active filters and Voltage regulators. • To understand the operation of the most commonly used D/A and A/D converter types and its applications.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Explain the principles, characteristics, and configurations of operational amplifiers, including IC 741.	**K2**
CO2	Apply op-amp principles to implement linear and non-linear circuits such as amplifiers, converters, and comparators.	**K3**
CO3	Examine waveform generators, IC 555 Timer, and Phase Locked Loop (PLL) circuits.	**K3**
CO4	Analyze frequency response and regulation characteristics of active filters and voltage regulators.	**K4**
CO5	Compute output and performance parameters of DAC and ADC converters.	**K3**

UNIT I BASICS OF OPERATIONAL AMPLIFIERS	**9**
Op-amp symbol-Terminals-Packages and specifications-Block diagram Representation of op-amp-Ideal op-amp and practical op-amp-Open loop and closed loop configurations–DC and AC performance characteristics of op-amp –Differential amplifiers –General Description, Manufacturer's Specification, Electrical Characteristics and internal schematic of 741 op-amps.	
UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS	**9**
Voltage follower-Summing-Scaling and Sign changer-Linear Applications: Instrumentation Amplifiers-V-to-I and I-to-V Converters-Differentiator and Integrator, Non-linear Applications: Precision Rectifiers-Wave Shaping Circuits (Clipper and Clampers)–Analog voltage multiplier circuit and its applications–Operational Trans-Conductance Amplifier (OTA)-Comparators and its applications	
UNIT III WAVEFORM GENERATORS AND PLL	**9**
Waveform Generators: Sine-wave Generators – Square / Triangle / Saw-tooth Wave generators, IC 555 Timer: Monostable operation and its applications–Astable operation and its applications-PLL: Operation of basic PLL-Closed loop analysis of PLL-Voltage Controlled Oscillator-PLL applications.	
UNIT IV ACTIVE FILTERS AND VOLTAGE REGULATOR	**9**
Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter-Voltage Regulators: Basics of Voltage Regulator–Linear Voltage Regulators using Op-amp-IC Regulators (78xx, 79xx, LM 317)-Switching Regulators-723 general purpose regulators.	

UNIT V ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS	**9**
Digital- to-Analog Conversion: DAC Specifications–DAC circuits–Weighted Resistor DAC-R-2R Ladder DAC-Inverted R-2R Ladder DAC, Analog-to-Digital conversion: ADC specifications, ADC circuits-Ramp Type ADC, Successive Approximation ADC, Dual Slope ADC, Flash Type ADC, Monolithic ADC.	
TOTAL : 45 PERIODS	

TEXT BOOKS:

1. Roy Choudhury, D., and Jain, S., Linear Integrated Circuits, 5th Edition, New Age International Pvt. Ltd., 2018.

REFERENCES:

1. Gayakwad, R. A., OP-AMP and Linear Integrated Circuits, 4th Edition, Prentice Hall / Pearson Education, 2015.
2. Coughlin, R. F., and Driscoll, F. F., Operational Amplifiers and Linear Integrated Circuits, 6th Edition, PHI Learning, 2001.
3. Sonde, B. S., System Design Using Integrated Circuits, 2nd Edition, New Age Publications, 2001.
4. Gray, P. R., and Meyer, R. G., Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley International, 2009.
5. Stanley, W. D., Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2001.
6. Salivahanan, S., and Kanchana Bhaskaran, V. S., Linear Integrated Circuits, 2nd Edition (4th Reprint), Tata McGraw-Hill, 2016.

Mapping of COs with POs / PSOs

	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	–	–	–	–	–	–	–	–	3	3	2
2	3	3	2	2	2	–	–	–	–	–	2	3	2	2
3	2	3	2	2	2	–	–	–	–	–	2	3	2	2
4	3	3	2	2	2	–	–	–	–	–	2	3	2	2
5	3	3	2	2	2	–	–	–	–	–	2	3	3	3
Avg.	**3.0**	**2.8**	**2.0**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**3.0**	**2.4**	**2.2**

EC25402	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the components and their representation of control systems.
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Compute the transfer function of different physical systems.	**K3**
CO2	Analyze the time domain specification and calculate the steady state error.	**K4**
CO3	Analyze the frequency response characteristics of closed loop system.	**K4**
CO4	Analyze the stability using Routh and root locus techniques.	**K4**
CO5	Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.	**K2**

