Loyola-ICAM

College of Engineering and Technology (LICET)

(Autonomous)

Loyola Campus, Nungambakkam, Chennai – 600 034

Curriculum and Syllabi (R-2024)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Loyola-ICAM
College of Engineering and Technology (LICET)
(Autonomous)

CURRICULUM AND SYLLABI (R-2024)

CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Vision of the Institution:

- To form responsible engineers, who would engineer a just society.

Mission of the Institution:

- To provide technical education in a Christian atmosphere to deserving students who are economically poor and socially marginalized.
- To train young men and women of quality to be leaders in all walks of life and serve their fellow men with justice, truth and love.
- To implement teaching learning processes that ensure guidance and mentoring for students throughout their period of study.
- To provide higher education through academic collaboration and pursue research in the international perspective of Engineering.

Vision of the Department:

- To facilitate the transformation of students into globally competent and socially committed engineers, innovators and entrepreneurs.

Mission of the Department:

M1: To develop skilled electronics engineers for providing innovative solutions through effective teaching learning practices.

M2: To inculcate ethical values, integrity, leadership qualities, and creativity to build entrepreneurial skills.

M3: To provide a holistic environment for the development of intellectual, social and personal abilities.

M4: To develop a centre of excellence in VLSI and Embedded system design.

M5: To provide international exposure to students through collaboration with universities abroad.

Programme Educational Objectives:

Graduates will be able to,

PEO1: Apply the acquired mathematical, scientific and engineering skills to meet the growing challenges of the industry, pursue higher education, and research.

PEO2: Provide solutions to contemporary engineering problems in the fields of Electronics and Communication engineering by employing modern techniques and tools.

PEO3: Exhibit leadership skills and work as team to provide solutions that address the societal, global, and environmental issues.

PEO4: Engage in lifelong learning and adapt to trending technologies for sustained career advancement.

Programme Outcomes:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

Programme Specific Outcomes:

PSO1: Identify, analyze and design Electronics and Communication systems for providing solutions to societal problems by applying core engineering principles.

PSO2: Ideate and formulate solutions for engineering problems in real-time computing and embedded systems by adapting emerging technologies.

Loyola-ICAM
College of Engineering and Technology (LICET)
(Autonomous)
CURRICULUM AND SYLLABI (R-2024)

CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER – I

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1	MA24101	Calculus for Engineers	BSC	3	1	0	4	4
2	BE24103	Basic Electrical and Instrumentation Engineering	ESC	3	0	0	3	3
3	HS24101	English for Professional Communication	HSMC	3	0	0	3	3
4	PH24102	Engineering Physics	BSC	3	0	0	3	3
5	GE24101	Heritage of Tamils / தமிழர் மரபு	HSMC	1	0	0	1	1
Laboratory Integrated Theory Courses								
6	GE24111	Engineering Graphics	ESC	2	0	4	6	4
Laboratory Courses								
7	GE24122	Engineering Practices Laboratory - Electrical and Electronics	ESC	0	0	2	2	1
8	PH24121	Physics Laboratory	BSC	0	0	2	2	1
Formation Courses								
9	GE24123	Design Thinking[$]	HSMC	0	0	2	2	1
10	FC24102	Cultural Identities and Globalization	HSMC	2	0	0	2	0
Total				**17**	**1**	**10**	**28**	**21**

[$] Skill based courses

SEMESTER – II

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1	MA24202	Laplace Transforms and Complex Variables	BSC	3	1	0	4	4
2	CY24201	Chemistry for Electronic Engineering	BSC	3	0	0	3	3
3	EC24201	C Programming and Data Structures	PCC	3	0	0	3	3
4	GE24201	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1	1
Laboratory Integrated Theory Courses								
5	EC24211	Circuit Analysis	PCC	3	0	2	5	4
Laboratory Courses								
6	CY24121	Engineering Chemistry Laboratory	BSC	0	0	2	2	1
7	EC24221	C Programming and Data Structures Laboratory	PCC	0	0	2	2	1
8	GE24121	Engineering Practices Laboratory - Civil & Mechanical	ESC	0	0	2	2	1
Formation Courses								
9	FC24101	Life Skills[$]	HSMC	2	0	0	2	1
Total				**15**	**1**	**8**	**24**	**19**

[$] Skill based courses

SEMESTER – III

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1	EC24301	Signals and Systems	PCC	3	1	0	4	4
2	MA24303	Probability and Random Processes	BSC	3	1	0	4	4
3	EC24302	Electronic Circuits	PCC	3	0	0	3	3
4	EC24303	Theory and Design of Control Systems	PCC	3	0	0	3	3
Laboratory Integrated Theory Courses								
5	EC24311	Digital System Design	PCC	3	0	2	5	4
6	GE24112	Problem Solving using Python	ESC	2	0	4	6	4
Laboratory Courses								
7	EC24321	Devices and Circuits Laboratory	PCC	0	0	4	4	2
Formation Courses								
8	HS24321	Communication Skills Building Laboratory[$]	BSC	0	0	2	2	1
9	BS24321	System Discovery and Analysis	HSMC	0	0	2	2	0
Total				**14**	**1**	**14**	**29**	**25**

[$] Skill based courses

SEMESTER – IV

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1	BS24301	Environmental Science and Sustainability	BSC	3	0	0	3	3
2	EC24401	Communication Theory	PCC	3	0	0	3	3
3	EC24402	Electromagnetic Fields and Waves	PCC	3	0	0	3	3
Laboratory Integrated Theory Courses								
4	EC24411	Digital Signal Processing	PCC	3	0	2	5	4
5	EC24412	Linear Integrated Circuits	PCC	3	0	2	5	4
6	CS24414	Object-Oriented Programming	ESC	2	0	2	4	3
Formation Courses								
7	EC24422	Project Driven Learning[$]	EEC	0	0	2	2	1
8	FC24301	Soft Skills[$]	HSMC	2	0	0	2	1
Total				**19**	**0**	**12**	**31**	**22**

[$] Skill based courses

Foreign language courses to be completed by the end of IV semester.

SEMESTER – V

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1	EC24501	Digital Communication	PCC	3	0	0	3	3
2	EC24502	Transmission Lines and RF Systems	PCC	3	0	0	3	3
3		Professional Elective – I	PEC	3	0	0	3	3
Laboratory Integrated Theory Courses								
4	EC24511	VLSI and Chip Design	PCC	3	0	2	5	4
5	EC24512	Computer Networks	PCC	3	0	2	5	4
6	EC24513	Microprocessors and Microcontrollers	PCC	2	0	2	4	3
Laboratory Courses								
7	EC24521	Communication Systems Laboratory	PCC	0	0	4	4	2
8	EC24522	Mini Project	EEC	0	0	2	2	1
Formation Courses								
9	FC24501	Universal Human Values and Service Learning[$]	HSMC	1	0	1*	1	1
10	BS24502	Logical Reasoning and Aptitude Training	BSC	2	0	0	2	1[#]
Total				**19**	**0**	**15**	**33**	**24**

[$] Skill based courses

[#] Not included for GPA calculation

***** Activities on non-working days/hours

SEMESTER – VI

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1		Open Elective – I	OEC	3			3	3
2		Professional Elective – II	PEC	3			3	3
3		Professional Elective – III	PEC	3			3	3
4		Professional Elective – IV	PEC	3			3	3
5	GE24501	Project Management and Operations Management	HSMC	2	0	0	2	2
6	GE24502	Entrepreneurship and International Business Market	HSMC	2	0	0	2	2
Laboratory Integrated Theory Courses								
7	EC24611	Embedded Real Time Systems with ARM	PCC	3	0	2	5	4
8	CS24611	Fundamentals of ML and AI	ESC	2	0	2	4	3
Formation Courses								
9	GE24621	Interdisciplinary Project[$]	EEC	0	0	2	2	1
10	GE24622	Problem Solving Techniques	EEC	0	0	2	2	1[#]
11	GE24503	Financial Literacy	HSMC	2	0	0	2	0
Total				**21**	**0**	**6**	**27**	**24**

[$] Skill based courses

[#] Not included for GPA calculation

SEMESTER – VII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Theory Courses								
1		Open elective – II	OEC	3			3	3
2		Open Elective – III	OEC	3			3	3
3		Professional Elective – V	PEC	3			3	3
4		Professional Elective – VI	PEC	3			3	3
5	GE24701	Working to Engineer a Better World	HSMC	2	0	0	2	2
6		Audit Course	HSMC	2	0	0	2	0
Laboratory Integrated Theory Courses								
7	EC24711	Antennas and Microwave Engineering	PCC	3	0	2	5	4
Laboratory Courses								
8	EC24721	Professional Project – I	EEC	1	0	2	3	2
Formation Courses								
9	EC24722	Internship[$]	EEC	0	0	0	0	2
Total				**20**	**0**	**4**	**24**	**22**

[$] Skill Based Courses

SEMESTER – VIII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
Laboratory Courses								
1	EC24821	Professional Project – II	EEC	0	0	20	20	10
Total				**0**	**0**	**20**	**20**	**10**

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Communication Engineering	Signal Processing	RF Technologies	Semiconductor chip design and testing	Embedded and IoT	Biomedical and Robotics	Diversified
Optical Communication	Advanced Digital signal processing	Electromagnetic Interference and compatibility in electronic systems	Low Power IC design	Embedded C Programming	Biomedical Measurements and Instrumentation	Bio-inspired Computing
Wireless communication	Image Processing	Passive RF and Microwave Integrated Circuits	VLSI Testing & Design for Testability	Real Time Operating Systems	Medical Imaging Systems	Big data analytics
4G/5G/6G communication	Machine learning for signal processing	Electronic warfare	CMOS Analog IC Design	IoT Processors	MEMS Design	Database management systems
Satellite Communication	Computer Vision	Advanced Antennas	Mixed Signal IC	Wireless sensor network design	Sensors and Actuators	Cyber Security
Software Defined Radio	Speech Processing	Radar Technologies	SoC Design	IoT Based System Design	Robotics and automation	Devops
Ad Hoc Networks	Natural language processing	RF Microelectronics	VLSI Signal Processing	Industry 4.0 & Industrial IoT	Concepts in Mobile Robots	Electric vehicle technology

MA24101	Calculus for Engineers	BSC	L	T	P	C
			3	1	0	4

Course Objectives:

- To develop the usage of matrix algebra techniques and its applications, which are essential for engineers.
- To provide the students with the rules of differentiation.
- To impart the students with the concepts of functions of several variables.
- To make the students understand various techniques of integration.
- To acquaint the students with mathematical knowledge in evaluating multiple integrals and their applications.

UNIT I TRANSFORMATIONS 12

Stretching of an elastic membrane - eigenvalues and eigenvectors of a real matrix – properties – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms - Cayley Hamilton Theorem

UNIT II DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Parametric differentiation- Maxima and Minima of functions of single variable

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Total derivative – Partial differentiation of implicit functions – Jacobians – Taylor's series – Maxima and Minima of a function of two variables - Method of Lagrangian Multipliers - Evaluating extremum of single and two variable functions.

UNIT IV INTEGRAL CALCULUS 12

Techniques of Integration: Substitution rule, Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Moments and center of mass.

UNIT V MULTIPLE INTEGRALS 12

Double integrals in cartesian and polar coordinates – Area enclosed by plane curves - Change of order of integration – Change of variables in double integrals - Triple integrals in cartesian coordinates – Volume of solids - Change of variables from Cartesian to Spherical polar coordinates and Cylindrical polar coordinates.

Total Periods:60

Course Outcomes:

On completion of the course, the students will be able to

CO1: To identify the eigenvalues and eigenvectors of a matrix and to execute diagonalization.
CO2: Identify the limit of functions and apply the rules of differentiation to differentiate functions.
CO3: Apply differentiation to functions of several variables
CO4: Evaluate extreme values of functions
CO5: Evaluate integrals using various techniques of integration
CO6: Evaluate multiple integrals in various coordinate systems and applications of multiple integrals.

Suggested Activities:

- Evaluation of eigenvalues and eigenvectors using scientific tool
- Plotting and visualizing curves, and extreme values using a scientific tool 3. Plotting and visualizing surfaces, and extreme values using a scientific tool
- Evaluation of line integrals using scientific tool
- Evaluation of multiple integrals using a scientific tool
- Visualizing 2D and 3D functions using GeoGebra and Desmos

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, " Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.

References:

1. Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
2. Bali.N., Goyal.M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009. 3.
3. Jain.R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
5. Kuldeep Singh, "Engineering Mathematics Through Applications", 2nd Edition, Bloomsbury Academic.
6. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.
7. Amos Gilat, "MATLAB: An Introduction with Applications", 4th Edition, John Wiley.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	2	-	-	-	-	-	2	1	-
CO2	3	2	1	1	2	-	-	-	-	-	2	1	-
CO3	3	2	1	1	2	-	-	-	-	-	2	1	-
CO4	3	2	1	1	2	-	-	-	-	-	2	1	-
CO5	3	2	1	1	2	-	-	-	-	-	2	1	-
CO6	3	2	1	1	2	-	-	-	-	-	2	1	-
Avg.	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**

BE24103 Basic Electrical and Instrumentation Engineering ESC L T P C

3 0 0 3

Course Objectives:

- To familiarize the important laws of electromagnetism
- To understand the construction and working principle of Transformer and DC motors.
- To impart knowledge in basic solid-state devices.
- To understand different types of instruments, characteristics, and calibration.
- To familiarize different types of transducers and their working principle.

UNIT I BASIC CONCEPTS, LAWS AND PRINCIPLES 9

Electric Field and Magnetic Field, Electromagnetism and Electromagnetic Induction, Laws of Electromagnetic Induction, Induced EMF in a Coil Rotating in a Magnetic Field, EMF Induced in a Conductor, Dynamically Induced EMF and Statically Induced EMF, Self-induced EMF and Mutually Induced EMF, Self-inductance of a Coil, Mutual Inductance.

UNIT II ELECTRICAL MACHINES 9

Transformers: Basic principle and constructional details, Circuit Parameters and Equivalent Circuit, EMF Equation, Voltage Regulation, Ideal transformer, Efficiency. DC Motor: Working Principle, Changing the direction of Rotation, Energy Conversion Equation, Torque Equation, Starting a DC Motor. Applications of Stepper Motor, Servo Motor.

UNIT III SOLID STATE DEVICES 9

Semiconductor Devices: Introduction, Review of Atomic Theory, Binding Forces Between Atoms in Semiconductor Materials. Extrinsic Semiconductors, Semiconductor Diodes, Zener Diode, Bipolar Junction Transistors, Field Effect Transistors, MOSFET, Silicon-controlled Rectifier, DIAC, TRIAC, Optoelectronic Devices: Light-dependent Resistor, Light-emitting Diodes, Liquid Crystal Displays, Phototransistors

UNIT IV MEASUREMENT AND INSTRUMENTATION 9

Analog and Digital Instruments, Passive and Active Instruments, Static Characteristics of Instruments, Linear and Nonlinear Systems, Dynamic Characteristics of Instruments, Classification of the Instrument System, Measurement Error. Calibration of Instruments. Measurement of Power, Instrument Transformers, Multimeter, and Measurement of Resistance.

UNIT V TRANSDUCERS 9

Transducers: Classification of Transducers, Characteristics of a Transducer, Linear Variable Differential Transformer, Capacitive Transducers, Inductive Transducers, Potentiometric Transducer, Strain Gauge Transducer, Thermistors, Thermocouples, Hall Effect Transducers, Piezoelectric Transducer, Photoelectric Transducer, Selection of Transducers.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Illustrate and interpret the significance of laws of electromagnetism.
CO2: Explain the main components and working principles of Transformers and DC motors.
CO3: Identify and describe the function of basic solid-state devices such as diodes, and transistors.
CO4: Identify various measuring instruments and interpret calibration data to ensure accurate measurements.
CO5: Identify and describe various types of transducers and their operating principles.

Suggested Activities:

- Simulation study using virtual Labs
- Problems based on design
- Problem solving using transducers

Text Books:

1. Bhattacharya, S. K. (2011). *Basic Electrical Engineering*. Pearson.
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, 2015

References:

1. Hughes, E., Hiley, J., Brown, K., & Smith, I. M. (2008). *Hughes Electrical and Electronic Technology*. Pearson/Prentice Hall.
2. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International pvt.ltd.,2003
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	1	-	-	-	-	-	-	-	-	1	-
CO2	2	1	1	1	-	-	-	-	-	-	-	1	-
CO3	2	-	1	1	-	-	-	-	-	-	-	2	-
CO4	1	1	1	2	-	-	-	-	-	-	-	1	-
CO5	2	1	1	2	-	-	-	-	-	-	-	2	1
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	**1.8**	**0.6**	**1**	**1.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.4**	**0.2**

HS24101 English for Professional Communication HSMC L T P C

3 0 0 3

Course Objectives:

- To develop effective listening, speaking, reading, and writing skills for professional contexts.
- To cultivate formal correspondence skills for workplace communication.
- To analyze and apply rhetorical techniques in writing and speaking.
- To encourage self-expression through storytelling and reflective writing.
- To strengthen grammar and vocabulary for improved language proficiency.

UNIT I COMMUNICATION BASICS 9

Listening - Link verbal and nonverbal cues and listen to podcasts and news stories. Reading - Read brochures and running headlines. Social media messages and electronic correspondence relevant to professional advancement
Writing - Formal letters
Speaking - Self-introduction - Dialogues and role plays, discussing news stories, asking doubts (clarification, direction, inquiring details…)
Grammar - Noun, Pronoun, Articles
Vocabulary - one-word substitution, phrasal verbs

UNIT II PROFESSIONAL CORRESPONDENCE 9

Listening - Listen to voicemails, presentations, and panel discussions
Reading - MoM - minutes of the meeting, memos, business and economic articles
Writing - Respond to Business Emails
Speaking - Inaugural speech, Vote of thanks, and mini-presentation
Grammar - Verb, concord, wh questions, and Yes/no, question tag
Vocabulary - Word forms (Prefix & suffix)

UNIT III RHETORIC COMMUNICATION 9

Listening - Monologue from plays and movies, and sale pitches (marketing and promotions)
Reading - Looking for ambiguity - Ethos, pathos, and logos (poem or play)
Writing - Essays - problem solution, cause and effect essay
Speaking - Deliver a monologue - situational scenarios
Grammar - Conjunctions, prepositions, interjections
Vocabulary - Discourse markers for contextual essays, idioms, and phrases

UNIT IV EXTENDED NARRATION 9

Listening - Listen to documentaries, debates, discussions, and Toastmasters speech
Reading - Read professional resumes, LinkedIn profiles, newsletter
Writing - Blog writing, writing reviews
Speaking - Debate, group discussion
Grammar - Mixed tenses, Adverb
Vocabulary - Compound words, Collocation

UNIT V LANGUAGE AND SELF 9

Listening - Listen to tone, mood, and attitude. Find meanings based on the context, and listen to different accents.
Reading - An excerpt from an autobiography
Writing - Reflective journal and diary entries
Speaking - Narrate stories from personal experience
Grammar - Adjective, direct, and indirect speech
Vocabulary - Contextual meaning of words, Abbreviations, and acronyms

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Demonstrate enhanced listening, speaking, reading, and writing skills tailored for professional environments.
CO2: Compose clear formal emails and letters for workplace communication.
CO3: Analyze and use rhetorical techniques to engage and persuade audiences.
CO4: Develop storytelling and reflective writing skills to share personal experiences.
CO5: Improve grammar and vocabulary for effective communication.
CO6: Foster teamwork and discussion abilities through debates and group presentations.

Suggested Activities:

- Take a set of 15 messages and classify them into spam, alerts, scams, discount texts, news, cautionary, personnel, and informative.
- Reflective journal - write your own personal and learning experience so far at LICET. Page limit: 3 pages.

- Rhetoric Writing - Find a product or create a product and employ ethos, pathos, and logos to persuade the customers to buy your product. Write in 250 words.
- Creative writing - Create your account on Blogger and write reviews, articles, and stories.

Text Books:

1. English for Engineers and Technologists. Volume I by Orient Blackswan, 2022
2. English for Science & Technology - I by Cambridge University Press, 2023

References:

1. Interchange. Cambridge University Press. USA, 2022.
2. Embark. Cambridge University Press. USA, 2016.
3. A course in Technical English. Cambridge University Press. USA, 2023.
4. High School English Grammar & Composition. Wren & Martin's Regular & Multicolour Edition. S.Chand Publishing, 2016.
5. Interchange by Jack C. Richards, Fifth Edition, Cambridge University Press, 2017.
6. English for Academic Correspondence and Socializing. Adrian Wallwork, Springer, 2011.
7. The Study Skills Handbook. Stella Cortrell, Red Globe Press, 2019
8. www.uefap.com

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	1	1	3	-	2	3	-	3	-	1
CO2	-	-	-	1	1	3	-	2	3	-	3	-	1
CO3	-	-	-	1	1	3	-	3	3	1	3	-	1
CO4	-	-	-	1	1	3	1	1	1	2	3	-	1
CO5	-	-	-	1	1	3	-	2	3	-	3	-	1
CO6	-	-	-	1	1	3	-	3	3	1	3	-	1
Avg.	-	-	-	1	1	3	1	2.1	2.6	1.3	3	-	1

PH24102 Engineering Physics **BSC** **L T P C**

3 0 0 3

Course Objectives:

- To make the students understand the basics of crystallography and its importance in studying materials properties.
- To instill knowledge of oscillations and waves and make them able to apply this knowledge in engineering situations.
- To establish a sound grasp of foundational principles of quantum mechanics and enable them to perform basic quantum mechanical calculations.
- To introduce the basics principles of photonics and fibre optic communication to students
- To make students understand the applications of quantum mechanics in solid-state physics to decipher the electrical properties of materials.

UNIT I CRYSTAL PHYSICS 9

Crystal structures: Crystal lattice – basis - unit cell and lattice parameters – crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic & HCP systems– crystal planes, directions and Miller indices – distance between successive planes - imperfections in crystals-classification of defects.

UNIT II OSCILLATIONS AND WAVES 9

Simple harmonic motion - Torsional pendulum – Damped oscillations –Shock Absorber - Forced oscillations and Resonance (qualitative)–Applications of resonance - Electrical analogy of mechanical oscillators - waves on a string - progressive waves - stationary waves- Energy transfer of a wave.

UNIT III QUANTUM MECHANICS 9

Black body radiation – Planck's hypothesis and black body radiation formula (qualitative)- Wave-particle duality– de Broglie hypothesis– Uncertainty Principle – The Schrodinger Wave equation (time-dependent and time-independent) – Physical interpretation of wave function - Normalization - Particle in an infinite potential well - Energy values and wavefunctions Quantum mechanical tunneling. Scanning tunneling microscope.

UNIT IV PHOTONICS AND FIBRE OPTICS 9

Laser – characteristics – Spontaneous and Stimulated emission-Einstein's coefficients - population inversion - Metastable states - Basic components of a laser system - CO2 laser, Semiconductor laser - Industrial and medical applications - Optical Fibres – Total internal reflection – Numerical aperture and acceptance angle – Fibres optic communication system.

UNIT V QUANTUM THEORY OF SOLIDS 9

Particle in a three-dimensional box - Degenerate energy states. Electrons in metals - Classical free electron theory-quantum free electron theory Fermi- Dirac statistics – Density of energy states. Fermi energy and free electron density. Drawbacks of quantum free electron theory- Electrons in a periodic potential- Kronig-Penney Model (qualitative) -Band theory. Classification of solids based on energy band structure.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Describe the structural properties of semiconducting materials possessing cubic structure.
CO2: Estimate the vibrational stability of an engineering system which employs periodic motion.
CO3: Calculate basic measurable quantities of simple quantum mechanical models.
CO4: Apply the characteristics of lasers for material processing and in the medical field.
CO5: Outline the operational principle of fiber optic communication systems.
CO6: Apply quantum mechanical principles towards the formation of energy bands.