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION	**9**
Basic elements in control systems-Open loop and closed loop systems-Feed forward and Feedback control system characteristics-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models.	
UNIT II TIME RESPONSE ANALYSIS	**9**
Standard test inputs-Time response-Transient response-Steady state response-Measures of performance of the standard first order and second order system-Steady state error constant and system-PID control-Analytical design for PD, PI,PID control systems.	
UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS	**9**
Frequency response-Performance specification in frequency domain, Frequency response of standard second order system-Bode Plot-Polar Plot-Nyquist plot-Constant M and N circles-Compensation-Lag, Lead and, Lag-Lead compensation.	
UNIT IV CONCEPTS OF STABILITY ANALYSIS	**9**
Concept of stability-Bounded Input and Bounded Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus- Stability analysis using root locus-Nyquist stability criterion.	
UNIT V STATE VARIABLE ANALYSIS	**9**
Concept of state variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to canonical state variable models-Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.	
TOTAL : 45 PERIODS	

TEXT BOOKS:

1. M.Gopal, Control System – Principles and Design, Tata McGraw Hill, 4th Edition, 2012.

REFERENCES:

1. J.Nagrath and M.Gopal, Control System Engineering, New Age International Publishers, 5th Edition, 2007.

2. K.Ogata, Modern Control Engineering, PHI, 5th Edition, 2012.
3. S.K.Bhattacharya, Control System Engineering, Pearson, 3rd Edition, 2013.
4. B. C. Kuo and F. Golnaraghi, Automatic Control Systems, 9th Edition, Wiley, 2014.

Mapping of COs with POs / PSOs														
	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	–	–	–	–	–	–	–	–	3	2	-
2	3	3	–	–	–	–	–	–	–	–	–	3	2	-
3	3	3	2	2	–	–	–	–	–	–	2	3	2	2
4	3	3	2	2	–	–	–	–	–	–	–	3	2	2
5	2	2	2	–	2	–	–	–	–	–	2	2	3	2
Avg.	**2.8**	**2.6**	**2.0**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.0**	**2.8**	**2.2**	**2.0**

EC25403	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To understand the effects of finite precision representation on digital filters.
- To understand the fundamental concepts of multi rate signal processing and its applications.
- To introduce the concepts of adaptive filters and its application to communication engineering.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Apply DFT and FFT techniques for frequency-domain analysis and linear filtering of digital signals.	**K3**
CO2	Compute IIR digital filter parameters using standard transformation methods.	**K3**
CO3	Apply window, Fourier series, and frequency sampling methods to compute coefficients of linear phase FIR digital filters.	**K3**
CO4	Analyze the effects of finite precision representation on the performance of digital filters.	**K4**
CO5	Apply multirate signal processing and adaptive filtering techniques using appropriate DSP architectures for various signal processing applications.	**K3**

UNIT I DISCRETE FOURIER TRANSFORM	**9**
Sampling Theorem-Concept of frequency in discrete-time signals-Summary of analysis and synthesis equations for FT and DTFT-Frequency domain sampling-Discrete Fourier transform (DFT)-Deriving DFT from DTFT- Properties of DFT: Periodicity, Symmetry, Circular convolution-Linear filtering using DFT-Filtering long data sequences: Overlap save and overlap add method-Fast computation of DFT-Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT)-Decimation-in-frequency (DIF) Fast Fourier transform (FFT)-Linear filtering using FFT.	
UNIT II FINITE IMPULSE RESPONSE FILTERS	**9**
Design of FIR filters-Symmetric and Anti-symmetric FIR filters-Design of linear phase FIR filters using Fourier series method-FIR filter design using windows (Rectangular, Hamming and Hanning window)-Frequency sampling method-FIR filter structures: Linear phase structure, Direct form realizations.	
UNIT III INFINITE IMPULSE RESPONSE FILTERS	**9**
Characteristics of practical frequency selective filters-Characteristics of commonly used analog filters: Butterworth filters, Chebyshev filters-Design of IIR filters from analog filters (LPF, HPF, BPF, BRF)- Approximation of derivatives: Impulse invariance method, Bilinear transformation-Frequency transformation in the analog domain-Structure of IIR filter: Direct form I, Direct form II, Cascade, Parallel realizations.	
UNIT IV FINITE WORD LENGTH EFFECTS	**9**

Fixed point and floating point number representation-ADC-Quantization-Truncation and rounding - Quantization noise - Input / output quantization - Coefficient quantization error - Product quantization error - Overflow error - Limit cycle oscillations due to product quantization and summation-Scaling to prevent overflow.

UNIT V DSP APPLICATIONS	**9**

Multirate signal processing: Decimation, Interpolation-Sampling rate conversion by a rational factor- Adaptive Filters: Introduction, Applications of adaptive filtering to equalization-DSP Architecture: Fixed and Floating point architecture principles.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, 4th Edition, Pearson Education / Prentice Hall, 2007.

REFERENCES

1. Emmanuel C. Ifeachor and Barrie. W. Jervis, Digital Signal Processing, 2nd Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, Digital Signal Processing – A Computer Based Approach, Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, Digital Signal Processing, Tata Mc Graw Hill, 2006.

Mapping of COs with POs / PSOs

	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	–	2	2	–	–	–	–	–	–	3	3	2
2	3	3	2	-	2	–	–	–	–	–	–	3	3	2
3	3	3	2	2	2	–	–	–	–	–	–	3	3	2
4	2	3	1	2	–	–	–	–	–	–	2	3	3	-
5	3	3	3	2	2	–	–	2	2	–	2	3	2	-
Avg.	**2.8**	**3.0**	**2.0**	**2.0**	**2.0**	**-**	**-**	**2.0**	**2.0**	**-**	**2.0**	**3.0**	**2.8**	**2.0**

EC25404	COMPUTER COMMUNICATION NETWORKS	L	T	P	C
		2	0	2	3

Course Objectives:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks.
- Be exposed to the required functionality at each layer.
- Learn the flow control and congestion control algorithms.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Apply data communication concepts, OSI model, and link layer mechanisms.	**K3**
CO2	Apply MAC protocols, Ethernet, wireless networks, and IPv4 addressing.	**K3**
CO3	Analyze routing algorithms, routing protocols, and IPv4–IPv6 transition.	**K4**
CO4	Analyze TCP/UDP, congestion control, and QoS mechanisms.	**K4**
CO5	Apply application layer protocols and basic network security concepts.	**K3**

UNIT I FUNDAMENTALS ANS LINK LAYER	**6**
Overview of Data Communications-Networks: Building Network and its types-Overview of Internet-Protocol Layering-OSI Model-Physical Layer-Overview of Data and Signals-Introduction to Data Link Layer-Link layer Addressing-Error Detection and Correction.	
UNIT II MEDIA ACCESS AND INTERNETWORKING	**6**
Overview of Data link Control and Media access control-Ethernet (802.3)-Wireless LANs - Available Protocols : Bluetooth, Bluetooth Low Energy, WiFi, 6LowPAN, Zigbee-Network layer services-Packet Switching-IPV4 Address-Network layer protocols (IP, ICMP, Mobile IP).	
UNIT III ROUTING	**6**
Routing-Unicast Routing-Algorithms-Protocols-Multicast Routing and its basics-Overview of Intradomain and interdomain protocols-Overview of IPv6 Addressing-Transition from IPv4 to IPv6.	
UNIT IV TRANSPORT LAYER	**6**
Introduction to Transport layer-Protocols: User Datagram Protocols (UDP) and Transmission Control Protocols (TCP)-Services-Features-TCP Connection-State Transition Diagram-Flow, Error and Congestion Control-Congestion avoidance (DECbit, RED)-QoS-Application requirements.	
UNIT V APPLICATION LAYER	**6**
Application Layer Paradigms-Client Server Programming-World Wide Web and HTTP, DNS-Electronic Mail (SMTP, POP3, IMAP, MIME)-Introduction to Peer to Peer Networks-Need for Cryptography and Network Security-Firewalls.	
	TOTAL : 30 PERIODS

LIST OF EXPERIMENTS: **TOTAL : 30 PERIODS**

1. Implementation of Error Detection / Error Correction Techniques.
2. Implementation of Stop and Wait Protocol and sliding window.
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control.

5. Create scenario and study the performance of network with CSMA / CA protocol and compare with
CSMA/CD protocols.
6. Network Topology - Star, Bus, Ring.
7. Implementation of distance vector routing algorithm.
8. Implementation of Link state routing algorithm.

HARDWARE/SOFTWARE REQUIRED:

HARDWARE

Standalone Desktops.
Standard LAN Trainer Kits.

SOFTWARE

- C / Python / Java / Equivalent Compiler.
- MATLAB/NS2

TEXT BOOK:

1. Forouzan, B. A., Data Communications and Networking with TCP/IP Protocol Suite, 6th Edition, McGraw-Hill Education, 2022.
2. Kurose, J. F., and Ross, K. W., Computer Networking: A Top-Down Approach, 9th Edition, Pearson Education, 2025.