Text Books:

1. Avadhanulu M N, Kshirsagar P G, "A Textbook of Engineering Physics", S Chand & Co Ltd, Ninth Revised Edition, 2012.
2. Hitendra K Malik, A K Singh " Engineering Physics McGraw Hill Education; Second edition, 2017.
3. Gaur R K, Gupta S L, "Engineering Physics", Dhanpat Rai Publishers, 2012.

References:

1. Serway R A, Jewett J W, “Physics for Scientists and Engineers”, Cengage Learning, 2010.
2. Halliday D, Resnick R, Walker J, “Principles of Physics”, Wiley, 2015.
3. V. Raghavan, Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015.
4. S.O.Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 20181.
5. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.

MAPPING OF COs WITH POs AND PSOs

COs	Pos											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	1	1	1
CO2	2	2	1	1	-	-	-	-	-	-	1	1	1
CO3	2	1	1	1	-	-	-	-	-	-	1	1	1
CO4	2	1	1	1	-	-	-	-	-	-	1	1	1
CO5	2	2	1	1	-	-	-	-	-	-	1	1	1
CO6	2	2	1	1	-	-	-	-	-	-	1	1	1
Avg.	**2**	**1.66**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**

GE24101 HERITAGE OF TAMILS / தமிழர் மரபு HSMC L T P C

1 0 0 1

Course Objectives:

- Provide an insight to the students into the rich culture and heritage of the state
- Provide the students with detailed information on the engineering techniques to construct architectural marvels practiced in Tamil Nadu
- Make the students connect with their roots, appreciate, and preserve it.

UNIT I / அலகு I LANGUAGE AND LITERATURE / மொழி மற்றும் இலக்கியம் 3

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

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

UNIT II / அலகு II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE / மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை**	**3**

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

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

UNIT III / அலகு III	**FOLK AND MARTIAL ARTS / நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**	**3**

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

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தொல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

UNIT IV / அலகு IV	**THINAI CONCEPT OF TAMILS / தமிழர்களின் திணைக் கோட்பாடுகள்**	**3**

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

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

UNIT V / அலகு V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE / இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குக் தமிழர்களின் பங்களிப்பு**	**3**

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

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total Periods:15

Course Outcomes:

On completion of the course, the students will be able to

CO1: Understand the human values and rights in Tamil literature
CO2: Learn the art and culture being practiced by the people of Tamil Nadu
CO3: Understand various games and dance practices by the people of Tamil Nadu
CO4: Understand the Tamil Culture and Customs through Folklore
CO5: Learn the concepts of Sangam Literature and the bravery of Kings
CO6: Learn the life history of freedom fighters Vedic herbs and developments in lifestyle

Text Cum Reference Books

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

GE24111	ENGINEERING GRAPHICS	ESC	L	T	P	C
			2	0	4	4

Course Objectives:

- To draw engineering curves and freehand sketch of simple objects.
- To draw orthographic projection of solids and sections of solids.
- To draw development of solids
- To draw isometric and perspective projections of simple solids.

CONVENTIONS AND GEOMETRIC CONSTRUCTION (Not for examinations) **1**

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING **6+11**

Basic curves used in engineering practices: Construction of conic sections by eccentricity method - Construction of cycloidal curves - Construction of involutes of square and circle - Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles - Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE **6+11**

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

UNIT III PROJECTION OF SOLIDS 6+12

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

UNIT IV SECTION AND DEVELOPMENT OF SOLIDS 6+12

Sectioning of simple solids like prisms, pyramids, cylinders, and cone in a simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection - isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only, Not for Exam) 3

The Concepts of Computer Aided Drafting for Engineering drawing, Computer graphics & Geometrical modelling (2D Orthographic Views) and 3D drafting (Isometric Views) using design software.

Total Periods: 90

Course Outcomes:

On completion of the course, the students will be able to

CO1: Construct the conic curves, involutes and cycloids.
CO2: Visualize and construct multiple views of solid.
CO3: Solve practical problems involving projection of lines and planes.
CO4: Draw the projection of simple solids.
CO5: Draw the sectional views of simple solids, obtain true shape and develop sectioned solids.
CO6: Draw the isometric and perspective projections of simple solids.

Text Books:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Jayapoovan T, "Engineering Graphics using AUTOCAD", Vikas Publishing ,7 th Edition.
3. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

References:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS10711 — 2001: Technical products Documentation — Size and layout of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation —Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
4. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to Semester End Examinations on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	2	-	2	-	-	-	2	-	2	-	-
CO2	3	1	2	-	2	-	-	-	2	-	2	-	-
CO3	3	1	2	-	2	-	-	-	2	-	2	-	-
CO4	3	1	2	-	2	-	-	-	2	-	2	-	-
CO5	3	1	2	-	2	-	-	-	2	-	2	-	-
CO6	3	1	2	-	2	-	-	-	2	-	2	-	-
Avg.	**3**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**

GE24122 Engineering Practices Laboratory - Electrical and Electronics ESC L T P C

0 0 2 1

Course Objectives:

- To learn the basics of electronic components.
- To understand the internal structure and working of the measuring instruments.
- To construct a prototype circuit on a breadboard and verify.
- To understand the process behind the PCB fabrication.
- To introduce the functionality of various electrical components namely switches, fuse, and meters to perform wiring various electrical joints in common household electrical wire work.
- To introduce the methods for measuring electrical quantities

LIST OF EXPERIMENTS:

Electrical

1. Introduction to Electrical Components switches, fuses, indicators, and lamps
2. Basic switchboard wiring with lamp, fan, three-pin socket, and energy meter
3. Staircase wiring
4. Fluorescent Lamp wiring with introduction to CFL and LED types
5. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit

Electronics

1. Study of electronic components resistor, capacitor, inductor, transistor and diode.
2. Introduction to CRO, DSO, MSO, FG and their working principles.
3. Circuit prototyping and verification.
4. Build a printed circuit board and verify the desired output.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify and describe the function of various electronic components, leading to successful application in circuit design.
CO2: Accurately interpret and apply measurement data in practical scenarios.
CO3: Build a prototype of a circuit and validate its output.
CO4: Gain knowledge of PCB fabrication processes, including design, etching, and assembly.
CO5: Understand the working of electrical switches, measuring instruments, and wiring layouts used in domestic applications and carry out basic electrical wiring work.
CO6: Comprehend the concepts of current, voltage, power, and power factor using various measuring instruments

Laboratory Requirements:

S. No.	Description of equipment	Required numbers (for a batch of 30 students)
1.	Resistors, Capacitors, Inductors – sufficient quantities, Bread Boards	15 nos.
2.	CRO, MSO, DSO, FG, Power Supply	5 Nos.
3.	PCB etching kit (Ferric Chloride, Drilling machine, Layout design)	15 kits
4.	Soldering iron, paste, lead, desoldering pump	15 nos. each
5.	Single-way switch, Two-way switch, fuses, indicators, 230 V -60W incandescent lamp	5 nos each
6.	Basic switchboard wiring kit and Energy meter	5 nos each
7.	Staircase wiring kit	5 nos each
8.	Fluorescent Lamp wiring kit, CFL, and LED lamps	5 nos each
9.	1φ Auto Transformer, Voltmeter, Ammeter, Rheostat, Capacitor, Choke	5 nos each
10.	Multimeters	6 nos

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	1	1	2	1	2	1	-	-	1	1
CO2	2	1	1	2	1	-	-	2	1	-	-	1	1
CO3	2	1	1	1	1	-	-	2	1	-	-	1	1
CO4	2	1	1	1	1	-	-	2	1	-	-	1	1
CO5	2	1	1	1	1	-	1	2	1	-	-	-	1
CO6	2	1	1	2	1	2	-	2	1	-	-	-	1
Avg.	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**-**	**-**	**1**	**1**

PH24121 Physics Laboratory **BSC** **L T P C**

0 0 2 1

Course Objectives:

- To learn the measurements of various elastic moduli of materials
- To learn determination of thermal properties of materials.
- To study different optical phenomena involving ordinary light.
- To measure the characteristic properties of lasers.
- To understand the characteristics of oscillatory motion.
- To learn measurement of rigid body moment of inertia.

LIST OF EXPERIMENTS:

1. Non-uniform bending - Determination of Young's modulus
2. Uniform bending – Determination of Young's modulus
3. Lee's Disc Experiment - Determination of thermal conductivity of bad conductors.
4. Torsional pendulum - Determination moment of inertia of regular and irregular objects.
5. Simple harmonic oscillations of cantilever
6. Ultrasonic interferometer – determination of sound velocity and liquids compressibility
7. Viscosity of Liquids
8. Air wedge - Determination of thickness of a thin sheet/wire
9. Optical fibre -Determination of Numerical Aperture and acceptance angle
10. Spectrometer-Determination of the wavelength of light using grating
11. (a) Laser- Determination of the wavelength of the laser using grating
    (b) Compact disc- Determination of width of the groove using laser.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Determine various moduli of elasticity of materials
CO2: Determine thermal properties of solids
CO3: Analyze various optical phenomena involving ordinary light.
CO4: Determine the characteristic properties of lasers.
CO5: Measure characteristic properties of systems executing oscillatory motion.
CO6: Determine the moment of inertia of rigid bodies

References:

1. Engineering Physics Practicals by Dr. P. Mani, Dhanam Publications, 2023
2. Practical Physics by Gordon L Squires, Cambridge University Press; 4th edition, 2001

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	3	-	-	-	2	-	-	1	1	-
CO2	2	2	1	3	-	-	-	2	-	-	1	1	-
CO3	2	2	1	3	-	-	-	2	-	-	1	1	-
CO4	2	2	1	3	-	-	-	2	-	-	1	1	-
CO5	2	2	1	3	-	-	-	2	-	-	1	-	-
CO6	2	2	1	3	-	-	-	2	-	-	1	1	-
AVG	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**1**	**-**

GE24123	Design Thinking	HSMC	L	T	P	C
			0	0	2	1

Course Objectives:

- Students will understand the different learning methodologies
- Students will learn the art of observation and visualization
- Students will understand the need for empathy in problem-solving
- Students will learn how to work in a team
- Students will learn to use different design thinking tools to solve problems

Module 1	An Insight to Learning: Understanding the Learning Process and Kolb's Learning Styles	2
Module 2	Journey of my life: Visualization and Wheel of Life. Introduction to project	4
Module 3	Observation: Listening vs hearing, Beyond observations and Mind maps	2
Module 4	Teamwork: Divergent thinking and Brainstorming	2
Module 5	Customer Journey: Journey mapping	2
Module 6	Conflict management: Balancing priorities, Reacting and Responding, Constraints to opportunities	2
Module 7	Empathy: Persona and Empathy map	2
Module 8	Design Thinking Model: 5-step process: Empathize, define, ideate, prototype, and scale	2
Module 9	Appreciation: The wonder of recognition, Articulation and Influence	2
Module 10	Project presentation	10

Total Periods:30

Course Outcomes:
On completion of the course, the students will be able to

CO1: To understand various learning processes and stages
CO2: To observe and visualize different scenarios
CO3: To empathize with a customer
CO4: To develop a journey map based on experiences
CO5: To understand the art of conflict management
CO6: To use design thinking as a tool to solve problems

Suggested Activities:
Solve real-life problems using Design Thinking

Text Books:

1. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Pavan Soni, Penguin Random House India, Pvt. Ltd. 2020
2. Developing Thinking Skills (The Way to Success), E. Balagurusamy, 2024, Khanna Publishing House
3. The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods, Michael Lewrick, Patrick Link, Larry Leifer, Wiley, March 2020

References:

1. Internet Reference: https://www.interaction-design.org/
2. Internet Reference: https://online.hbs.edu/
3. Internet Reference: https://dschool.stanford.edu/

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	1	1	-	-	3	-	-
CO2	-	-	-	-	-	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	2	2	2	2	-	3	-	-
CO4	-	-	-	-	-	2	-	-	-	-	3	-	-
CO5	-	-	-	-	-	2	2	2	2	-	3	-	-
CO6	-	-	-	-	-	3	2	3	2	2	3	-	-
Avg.	-	-	-	-	-	2.1	1.7	2	2	2	3	-	-

FC24102 Cultural Identities and Globalization **HSMC** **L T P C**

2 0 0 0

Course Objectives:

- To enable students to reflect on their own cultural identity in relation to their socialisation.
- To encourage cultural diversity that underpins the formation of identity and social behaviours.
- To give exposure to the varied cultural influences on the parent culture.
- To prepare to address the challenges and tensions in the globalised society.

UNIT I Exploring Social and Cultural Identity **5**

Identity formation & environmental interaction

- Race/ethnicity
- Gender
- Language
- Religion
- Socialisation (contact with different cultures)

UNIT II Regional and Cultural Influence on Social Behaviour and Identity **6**

- Assimilation, Amalgamation and Hybridisation
- Cultural Behaviour - dialect, traditions, social behaviour (customs), etiquette (work culture), habits, cuisine and regional variation

UNIT III Dissemination of Mass Culture Practices **6**

- Cultural Imperialism
- Colonisation and Globalization - Cultural turn
- Manufacturing pop culture - Language, food, movies, music, fashion, cosmetics.

UNIT IV Socio-Cultural Changes via Globalisation 6

- Indian globalisation through trade liberalisation
- Increased migration flow with economic opportunities
- Cultural exchange, global networks
- Urbanisation - impact on family ideology and social structure

UNIT V Embracing Global Identities 7

- Challenges and tension
- Adaptable to changing society - etiquettes (in cross-cultural workspace) and social behaviours
- Building understanding and tolerance

Total Periods:30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Engage in conversations with themselves in relation to their local culture and society.
CO2: Realise the nuances of identity formation through various means of socialisation.
CO3: Critically assess the countless social and cultural behaviours that influence their identity and behaviour.
CO4: Examine the role of globalisation and liberalisation in urbanisation and cultural imperialism.
CO5: Adapt to the cross-cultural changes and engage in global networking.
CO6: Respond appropriately in a multicultural space by building tolerance and understanding.

Suggested Activities:

- Exercise on identity formation - creation of mind maps / storyboards
- A mini presentation on "Identifying one's own culture amidst the influence of the diverse cultural environment" - expressing only one cultural aspect (language, attire, habits, food, …)
- Opinion piece speech - Deliver a short speech expressing personal opinions
- Survey report - Comparison chart (5 exchanges) by engaging conversations with a elderly stranger or grandparents
- Produce a 30-second reel showcasing their understanding of the social etiquette of a specific country.

References:

1. Brooks, Ann. Popular Culture: Global Intercultural Perspectives. United Kingdom, Bloomsbury Publishing, 2014.
2. Verkuyten, Maykel. Identity and Cultural Diversity: What Social Psychology Can Teach Us. United Kingdom, Taylor & Francis, 2013, pp. 1-27.
3. Savage, Michael, et al. Globalization and Belonging. United Kingdom, SAGE Publications, 2004.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	-	2	1	-	2	-	-
CO2	-	-	-	-	-	2	-	-	1	-	-	-	-
CO3	-	-	-	-	-	2	-	-	1	-	2	-	-
CO4	-	-	-	-	-	2	-	2	1	-	2	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	2	-	2	1	-	2	-	-
Avg.	-	-	-	-	-	**2**	-	**2**	**1**	-	**2**	-	-

MA24202	Laplace Transforms and Complex Variables	BSC	L	T	P	C
			3	1	0	4

Course Objectives:

- Find the Laplace transforms of standard functions
- Find the inverse Laplace transform of a function and use it in solving differential equations
- To introduce vector differential operator and evaluation of sine, surface and volume integrals
- To introduce the basic understanding and application of the concepts of divergence and curl
- Enhance the understanding of Cauchy-Reimann equations and it's usage in the construction of analytic functions
- Familiarise the methods of complex integration, series expansion of functions

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Euler's and Legendre's Homogeneous equation – System of simultaneous linear differential equations with constant coefficients.

UNIT II LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Transform of periodic functions - Initial and final value theorems – Inverse Laplace transforms – Convolution theorem – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT III VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems (no proof).

UNIT IV ANALYTIC FUNCTIONS 12

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions w=z+c, cz,1/z, z2, Bilinear transformation.

UNIT V COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals.

Total Periods:60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Use Laplace transforms to compute transformations of functions
CO2: Solve higher-order linear differential equations with constant coefficients
CO3: Solve higher-order linear equations with variable coefficients
CO4: Compute vector differential quantities and vector integrals
CO5: To understand the standard techniques of complex variable theory in particular analytic function
CO6: To familiarise with complex integration techniques

Suggested Activities:

- Evaluation of Laplace transforms using scientific tool
- Evaluation of Inverse Laplace transforms using scientific tool
- Evaluation of higher order ODE using scientific tool
- Visualizing complex analytic function using scientific tool
- Visualizing complex line integrals using scientific tool

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Publishers, 10th Edition, 2014.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.

References:

1. Churchill, R.V. and Brown, J.W, Complex Variables and Applications, Tata Mc Graw-Hill, 8th Edition, 2012.
2. Murray Spiegel, John Schiller, Probability and Statistics, Schaum's Outline Series, 3rd Edition, 2010.
3. Conway J.B., "Functions of one Complex variables", Springer International Student Edition, Second Edition, New York, 2000.
4. Lars V. Ahlfors, "Complex Analysis", McGraw Hill International, Indian Edition, 2017.
5. Kumaresan, S. A Pathway to Complex Analysis, Techno Wold Publication, Kolkata, 2022
6. Ponnusamy S., Foundations of Complex Analysis, Narosa Publishing House, Second Edition, New Delhi, 2018.
7. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	2	1	-
CO2	3	2	2	2	2	-	-	-	-	-	2	1	-
CO3	3	2	2	2	2	-	-	-	-	-	2	1	-
CO4	3	2	2	2	2	-	-	-	-	-	2	1	-
CO5	3	2	2	2	2	-	-	-	-	-	2	1	-
CO6	3	2	2	2	2	-	-	-	-	-	2	1	-
Avg.	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	1	-

CY24201 Chemistry for Electronic Engineering **BSC** **L T P C**

3 0 0 3

Course Objectives:

- To understand the fundamental concepts of electrochemical cells, redox reactions, and their applications in various chemical processes.
- To introduce the principles of corrosion, including the types, factors influencing corrosion, and methods for corrosion control.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To learn the techniques of instrumental analysis for the characterization of materials.
- To explore the properties and applications of smart materials in engineering.

UNIT I ELECTROCHEMISTRY AND CORROSION 9

Electrochemical Cell, Redox Reaction, Electrode Potential - Oxidation and Reduction Potential. Nernst Equation and Applications. Emf series.
Introduction to Corrosion - Chemical and Electrochemical Corrosion (Galvanic Corrosion, Concentration Cell Corrosion), Galvanic series - Factors Influencing Corrosion. Corrosion Control - Material Selection and Design - Electrochemical Protection - Sacrificial Anodic Protection and Impressed Current Cathodic Protection. Protective Coatings – Metallic Coatings (Galvanizing, Tinning), Organic Coatings (Paints). Paints: Constituents and Functions.

UNIT II STORAGE DEVICES AND ENERGY SOURCES 9

Batteries - Characteristics - Types of Batteries – Primary Battery (Alkaline Battery), Secondary Battery (Lead Acid, Lithium - Ion - Battery) - Emerging Batteries – Nickel - Metal Hydride Battery, Aluminum Air Battery, Batteries for Automobiles and Satellites - Fuel Cells (Types) – H2-O2 Fuel Cell - Supercapacitors - Types and Applications, Nuclear Energy – Nuclear Fission, Fusion, Differences, Characteristics – Nuclear Chain Reactions – Light Water Nuclear Reactor – Breeder Reactor. Renewable Energy: Solar energy - Solar Cells, DSSC.

UNIT III NANOCHEMISTRY 9

Basics: Distinction Between Molecules, Nanomaterials and Bulk materials; Size - Dependent Properties (Optical, Electrical, Mechanical, Magnetic and Catalytic). Types of Nanomaterials: Definition, Properties and Uses of - Nanoparticle, Nanocluster, Nanorod, Nanowire, and Nanotube. Preparation of Nanomaterials: Sol-Gel, Solvothermal, Laser Ablation, Chemical Vapour Deposition, Electrochemical Deposition and Electro Spinning. Applications of Nanomaterials in Medicine, Agriculture, Energy, Electronics and Catalysis.

UNIT IV INSTRUMENTAL METHODS AND ANALYSIS 9

Introduction, Absorption of Radiation, Types of Spectra, UV-Visible and IR Spectrophotometer: Instrumentation and Applications, Cyclic Voltammetry for Redox System. Thermal Methods of Analysis TGA, DTA, DSC. Sensors: Oxygen, Pulse Oximeter, Biometrics, and Glucose Sensor.

UNIT V SMART MATERIALS FOR ENGINEERING APPLICATIONS 9

Polymers – Definition – Classification – Smart Polymeric Materials - Preparation, Properties and Applications of Piezoelectric Polymer - Polyvinylidene Fluoride (PVDF), Electroactive Polymer - Polyaniline (PANI) and Biodegradable Polymer - Polylactic acid (PLA). Polymer Composites: Definition, Classification – FRP's – Kevlar. Shape Memory Alloys: Introduction, Shape Memory Effect – Functional Properties of SMAs – Types of SMA - Nitinol (Ni-Ti) Alloys - Applications.
Chromogenic Materials: Introduction – Types - Applications.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the electrochemical cells, electrode potential and its applications.
CO2: Analyze the factors leading to corrosion for corrosion prevention and control in engineering materials.
CO3: Explain the operating principles, working processes and applications of energy conversion and storage devices.
CO4: Apply the basic concepts of nanochemistry in designing the synthesis of nanomaterials for engineering applications.
CO5: Analyze materials using various instrumental techniques and sensors.
CO6: Understand the characteristics of smart materials for advanced engineering applications.

Suggested Activities:

- Quiz
- Mind Mapping on Types of Nanomaterials
- Seminar
- Animated videos on Nuclear Power Plant
- Electroplating process by group of students
- Demonstration of sensors

Text Books:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi,2012.
3. Dara S.S., "A Textbook of Engineering Chemistry", Chand Publications, 2004. 4. B.K.Sharma, "Instrumental Methods of Chemical Analysis", 28th Edition, Goel Publishing House. 2012.

References:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text Book of Nanoscience and Nanotechnology", Universities Press - IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry - A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.
6. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New AGE International Publishers, 2009.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	2	-	-	-	-	2	-	-
CO2	3	2	2	1	-	2	-	-	-	-	2	-	-
CO3	3	1	2	1	-	2	-	-	-	-	2	-	-
CO4	2	1	-	-	-	1	-	-	-	-	1	-	-
CO5	2	1	1	-	-	1	-	-	-	-	1	1	1
CO6	3	1	2	-	-	2	-	-	-	-	1	**1**	**1**
Avg.	**2.7**	**1.3**	**1.8**	**1**	**-**	**1.6**	**-**	**-**	**-**	**-**	**1.5**	1	1

EC24201 C PROGRAMMING AND DATA STRUCTURES PCC L T P C

3 0 0 3

Course Objectives:

- To understand the constructs of C Language.
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions

- To develop applications in C using pointers and structures
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting and searching techniques

UNIT I C PROGRAMMING BASICS 9

Compiler, Interpreter, Loader, Linker - Program Execution, Classification of Programming – Algorithms – Flowcharts - Basics of C: Introduction, Standardizations of C language - Developing Programs in C - Structure of C program - Variables, Data Types, Declaration – Token - Operators and Expressions - Type Conversion in C.