REFERENCES

1. Mir, N. F., Computer and Communication Networks, 2nd Edition, Pearson, 2014.
2. Lin, Y.-D., Hwang, R.-H., and Baker, F., Computer Networks: An Open Source Approach, 1st Edition, McGraw-Hill, 2011
3. Peterson, L. L., and Davie, B. S., Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann, 2011.

Mapping of COs with POs / PSOs

	POs											PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	-	–	–	–	–	–	–	–	3	2	2
2	3	3	-	-	2	–	–	–	–	–	–	3	3	2
3	3	3	2	2	–	–	–	–	–	–	2	3	2	–
4	3	3	2	2	–	–	–	–	–	–	2	3	2	–
5	2	2	2	-	2	2	–	2	2	–	2	3	2	2
Avg.	**2.8**	**2.6**	**2.0**	**2.0**	**2.0**	**20**	**-**	**2.0**	**2.0**	**-**	**2.0**	**3.0**	**2.2**	**2.0**

CY25401	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the basic concepts of environment, ecosystems, and biodiversity, with emphasis on the biodiversity of India and its conservation.
- To impart knowledge of the causes, effects, control, and prevention measures of environmental pollution and natural disasters.
- To facilitate understanding of the global and Indian scenarios of renewable and non-renewable resources, the causes of their degradation, and measures for their conservation.
- To create awareness of sustainable development goals and environmentally responsible practices for sustainable living.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Understand the structure and functions of the environmental ecosystem.	**K2**
CO2	Recognize the types of biodiversity and their conservation.	**K2**
CO3	Identify the causes and effects of environmental pollution and natural disasters, and contribute to preventive measures in society.	**K3**
CO4	Explain major environmental issues and evaluate their impact on society and sustainable development.	**K2**
CO5	Understand the Sustainable Development Goals (SDGs) and their role in promoting sustainable practices.	**K2**

UNIT I – ENVIRONMENTAL ECOSYSTEM	**9**
Environmental studies, Environmental impacts of urbanization, Ecosystem-Food chains and webs-Types, structure and functions of an ecosystem, Energy flow through an ecosystem, Ecological pyramids, Ecological Succession.	
UNIT II – BIODIVERSITY	**9**
Types of biodiversity, Values of biodiversity, India as a mega- diversity nation, Biodiversity Hot-spots, Threats to biodiversity, Endangered and Endemic species of India, Conservation of biodiversity (In- situ and ex-situ)-Man-wild life conflicts.	
UNIT III – ENVIRONMENTAL POLLUTION	**9**
Sources, Effects and Preventive measures of Air, water, soil and noise pollutions, Solid waste, Hazardous waste and E waste management, Pollution Control Board regulations and environmental legislation in India, Role of an individual in prevention of pollution, Pollution case studies.	
UNIT IV – SOCIAL ISSUES AND THE ENVIRONMENT	**9**
Urban problems related to energy, Water conservation, Watershed management, Ozone layer depletion, Global warming and climate change, Green chemistry, Wasteland reclamation, Consumerism and waste generation, Resettlement and rehabilitation of people (case studies), Public awareness.	

UNIT V – SUSTAINABILITY AND PRACTICES	9
From unsustainability to sustainability, Sustainability Development Goals (SDG), Life cycle assessment, Environmental impact assessment, Environmental ethics, Value education, Biogeochemical cycles (Carbon Cycle and Nitrogen Cycle).	
TOTAL: 45 PERIODS	

TEXT BOOKS

1.Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, 1st Edition, New Delhi, 2016.

2.Anubha Kaushik and C. P. Kaushik's, Perspectives in Environmental Studies, 6th Edition, New Age International Publishers 2018.

REFERENCES

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

2.R.K. Trivedi, Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, 38th Edition, 2010.

Mapping of COs with POs / PSOs

	POs											PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	2	–	–	-	–	2	3	–	–	–	–	–	–	–
2	2	–	–	-	–	2	3	–	–	–	–	–	–	–
3	2	2	–	2	–	3	3	2	–	–	–	–	–	2
4	2	3	–	2	–	3	3	2	–	–	2	–	–	2
5	–	2	2	-	–	3	3	2	2	2	3	–	2	2
Avg.	**2.0**	**2.3**	**2.0**	**2.0**	**-**	**2.6**	**3.0**	**2.0**	**2.0**	**2.0**	**2.0**	**–**	**2.0**	**2.0**