UNIT II INPUT AND OUTPUT 9

Basic screen and key board I/O in C , Non formatted input and output , Formatted Input and output. Control Statements: Specifying Test Condition for Selection and Iteration, Writing Test Expressions, Conditional Execution and Selection, Iterative and Repetitive Execution, GOTO Statement, Special Control statements, Nested loops.

UNIT III ARRAYS AND STRINGS 9

One dimensional Array, Strings: One-Dimensional Character Arrays, Multidimensional Arrays, Arrays of Strings. Functions: Concept of function, Call by Value Mechanism, passing arrays to Functions, Scope and extent, Storage classes, Inline function, Recursion, Searching and sorting.

UNIT IV POINTERS AND FILES 9

Pointers: Introduction, Understanding Memory Address, Address Operators, pointer, Void pointer, Null pointer, use of pointers, arrays and pointers, Pointer and strings, pointer arithmetic, pointers to pointers, pointer to arrays, Pointers to functions, Dynamic memory allocation, Pointer and const Qualifier. User-defined data types and variables: Structures, union, Enumerations types, Bitfields.
Files in C: Working with text files, Binary files, Random Access files, other file management functions, Command line arguments, C preprocessor, Type qualifier.

UNIT V DATA STRUCTURES 9

Linked Lists: Singly Linked Lists, Circular Linked lists, Doubly Linked list Applications of Linked Lists. Stacks and Applications, Queues, Other Variations of Queues, Applications, Tree-Binary tree, Traversals, Kinds of binary tress, Binary Search tree, Application of tree.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Develop simple applications in C using basic constructs
CO2: Develop simple applications in C using control flow constructs
CO3: Design and implement applications using arrays and strings
CO4: Develop and implement modular applications in C using functions
CO5: Develop applications in C using structures and pointers
CO6: Implement linear data structure operations.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as
- Flipped Learning - tkinter package
- Mini-project

Text Books:

1. Pradip Dey and Manas Ghosh, ―Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

References:

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms, Pearson Education, 1983.
3. Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , ― Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, ―An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	3	1	-	-	-	1
CO2	3	2	1	-	-	-	-	3	1	-	-	-	1
CO3	3	2	1	-	-	-	-	3	1	-	-	-	1
CO4	3	2	2	-	-	-	-	3	1	-	-	-	1
CO5	3	2	2	1	-	-	-	3	1	-	-	-	1
CO6	3	2	2	1	-	-	-	3	1	-	-	-	1
Avg.	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**3**	**1**	**-**	**-**	**-**	**1**

GE24201	TAMILS AND TECHNOLOGY / தமிழரும் தொழில்நுட்பமும்	HSMC	L	T	P	C
			1	0	0	1

Course Objectives:

- Understand the art of making things and developments in the lifestyle of people
- Understand the various methods of constructing buildings
- Understand the techniques being used in Architecture by Tamils
- Understand and apply the concepts of Tamils with modern technology

UNIT I / அலகு I **WEAVING AND CERAMIC TECHNOLOGY / நெசவு மற்றும் பானைத் தொழில்நுட்பம்** **3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries/

சங்க காலத்தில் நெசவு தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

UNIT II / அலகு II **DESIGN AND CONSTRUCTION TECHNOLOGY / வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்** **3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period/

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் –நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தொ-சாரோசெனிக் கட்டிடக் கலை.

UNIT III / அலகு III **MANUFACTURING TECHNOLOGY / உற்பத்தித் தொழில் நுட்பம்** **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram/

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

UNIT IV / அலகு IV **AGRICULTURE AND IRRIGATION TECHNOLOGY / வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்** **3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society/

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

UNIT V / அலகு V **SCIENTIFIC TAMIL & TAMIL COMPUTING / அறிவியல் தமிழ் மற்றும் கணித்தமிழ்** **3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project/

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

Total Periods:15

Course Outcomes:

On completion of the course, the students will be able to

CO1: Know the gradual improvement in the life history of Tamils
CO2: Construct buildings with the impact of the past with the present
CO3: Learn to manufacture remarkable things with the help of technology
CO4: Apply new Concepts in agriculture to the upliftment of the future society
CO5: Apply the ancient skills to find out the measurements of oceans
CO6: Apply the concepts of Tamil with modern technology

Text Books:

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

EC24211	**Circuit Analysis**	**PCC**	**L**	**T**	**P**	**C**
			3	**0**	**2**	**4**

Course Objectives:

- To explore the fundamental concepts of electric circuits and the mesh and nodal methods for circuit analysis.
- To introduce circuit theorems and duality for analysing DC circuits.
- To introduce sinusoidal steady-state and power analysis for AC circuits.
- To explore the transient and resonant characteristics of RL, RC, and RLC circuits.
- To acquire the skills to analyse magnetically coupled circuits.
- To determine the parameters of two-port networks.

UNIT I FUNDAMENTALS OF CIRCUIT ANALYSIS 9

Fundamentals of electric Circuits: Charge, current, Voltage, Power, Energy, Voltage and Current Sources, Circuit elements - Resistor, Inductor and Capacitor
Voltage and Current laws: Ohms Law, Kirchhoff's Current Law and voltage law, Circuit elements connected in Series and Parallel, Voltage and Current Division
Methods of Analysis: Basic Mesh and Nodal analysis for DC circuits, Super mesh and Super node analysis, Dual circuits

UNIT II CIRCUIT THEOREMS 9

Circuit theorems for DC circuits: Source transformation, Star-Delta Conversion, Superposition theorem, Thevenin and Norton Theorems, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem

UNIT III AC CIRCUITS – SINUSOIDAL STEADY STATE ANALYSIS AND POWER ANALYSIS 9

Sinusoidal Steady State analysis: Sinusoids, Phasors, Impedance and Admittance, Mesh and Nodal analysis for AC circuits, Source transformation, Superposition and Thevenin theorems for AC circuits, Phasor diagrams
AC Circuit Power analysis: Instantaneous power, Average power, Maximum power transfer, Effective values of current and voltage, Apparent power and Power factor, Complex power.

UNIT IV CIRCUIT DYNAMICS: TRANSIENTS AND RESONANCE 9

Transients: Behaviour of circuit elements under switching condition, Evaluation of initial and final conditions, Transient analysis of RL, RC and RLC circuits under source-free conditions and DC excitations.
Resonance: Analysis of Series and Parallel RLC circuits under resonance

UNIT V MAGNETICALLY COUPLED CIRCUITS AND TWO PORT NETWORK PARAMETERS 9

Magnetically coupled circuits: Self Inductance and Mutual Inductance, Dot convention, Energy in a coupled circuit, Linear transformer
Two port networks: Determination of Admittance, Impedance, Hybrid, and Transmission parameters of a two-port network.

Periods: 45

List of Experiments:

1. Verification of Kirchhoff's laws.
2. Verification of Mesh analysis for DC circuits.
3. Verification of Node analysis for DC circuits.
4. Verification of Thevenin theorem for DC circuits.
5. Verification of Maximum Power Transfer theorem for DC circuits.
6. Determination of resonant frequency and bandwidth of series and parallel RLC circuits.
7. Verification of superposition theorem of AC circuits using EDA tools.
8. Simulation of DC transients in RL and RC circuits using EDA tools.
9. Determination of impedance parameters of two-port networks using EDA tools.

Periods: 30

Total Periods: 75

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyse electric circuits using fundamental concepts and mesh and nodal methods.
CO2: Apply network theorems to analyse DC circuits.
CO3: Perform steady state analysis and power analysis for AC circuits.
CO4: Analyze the transient and resonant characteristics of RL, RC, and RLC circuits.
CO5: Analyze magnetically coupled circuits.
CO6: Apply fundamental concepts of circuits to determine the parameters of two-port networks.

Suggested Activities:

- Team-Based Problem Solving.
- Interactive Circuit analysis quizzes.
- GATE-Centric Practice Questions.

- Circuit Troubleshooting Challenges.
- Simulation of AC Circuits with EDA tools.

Text Books:

1. Hayt Jack Kemmerly, Steven Durbin, "Engineering Circuit Analysis",Mc Graw Hill education, 9th Edition, 2018.
2. Charles K. Alexander & Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", Mc Graw- Hill, 2nd Edition, 2003.
3. Joseph Edminister and Mahmood Nahvi, ―Electric Circuits, Schaum‘s Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016

References:

1. Robert.L. Boylestead, "Introductory Circuit Analysis", Pearson Education India, 12th Edition, 2014.
2. David Bell, "Fundamentals of Electric Circuits", Oxford University press, 7thEdition, 2009.
3. John O Mallay, Schaum’s Outlines "Basic Circuit Analysis", The Mc Graw Hill companies, 2nd Edition, 2011
4. Allan H.Robbins, Wilhelm C.Miller, ―Circuit Analysis Theory and Practice, Cengage Learning, Fifth Edition, 1st Indian Reprint 2013

Laboratory Requirements: (for a batch of 30 students)

- Resistor, Inductor, Capacitor - sufficient quantities
- Bread boards: 15 Nos
- CRO (30MHz): 10 Nos
- Function Generator(3MHz): 10 Nos
- Dual Regulated power supplies(0-30V): 10 Nos
- Multimeter: 10 Nos
- EDA tool for circuit simulation – Orcad Pspice/Equivalent software

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1	-	-	1	2	-	-	-	2	-
CO2	3	3	2	1	-	-	1	2	-	-	-	2	-
CO3	3	3	2	1	2	-	1	2	-	-	-	2	-
CO4	3	3	2	1	2	-	1	2	-	-	-	2	-
CO5	3	3	2	1	2	-	1	2	-	-	-	2	-
Avg.	**3**	**3**	**1.8**	**1**	**2**	**-**	**1**	**2**	**-**	**-**	**-**	**2**	**-**

EC24221	C PROGRAMMING AND DATA STRUCTURES LABORATORY	PCC	L	T	P	C
			0	0	2	1

Course Objectives:

- To familiarise with C programming constructs.
- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.

- To develop applications in C using structures.
- To demonstrate implementation of linear data structure algorithms.
- To implement Sorting and Searching techniques

LIST OF EXPERIMENTS

1. I/O statements, operators, expressions
2. decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
8. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
9. Array implementation of Stack and Queue ADTs
10. Linked list implementation of Stack and Linear Queue ADTs
11. Implementation of Binary Search Trees
12. Implementation of Insertion Sort , Merge Sort and Quick sort.

Total Periods:30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Develop simple applications in C using basic constructs
CO2: Develop simple applications in C using control flow constructs
CO3: Design and implement applications using arrays and strings
CO4: Develop and implement modular applications in C using functions
CO5: Develop applications in C using structures and pointers
CO6: Implement Linear data structure algorithms.
CO7: Develop the various searching and sorting algorithms

References:

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.
2. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.
3. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
4. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.

Laboratory Requirements:

S.No	Description of Equipment	Required numbers (for batch of 30 students)
1.	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17” or higher TFT Monitor, Keyboard and mouse	30
2.	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3.	Dev C++ / Linux Operating System with GNU compiler / equivalent open source IDE	30

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	3	1	-	-	-	1
CO2	3	2	1	-	-	-	-	3	1	-	-	-	1
CO3	3	2	1	-	-	-	-	3	1	-	-	-	1
CO4	3	2	2	-	-	-	-	3	1	-	-	-	1
CO5	3	2	2	1	-	-	-	3	1	-	-	-	1
CO6	3	2	2	1	-	-	-	3	1	-	-	-	1
CO7	3	2	2	-	-	-	-	3	1	-	-	-	1
Avg.	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**3**	**1**	**-**	**-**	**-**	**1**

GE24121 Engineering Practices Laboratory - Civil and Mechanical ESC L T P C

0 0 2 1

Course Objectives:

- Familiarize students with basic tools and equipment used in engineering.
- Develop practical skills in Mechanical, Civil and 3D Printing practices.
- Encourage teamwork and collaboration in a lab environment.
- Foster an understanding of safety protocols and procedures.

INTRODUCTION AND SAFETY PRACTICES

Overview of lab rules, expectations, and safety protocols, Personal Protective Equipment (PPE), handling tools and equipment safely, emergency procedures.

MECHANICAL PRACTICES

Workshop Tools: Identification and usage of basic mechanical tools (hammers, wrenches, screwdrivers, etc.).
Basic Machining: Introduction to lathe and drilling machines. Practicing Facing, Turning, and Drilling.
Sheet Metal Works: Making a dustpan and funnel.

CIVIL PRACTICES

Plumbing: Exposure to different plumbing components. Exposure to plumbing repair methods and troubleshooting of existing connections. Practicing pipe connection to the wash basin from the water tank.
Carpentry: A study on carpentry procedure. Making joints like the Tee joint and the Dovetail joint. Exposure and usage of power tools.

ADDITIVE MANUFACTURING PRACTICES

Welding: Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding, CO2, gas, and MIG welding techniques.
Foundry: Introduction to the foundry process and tools. Mold preparation for solid and split patterns.
3D Printing: Basics of 3D printing and simple projects.

ASSEMBLING AND FITTING

Introduction to Systems - Dismantling and Assembling of Mixer/IC Engines/Refrigerator and Air Conditioner

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: To perform basic machining operations
CO2: To perform operations on the given sheet metal
CO3: To understand the concepts of additive manufacturing methods like Welding, Moulding and 3D Printing
CO4: To understand the rudimentary concepts of refrigeration and air conditioning systems
CO5: To do basic household works like Plumbing, Carpentry Joints
CO6: To identify the components of Mixer/IC Engines/Refrigerator/AC.

References:

1. Workshop Technology by W.A.J. Chapman
2. Electrical Engineering Fundamentals by Vincent Del Toro
3. Basic Civil Engineering by M.S. Palanichamy

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	-	-	2	-	-	-	-	-
CO3	2	-	-	-	2	-	-	2	-	-	-	1	1
CO4	2	-	-	-	1	-	-	2	-	-	-	-	-
CO5	1	-	-	-	-	-	-	2	-	-	-	1	1
CO6	1	-	-	-	-	-	-	2	-	-	-	-	-
Avg.	**1.6**	**-**	**-**	**-**	**1.6**	**-**	**-**	**2**	**-**	**-**	**-**	**1**	**1**

CY24121 Engineering Chemistry Laboratory **BSC** **L T P C**

0 0 2 1

Course Objectives:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, and Chloride.
- To demonstrate the synthesis of nanoparticles.
- To familiarize the students with the determination of the molecular weight of a polymer by a viscometer.
- To familiarize the students with electroanalytical techniques such as pH meter, Potentiometry, and Conductometry to determine impurities in aqueous solutions.
- To understand the factors influencing corrosion.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na2CO3 as primary standard
2. Determination of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Determination of strength of given hydrochloric acid using pH meter.

8. Conductometric titration of strong acid vs strong base.
9. Estimation of iron content of the given solution using potentiometer.
10. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
11. Estimation of sodium and potassium present in water using a flame photometer.
12. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
13. Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol-Gel method.
14. Corrosion experiment-weight loss method.
15. Conductometric titration of barium chloride Vs Sodium Sulphate - Precipitation method.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyze the quality of water samples with respect to their acidity, alkalinity.
CO2: Determine the hardness and chloride content of the water sample.
CO3: Demonstrate precipitation method for synthesis of nanoparticles
CO4: Determine the molecular weight of the polymer.
CO5: Estimate the amount of analyte by conductometry.
CO6: Quantitatively analyze the impurities in solution by electroanalytical techniques.

References:

1. Engineering Chemistry Laboratory Manual – Department of SH-Chemistry, LICET, 2024.
2. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

Laboratory Requirements:

1. Conductivity meter – 15 Nos.
2. pH meter - 15 Nos.
3. Potentiometer - 15 Nos.
4. Viscometer - 35 Nos.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	2	-	-	-	-	2	-	-
CO2	3	2	1	-	-	2	-	-	-	-	2	-	-
CO3	2	1	2	-	-	2	-	-	-	-	-	-	-
CO4	2	1	2	-	-	1	-	-	-	-	1	-	-
CO5	3	1	2	-	1	2	-	-	-	-	2	-	-
CO6	3	1	2	-	1	2	-	-	-	-	2	-	-
AVG	**2.7**	**1.3**	**1.7**	**-**	**1**	**1.8**	**-**	**-**	**-**	**-**	**1.8**	-	-

FC24101	Life Skills	HSMC	L	T	P	C
			2	0	0	1

Course Objectives:

- To enhance self-awareness and understanding of personal strengths, weaknesses, and potential.
- To develop mechanisms to navigate through emotions and stress.
- To build effective interpersonal skills and maintain healthy social relationships.
- To foster and develop strategies for holistic well-being.
- To reflect on personal growth.

UNIT I Knowing Thyself **6**

- Knowing Thyself
  - Strengths, Limitations, Characteristics, Habits and Experiences
- Sense of SELF
  - Self Awareness, Self Image, Self-esteem, Self Love, Self Respect
- Three Dimensions of SELF
  - 1) Ideal Self, 2) Social Self, and 3) Real Self
- Personality Types
  - 1) Introvert, 2) Extrovert, and 3) Ambivert

UNIT II Emotional Competence **6**

- Understanding emotions
- Understanding the patterns of thoughts, feelings, and behaviors (Cognitive Behavior Theory)
- Handling stress, anxiety, and fear (flight mode) / anger (fright mode)
- Happy chemicals (4 chemicals - Dopamine, Oxytocin, etc)
- Positive Thinking

UNIT III Interpersonal Skills **6**

- Interpersonal relationships
- Communicating Positive Expressions
  - Empathy, Trust, Forgiveness, Gratitude, Compassion
- Personal and Social Associations - Family systems, Relationship management
- Building personal, social, and digital intelligence
- Sense of OTHERS
- Gender Equity

UNIT IV Dimensions of Well-being **6**

- Intellectual Well-being
- Emotional Well-being
- Spiritual Well-being
- Physical Well-being
- Social Well-being

UNIT V Life to the fullest **6**

- Happiness v/s Having fun
- Self-Retrospection and Positive Transformation
- Synthesis, Personal Reflection, and Way Forward

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify their strengths and weaknesses and demonstrate self-awareness through reflective practices.
CO2: Demonstrate the ability to recognize emotions and handle stress.
CO3: Enhance interpersonal skills to build strong and positive relationships. 4. Adapt to a comprehensive understanding of well-being, and be able to implement strategies for maintaining mental health.
CO4: Develop a deeper understanding of personal and social relationships, and identify areas for growth.
CO5: Synthesize learning into a cohesive life plan for future growth.

Suggested Activities:

- Cognitive behavior therapy
- PLOT
- SLOT
- SWOT
- Johari Window

References:

1. Bradberry, Travis, and Jean Greaves. *Emotional Intelligence 2.0*. TalentSmart,2009.
2. Republic of Philippines, Department of Education. *K to 12 Senior High School Core Curriculum.* - Personal Development, May 2016.
3. US Department of Education, *Career Guidance and Counselling Programs.* Rich South High School Horizon Program: (Rich Town Park Illinois: Rich South High School, 1998)

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	3	-	-	-	-	2	-
CO2	-	-	-	-	-	2	3	-	-	-	-	2	-
CO3	-	-	-	-	-	3	3	3	3	-	-	2	-
CO4	-	-	-	-	-	3	3	-	3	-	3	2	-
CO5	-	-	-	-	-	3	3	-	-	-	3	2	-
CO6	-	-	-	-	-	-	3	-	-	-	-	-	-
Avg.	-	-	-	-	-	**2.8**	**3**	**3**	**3**	-	**3**	**2**	-

EC24301	Signals and Systems	PCC	L	T	P	C
			3	1	0	4

Course Objectives:

- To understand the fundamental properties of signals and systems.
- To study Fourier and Laplace transforms and their properties for continuous-time signals.
- To learn the representation of discrete-time signals in the frequency domain using DTFT and Z-transform.
- To explore the response of continuous-time systems using convolution integrals, differential equations, and transform techniques.
- To examine the response of discrete-time systems using convolution sums, difference equations, and transform-domain methods.

UNIT I INTRODUCTION TO SIGNALS & SYSTEMS 12

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

UNIT II CONTINUOUS-TIME SIGNAL ANALYSIS 12

Trigonometric & Exponential Fourier Series for periodic signals, Fourier transform of standard signals, Properties of Fourier transforms. Laplace transforms, Inverse Laplace transforms and properties.

UNIT III ANALYSIS OF DISCRETE TIME SIGNALS 12

Fourier Transform of discrete time signals (DTFT) — Properties of DTFT — Z Transform & Properties, Stability analysis, SAMPLING: Sampling theorem – Graphical and analytical proof for Band Limited Signals

UNIT IV LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12

Impulse response — convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12

Impulse response — Difference equations- Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems

Total Periods:60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Classify different types of signals and systems based on their properties and perform basic operations.
CO2: Examine the spectral characteristics of continuous-time signals using Fourier series, Fourier transform, and Laplace transform.
CO3: Apply Fourier and Z-transforms to represent discrete-time signals in the frequency domain.
CO4: Determine the response of the continuous time systems using convolution and transform techniques.
CO5: Describe the process of sampling and effects of under-sampling
CO6: Apply transform techniques to discrete time systems.

Suggested Activities:

- Concept Mapping
- Lab Experiments
- Journal review assignments

- Problem-Solving Workshops
- Hands-on Circuit Implementation / Code-based Implementation
- Simulation

Text Books:

1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002

References:

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.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	-	-	3	1	-	-	2	-
CO2	3	2	-	-	-	-	-	-	1	-	2	2	-
CO3	3	3	1	-	-	-	-	3	1	-	-	2	-
CO4	3	2	1	-	1	-	-	-	1	-	-	2	-
CO5	3	2	2	-	2	-	-	-	1	-	2	2	-
CO6	2	3	1	-	1	-	-	-	1	-	-	2	-
Avg.	**2.7**	**2.3**	**1.3**	**-**	**1.3**	**-**	**-**	**3**	**1**	**-**	**2**	**2**	**-**

MA24303 Probability and Random Processes **BSC** **L T P C**

3 1 0 4

Course Objectives:

- To introduce the fundamentals of probability and develop understanding of one dimensional random variables and some standard distributions applicable to engineering which can describe real-life phenomenon
- To enable the understanding of the basic concepts of two dimensional random variables and the relation between variables
- To enhance the understanding of the basic concept of random processes
- To facilitate the exploration of time-domain and frequency-domain characteristics of random processes using correlation functions and spectral densities
- To understand the significance of linear systems with random inputs

UNIT I ONE - DIMENSIONAL RANDOM VARIABLES 9+3

Introduction to Probability - Random variables - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (Application only).

UNIT III RANDOM PROCESSES 9+3

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

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9+3

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

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9+3

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

Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply probability theory to analyse discrete random variables, continuous random variables
CO2: Apply standard distributions which can describe real life phenomenon
CO3: Analyse relation between random variables
CO4: Apply the concept of random processes in time dependent problems
CO5: Apply the concept of correlation and spectral densitiesAble to analyze the response of random inputs to linear time invariant systems.
CO6: Analyse the response of random inputs to linear time invariant systems.

Text Books:

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.