EC25405	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB.
- To implement FIR and IIR filters in MATLAB and DSP Processor.
- To study the architecture of DSP processor.
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	Analyze basic discrete-time signals and systems by generating elementary sequences, random signals, and noise, and by interpreting linear and circular convolution results.	**K4**
CO2	Apply frequency domain techniques to compute DFT, auto-correlation, and cross-correlation for real-time signals and interpret spectral characteristics.	**K3**
CO3	Apply window and frequency sampling methods to implement FIR filters (LPF, HPF, BPF, BSF).	**K3**
CO4	Analyze and compare IIR filter implementations (Butterworth and Chebyshev) for various frequency responses by evaluating magnitude and phase characteristics.	**K4**
CO5	Implement DSP processor–oriented operations such as MAC operations, up-sampling, down-sampling, and sampling rate conversion, and analyze their effect on signal quality.	**K3**

LIST OF EXPERIMENTS:

1. Generation of elementary Discrete-Time sequences.
2. Linear and Circular convolutions.
3. Auto correlation and Cross Correlation.
4. Frequency Analysis using DFT.
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation.
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations.
7. Study of architecture of Digital Signal Processor.
8. Perform MAC operation using various addressing modes.
9. Generation of various signals and random noise.
10. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering.
11. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering.
12. Implement an Up-sampling and Down-sampling operation in DSP Processor.

HARDWARE / SOFTWARE REQUIRED:

HARDWARE:

- DSP Trainer Kit.

SOFTWARE:

- MATLAB.
- VI Debugger

TOTAL: 60 PERIODS

Mapping of COs with POs / PSOs														
	POs											PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	–	2	2	–	–	2	2	–	–	3	2	2
2	3	3	1	2	2	–	–	2	2	–	–	3	2	2
3	3	3	2	2	3	–	–	2	2	–	–	3	3	-
4	3	3	2	3	2	–	–	2	2	–	2	3	2	-
5	3	3	3	2	3	–	–	2	2	2	2	3	3	2
Avg.	**3.0**	**3.0**	**2.0**	**2.2**	**2.4**	**-**	**-**	**2.0**	**2.0**	**2.0**	**2.0**	**3.0**	**2.4**	**2.0**

EC25406	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:	• To gain hands on experience in designing electronic circuits. • To learn simulation software used in circuit design. • To learn the fundamental principles of amplifier circuits. • To differentiate feedback amplifiers and oscillators. • To differentiate the operation of various multivibrators.

Course Outcomes The students will be able to		**Knowledge Level**
CO1	• Analyze the operation of inverting, non-inverting, and differential amplifiers.	**K4**
CO2	• Apply circuit principles to implement oscillators, wave-shaping circuits, and multivibrators.	**K3**
CO3	• Simulate feedback amplifiers, oscillators, and filters using SPICE/ Multisim tools.	**K3**
CO4	• Apply operational amplifier configurations to realize oscillators, amplifiers, and D-A converters.	**K3**
CO5	• Implement op-amp-based filters and measure their frequency response.	**K3**

LIST OF EXPERIMENTS:

DESIGN AND ANALYSIS

1. Inverting, non-inverting and differential amplifiers.
2. RC and LC Oscillator using Op-Amp.
3. RC Integrator and Differentiator circuits using Op-Amp.
4. Clippers and Clampers.
5. Instrumentation amplifier.
6. Active low-pass, High pass and Band pass filters.
7. PLL Characteristics and its use as frequency multiplier, clock synchronization.
8. R-2R ladder type D-A converter using Op-Amp.

DESIGN AND SIMULATION

1. Tuned Collector Oscillator and Twin -T Oscillator using transistors.
2. Bistable Multivibrator using transistors.
3. Schmitt Trigger circuit with Predictable hysteresis using transistors.
4. Power amplifier using transistors.

HARDWARE / SOFTWARE REQUIRED:

HARDWARE:

- Op-Amps, Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, and Transformers.

SOFTWARE:

- SPICE/ Multisim.

TOTAL: 60 PERIODS

Mapping of COs with POs / PSOs														
	POs											PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	1	2	2	–	–	2	2	–	–	3	2	-
2	3	3	2	2	2	–	–	2	2	–	–	3	2	2
3	2	2	-	3	3	–	–	2	2	2	2	3	3	1
4	3	3	3	2	2	–	–	2	2	–	2	3	2	2
5	3	3	2	3	2	–	–	2	2	–	–	3	3	2
Avg.	**2.8**	**2.8**	**2.0**	**2.4**	**2.2**	**-**	**-**	**2.0**	**2.0**	**2.0**	**2.0**	**3.0**	**2.4**	**1.8**