References:

1. Cooper. G.R., McGillem. C.D., Probabilistic Methods of Signal and System Analysis, Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes, Tata McGraw Hill Edition, New Delhi, 2004.
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications, Academic Press, 2004.
4. Stark. H. and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing, Pearson Education, Asia, 3rd Edition, 2002.
5. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes, Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.
6. Veerarajan. T., "Probability and Statistics, Random Process and Queueing Theory", Tata McGraw Hill, Second Reprint, 2025.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	-

CO5	3	3	2	2	-	-	-	-	-	-	-	-	-
CO6	3	3	2	2	-	-	-	-	-	-	-	-	-
AVG	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

EC24302 Electronic Circuits **PCC** **L T P C**

3 0 0 3

Course Objectives:

- To perform DC analysis of biasing circuits for transistors
- To perform AC analysis of BJT and MOSFET amplifiers.
- To determine the frequency response of amplifiers
- To design oscillator circuits using transistors
- To understand power amplifiers and DC-DC Converters

UNIT I BIASING OF TRANSISTORS **9**

Construction, Working and V-I characteristics of BJT and MOSFET; DC Load line, operating point, biasing methods, and stability factor for BJT; Design of biasing circuits for MOSFET

UNIT II BJT AND MOSFET AMPLIFIERS **9**

Small signal model based analysis: BJT - Common Emitter, Common Base, Common Collector configuration; MOSFET - Common Source, Common Drain, Common Gate configuration; Differential amplifier – Operating modes, DC and AC analysis, CMRR;

UNIT III FEEDBACK AMPLIFIERS AND FREQUENCY RESPONSE **9**

Types of negative feedback, effects of negative feedback in amplifiers; frequency response of single stage BJT amplifiers; High frequency model based analysis and upper cut—off frequency for BJT and MOSFET.

UNIT IV TUNED AMPLIFIERS AND OSCILLATORS **9**

Operation and frequency response of Single tuned amplifier; Positive feedback, condition for sustained oscillations, RC oscillators – RC phase shift and Wien Bridge; LC oscillators – Hartley and Colpitts

UNIT V POWER AMPLIFIERS AND DC-DC CONVERTERS **9**

Working and efficiency of Class A, Class B and Class C power amplifiers; Working of Buck, Boost and Buck boost DC-DC converters

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Design biasing circuits for transistors
CO2: Derive small signal parameters of amplifiers
CO3: Analyze the effect of feedback in amplifiers
CO4: Analyze high frequency models of transistors
CO5: Determine resonant frequency of oscillators and tuned amplifiers
CO6: Analyze power amplifiers and DC-DC converters

Suggested Activities:

- Crosswords
- Video animations
- Journal review assignments
- Oral seminars
- Mini-projects
- Simulation

Text Books:

1. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 5th Edition, Mc Graw Hill Education (India) Private Ltd., 2022.
2. Millman J, Halkias.C.and Sathyabrada Jit, Electronic Devices and Circuits, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2015
3. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5th Edition, 2010

References:

1. Muhammad H.Rashid, "Power Electronics: Devices, Circuits and Applications", Pearson Education / PHI 4th Edition, 2023.
2. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2010
3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 th Edition, 2014

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	1	3	1
CO2	2	3	1	1	-	-	-	-	-	-	1	3	1
CO3	2	3	1	1	-	-	-	-	-	-	1	3	1
CO4	2	2	1	1	-	-	-	-	-	-	2	3	1
CO5	2	2	1	1	-	-	-	-	-	-	2	3	1
CO6	2	2	1	-	-	-	-	-	-	-	1	3	1
Avg.	**2**	**2.33**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1.33**	**3**	**1**

EC24303 Theory and Design of Control Systems PCC 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.

UNIT I SYSTEM COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure- Feedforward and Feedback control theory. Electrical and Mechanical Transfer Function Models- Block diagram Models- Signal flow graphs models.

UNIT II TIME RESPONSE ANALYSIS 9

Transient response-steady state response-Measures of performance of the standard first order and second order system-steady state error constant and system-type number-PID control-Principle of PD, PI, PID controllers (Qualitative analysis).

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response- Performance specification in frequency domain- Frequency response of standard second order system using Bode Plot and Polar plot - Gain margin and phase margin - Principle of compensators (Qualitative analysis).

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability- Bounded Input Bounded Output stability, Routh stability criterion- Relative stability - Root locus concept - Guidelines for sketching root locus.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation- 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- Stability of linear systems.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Compute the transfer function of different physical systems.
CO2: Analyze the time domain specification and calculate the steady state error.
CO3: Illustrate the frequency response characteristics of open loop and closed loop system response.
CO4: Analyze the stability using Routh Hurwitz criterion and root locus techniques.
CO5: Analyze the stability using root locus techniques.
CO6: Illustrate the state space model of a physical system

Suggested Activities:

- Team-Based Problem Solving.
- Interactive quizzes.
- GATE-Centric Practice Questions.
- Troubleshooting Challenges.
- Simulation using MATLAB.

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. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition,1995.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	2	3	3
CO2	3	3	2	2	2	-	-	-	-	-	1	3	3

CO3	3	2	3	3	2	-	-	-	-	-	2	3	2
CO4	3	3	3	2	2	-	-	-	-	-	1	3	3
CO5	2	2	3	3	2	-	-	-	-	-	2	2	2
CO6	2	2	3	3	2	-	-	-	-	-	2	2	2
Avg.	**2.6**	**2.5**	**2.8**	**2.5**	**2**	**-**	**-**	**-**	**-**	**-**	**1.6**	**2.6**	**2.5**

EC24311 Digital System Design **PCC** **L T P C**

3 0 2 4

Course Objectives:

- To introduce the basics of number systems, Boolean algebra, logic function representation, and simplification techniques using Karnaugh Maps.
- To understand the design and analysis of combinational logic circuits, including arithmetic circuits, data processing circuits, and code converters.
- To learn the design and analysis of synchronous and asynchronous sequential circuits
- To learn different logic families, memory types, and the implementation of combinational logic using ROM, PLA, and PAL.

UNIT I BASICS OF DIGITAL SYSTEM **9**

Number systems, codes and Base conversions; Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions – Sum of Product (SOP) and Product Of Sum (POS) forms; NAND and NOR Implementation of logic functions; Simplification of switching functions using Karnaugh Maps; Verilog HDL models of simple logic functions.

UNIT II COMBINATIONAL LOGIC CIRCUITS **9**

Analysis of combinational logic; Combinational logic design - Problem formulation and design of combinational circuits; Arithmetic Circuits - Adders , Subtractors, Carry look ahead Adder, BCD Adder, Magnitude Comparator; Data processing circuits - Decoder, Encoder, Priority Encoder, Multiplexer, Demultiplexer; Code Convertors; Verilog HDL models of simple combinational circuits- Adder, Subtractor, Decoder, Multiplexer.

UNIT III SEQUENTIAL CIRCUITS **9**

Latches and Flip flops: SR, JK, T, D, Master/Slave FF, Triggering of FF; Analysis of clocked sequential circuits; Design of clocked sequential circuits – Counters: Ripple counter, Ring counter, modulo counters and Shift registers: SISO,SIPO,PISO,PIPO, Universal Shift register; Synthesizable HDL models of simple Sequential circuits-Ripple counter, Ring counter, Shift register (SISO,SIPO,PISO,PIPO)

UNIT IV SYNCHRONOUS FINITE STATE MACHINES AND ASYNCHRONOUS CIRCUITS **9**

Synchronous : Moore/Mealy models of Finite State Machines; State reduction and state assignment; Algorithmic Sate Machine(ASM) : Sequence detector, up-down counter Asynchronous Circuits: Analysis - Transition table, Flow table, stable and unstable states, cycles, races ; Design of Fundamental mode asynchronous circuits; Hazards in combinational and sequential circuits.

UNIT V LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES **9**

RTL, TTL,ECL and CMOS Logic families - Propagation Delay, Fan In and Fan Out, Noise Margin, Comparison of Logic families; Memory - RAM, ROM, PROM, PAL, PLA; Implementation of combinational logic design using ROM, PLA and PAL

Periods: 45

List of Experiments:

1. Design of one bit adders and subtractors
2. Design of Parallel adder/ subtractor using IC7483
3. Design of Multiplexers/Demultiplexers and Encoders/Decoders.
4. Design of Magnitude Comparators using IC.
5. Design and implementation of counters using flip-flops.
6. Design and implementation of shift registers using D flip flops.
7. Design and simulation of Finite State Machine – Sequence detector using Verilog HDL.
8. Design and simulation of RAM using Verilog HDL

Periods: 30

Total Periods: 75

Course Outcomes:

On completion of the course, the students will be able to

CO1: Implement Boolean algebra, and Karnaugh Map techniques to simplify and optimize logic functions.
CO2: Implement Combinational logic circuits.
CO3: Implement Synchronous Sequential logic circuits.
CO4: Design synchronous Finite State Machines and asynchronous sequential logic circuits.
CO5: Compare logic families and implement combinational logic using memory devices.
CO6: Implement digital circuits using Verilog HDL.

Suggested Activities:

- Verilog coding and simulation of digital circuits using Modelsim/equivalent simulators.
- GATE-Centric Practice Questions.

Text Books:

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 6th Edition, 2018.
2. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 7th Edition, 2014.

References:

1. John F. Wakerly, Digital Design Principles and Practices, Prentice Hall, Fifth Edition, 2018.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1 st Edition, 2015.
3. Samir Palnitkar, "Verilog HDL", Pearson Education, 2nd Edition,2003.
4. Stephen Brown and Zvonko Vranesic, "Fundamentals of Logic Design with Verilog", TMH publications, 3 rd Edition, 2013.

Laboratory Requirements: (for a batch of 30 students)

- Power supply (5V) : 10 Nos
- Bread boards: 15 Nos
- Clock pulse generator : 10 Nos
- Digital IC's : IC 7486 (XOR), IC 7408 (AND), IC 7432 (OR), IC 7404 (NOT), IC 7483, IC 7485, IC 7476 (JK Flip-Flop), IC 7474 (D Flip-Flop) – Sufficient quantities
- Connecting wires – Sufficient quantities
- Software Requirements for Verilog HDL simulation : Quartus Prime / Xilinx Vivado / ModelSim
- Desktop Computers : 5 Nos.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	-	-	2	2	-	-	3	2
CO2	3	3	3	2	-	1	-	2	2	-	1	3	2

CO3	3	3	3	2	-	1	-	2	2	-	1	3	2
CO4	3	3	3	2	-	1	-	-	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	3	2
CO6	2	2	2	2	3	-	-	2	2	-	1	3	2
Avg.	**2.8**	**2.7**	**2.7**	**1.8**	**3**	**1**	**-**	**2**	**2**	**-**	**1**	**3**	**2**

GE24112 Problem Solving using Python **ESC** **L T P C**

2 0 4 4

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To define Python functions and use function calls to solve problems.
- Learn to manage file operations, handle exceptions, and apply object-oriented programming principles in Python
- To familiarize with Python's module system, packages, and essential scientific libraries

UNIT I PROBLEM SOLVING AND INTRODUCTION TO PYTHON PROGRAMMING 7

Fundamentals of computational thinking, algorithmic problem solving and logical thinking, problem solving and decomposition, notations (pseudo code, flowchart) - Introduction to Python – Literals – Variables and Identifiers - Comments- Reserved words – Data Types - Operators and Expressions - Input and Output: Working with user input, displaying output, and formatting - Conditional if - alternative if - chained conditional - Iteration: state, while, for, break, continue, pass

UNIT II DATA STRUCTURES AND MANIPULATION 5

Lists: List operations - List slices - List methods - List loop - Mutability - Aliasing - Cloning lists - List parameters - Lists as arrays-Advanced list processing-List Comprehension- Tuples: Tuple assignment - Tuple as return value. Dictionaries: Operations and Methods- Sets: Creating Sets – Operations and methods – Set comprehension

UNIT III STRINGS AND FUNCTIONS 6

Functions - definition and use - Flow of execution - Parameters and arguments - Fruitful functions: Return values - Parameters - Local and global scope -Function composition - Recursion - Strings: string slices, immutability, string functions and methods, string module

UNIT IV FILES, EXCEPTIONS, CLASSES AND OBJECTS 6

Files and exception: Text files - Reading and writing files - Command line arguments-Errors and exceptions - Handling exceptions - Classes and Objects: Defining classes - Creating Objects Data abstraction – Class variables and Object variables – Working with objects and Methods

UNIT V MODULES AND PACKAGES 6

Introduction to Modules and Packages- Basics of NumPy - N-dimensional Array in NumPy - Methods and Properties - Basics of SciPy - Broadcasting in NumPy Array Operations - Array Indexing in NumPy, Pandas - Introduction - Series - Data Frame - Matplotlib - Basics - Figures and Axes - Method subplot - Axis container

Periods: 30

List of Experiments:

1. Identification and solving of simple real life or technical problems related to applications to specific discipline and developing algorithms/flowcharts.
2. Python programming using simple statements and expressions.
3. Solving problems using conditional statements.
4. Solving problems using iterative loops (Palindrome, Factorial, Prime Numbers).
5. Implementing real-time/technical applications using List.
6. Implementing real-time/technical applications using Tuples.
7. Implementing real-time/technical applications using Dictionaries.
8. Implementing real-time/technical applications using sets.
9. Implementing programs using functions.
10. Implementing programs using strings.
11. Implementing programs using modules.
12. Implementing programs using command line arguments
13. Implementing real-time/technical applications using file handling (Word count- longest word - Copy file).
14. Implementing real-time/technical applications using exception handling.
15. Creating and Instantiating classes (Creating student class and object, Voter's age validation, Marks range validation (0-100)).
16. Implement programs using standard libraries (Pandas, Numpy, Scipy).
17. Generating basic plots using Matplotlib.
18. Developing a game activity using Pygame

Periods: 60

Total Periods: 90

Course Outcomes:

On completion of the course, the students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop solutions to problems using control structures.
CO3: Process compound data using Python data structures.
CO4: Structuring python program into functions and to implement String handling functions
CO5: Read and write data from/to files in Python programs and handle exceptions
CO6: Understand object-oriented programming concepts through classes and objects.
CO7: Utilize Python modules and packages for performing data analysis.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Assign a project to create a small application that uses various Python data structures (lists, tuples, dictionaries, and sets) to manage and process a dataset (e.g., a contact list or inventory system).
- Data Analysis and Visualization using NumPy, Pandas, and Matplotlib - Provide a dataset (e.g., weather data, sales records) and ask students to perform data analysis using NumPy and Pandas, followed by visualizing the results using Matplotlib.
- External Learning - Recursion vs. Iteration.
- Flipped Learning - tkinter package
- Mini-project

Text Books:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

References:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

Laboratory Requirements: (for a batch of 30 students)

S.No.	Description of Equipment	Required numbers (for batch of 30 students)
1.	Desktop Computer (Windows/Linux) with Python 3 interpreter	30

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	2	-	-	-	-	1	1	-	-
CO2	2	2	1	-	2	-	-	-	-	1	1	-	-
CO3	2	2	-	-	2	-	-	-	-	1	1	-	-
CO4	2	2	2	2	2	-	-	-	-	1	1	-	-
CO5	2	2	-	-	2	-	-	-	-	1	1	-	-
CO6	2	2	2	2	2	-	-	1	-	1	1	-	-
CO7	2	2	2	2	2	-	-	1	-	1	1	-	-
Avg.	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**-**

EC24321 Devices and Circuits Laboratory **PCC** **L T P C**

0 0 4 2

Course Objectives:

- To gain hands on experience in building electronic circuits.
- To learn simulation software used in circuit design.
- To obtain the V-I characteristics of active devices
- To understand the effect of positive and negative feedback in amplifiers.
- To plot frequency response of single and multi-stage amplifiers.

LIST OF EXPERIMENTS:

HARDWARE BASED EXPERIMENTS ON

1. V-I Characteristics of PN junction diode and its application as a full wave rectifier
2. V-I Characteristics of Zener diode and its application as a regulator
3. V-I Characteristics of BJT in Common Emitter Configuration
4. V-I Characteristics of MOSFET in Common Source Configuration
5. Measurement of CMRR for Differential Amplifier
6. Effect of series and shunt negative feedback in amplifiers on bandwidth
7. Frequency response of Single Tuned Amplifier
8. Sinusoidal waveform generation

SIMULATOR (SPICE) BASED EXPERIMENTS ON

1. Voltage divider biasing circuits of BJT and MOSFET
2. Frequency response of cascade and cascode amplifiers
3. Analysis of series fed and transformer coupled power amplifiers

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Implement applications using basic diodes
CO2: Determine graphical parameters from V-I characteristics of active devices
CO3: Calculate AC parameters of Differential Amplifier
CO4: Analyse frequency responses of single and multi stage amplifiers
CO5: Design waveform generation circuits
CO6: Simulate the response of electronic circuits

References:

1. Datasheets of active devices and operating manuals of measuring instruments
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education / PHI, 2017

Laboratory Requirements:

1. Bread Boards – 15 Nos
2. CRO (Min 30MHz) – 15 Nos.
3. Signal Generator /Function Generators (3 MHz) – 15 Nos
4. Dual Regulated Power Supplies (0 – 30V) – 15 Nos.
5. Digital Multimeter– 15 Nos
6. DRB, DCB, DIB – 5 Nos each
7. Desktop Computer – 10 Nos.
8. Transistor/MOSFET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos each
9. Diode (PN, Zener) – 25 Nos each
10. DC Ammeters and DC Voltmeters – As per design – 10 Nos in each range
11. Transformers – 12V – 0 – 12V – 10 Nos
12. Resistors, Capacitors
13. SPICE Circuit Simulation Software: (any public domain or commercial software)

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	3	-	-	-	3	3	-	1	3	1
CO2	3	2	1	3	2	-	-	3	3	-	1	3	2

CO3	3	2	1	3	-	-	-	3	3	-	1	3	1
CO4	3	2	1	3	2	-	-	3	3	-	1	3	2
CO5	3	2	1	3	-	-	-	3	3	-	1	3	1
CO6	3	2	1	3	2	-	-	3	3	-	1	3	2
AVG	**3**	**2**	**1**	**3**	**2**	**-**	**-**	**3**	**3**	**-**	**1**	**3**	**1.50**

HS24321 Communication Skills Building Laboratory[$] **HSMC** **L T P C**

0 0 2 1

Course Objectives:

- Develop the ability to construct grammatically correct and contextually appropriate sentences
- Enhance critical thinking skills for analyzing and interpreting texts, media, and experiences
- Strengthen comprehension, summarization, and documentation skills for professional contexts
- Improve verbal and non-verbal communication for effective interaction in diverse professional settings
- Equip learners with teamwork, networking, and interview skills essential for career advancement
- Enable the creation of a professional digital identity through resumes, LinkedIn profiles, and self-presentation techniques

UNIT I The Art of Discourse **6**

Listening: Listen to stand-up comedy, political commentaries, and campaigns for appreciative listening.
Reading: Read and evaluate business and economic news articles; determine tone (neutral, positive, negative) and fact-check.
Writing: Craft commentary and opinion pieces to persuade or provoke discussion.
Speaking: Explain satire comic strips (e.g., Amul advertisements, political cartoons)

UNIT II Professional Communication Essentials **6**

Listening: Listen to voicemail, messages, and fill out forms.
Reading: Compare products & services; analyze advertisements.
Writing: Draft meeting agendas and minutes.
Speaking: Engage in open-field group discussions.

UNIT III Documentation and Summation **6**

Listening: Listen to documentaries, book summaries, and movie summaries for comprehensive understanding.
Reading: Read and analyze reports on significant events (e.g., environmental disasters, economic downturns).
Writing: Write survey reports and paraphrase key information.
Speaking: Report news, weather forecasts, and predictions.

UNIT IV Refining Professional Competence **6**

Listening: Translate informal language into formal business communication (Contextual translation)
Reading: Read and interpret technical texts and industry-specific jargon.
Writing: Write cover letters and statements of purpose.
Speaking: Role-play professional etiquette in workplace scenarios (e.g., expressing empathy, kindness, courtesy).

UNIT V Developing a Professional Profile **6**

Listening: Listen to podcasts, Josh Talks, and professional interviews.
Reading: Analyze professional resumes and LinkedIn profiles.

Writing: Set up a LinkedIn profile and write engaging posts.
Speaking: Conduct mock interviews and deliver an effective elevator pitch.

Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Construct coherent and professional sentences tailored to various workplace scenarios
CO2: Analyze and critically interpret professional texts and multimedia content
CO3: Document, summarize, and report information effectively across multiple formats
CO4: Communicate effectively in professional and social interactions
CO5: Demonstrate teamwork, networking, and interview skills relevant to career development
CO6: Curate a professional online presence through resume development - LinkedIn, Indeed, .

Suggested Activities:

1. Documentation and Summation
   Assignment: Newsroom Simulation (20 Marks)
   - Students record a 2-minute news report on an environmental/economic issue.
   - Must include paraphrased content from real news reports (cite sources).
   - Submission: Video + written news script.
2. Group Discussion (30 Marks)
3. Refining Professional Competence
   Assignment: Corporate Dilemma Role play (20 Marks)
   - Scenario-based role play on professional etiquette (handling client complaints, rejecting proposals kindly, etc.).
   - Each student submits a formal email responding to the scenario professionally.
4. Developing a Professional Profile
   Assignment: LinkedIn Challenge (30 Marks)
   - Students create or optimize their LinkedIn profile and write a compelling post (e.g., career reflections, lessons from a recent project).
   - Submit a screenshot of updated profile + link to post.
   - Optional: Engage with at least three classmates' posts with meaningful comments.

Text Books:

1. English for Engineers and Technologists. Volume I by Orient Blackswan, 2022
2. English for Science & Technology - I by Cambridge University Press, 2023

References:

1. Seely, John. Oxford Guide to Effective Writing and Speaking: How to Communicate Clearly. Oxford University Press, 2013.
2. Cottrell, Stella. Critical Thinking Skills: Developing Effective Analysis and Argument. Bloomsbury Academic, 2017.
3. Bhatnagar, Nitin. Communicative English for Professional Courses. Pearson, 2010.
4. Guffey, Mary Ellen, and Dana Loewy. Essentials of Business Communication. Cengage Learning, 2021.
5. Collins, Patrick. Speak with Power and Confidence: Tested Ideas for Becoming a More Powerful Communicator. Prentice Hall, 2009.
6. Locker, Kitty O., and Stephen Kyo Kaczmarek. Business Communication: Building Critical Skills. McGraw-Hill, 2020.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	1	1	1	1	1	-	-	-
CO2	-	1	-	1	-	-	-	1	1	-	1	-	-

CO3	-	-	-	-	-	-	-	-	1	-	1	-	-
CO4	-	-	-	-	-	-	1	1	1	-		-	-
CO5	-	-	-	-	-	-	-	1	1	-	1	-	-
CO6	-	-	-	-	-	-	-	-	-	-	1	-	-
AVG	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**

BS24321 System Discovery and Analysis HSMC L T P C

0 0 2 0

The purpose of the System discovery and analysis laboratory is to expose Electronics and Communication Engineering students to the practical aspects of analyzing and understanding electronic systems. This course focuses on reverse engineering as a method for discovering how a system's hardware and software components are organized and how they work together to perform key functions.

Course Objectives:

- To identify and prioritize the customer requirements in relation to the product functionality.
- To map the product's relationships with users, subsystems, and external elements.
- To perform systematic disassembly and understand the functional structure of a product.
- To apply insights from system analysis and propose alternative or improved design solutions.
- To enhance teamwork, technical documentation, and presentation skills through collaborative lab work.

List of Experiments:

1. Hardware disassembly and operating system installation for standalone machines.
2. Reverse engineering of a smart assistant device.
3. System breakdown and analysis of a BP Measurement device.
4. Study and functional decomposition of a Hearing Aid.
5. Functional analysis of a Walkie Talkie.
6. Analysis of an FM Transmitter and Receiver / Bluetooth speaker.
7. Sensor-to-Cloud system using IoT.
8. Team presentation on proposed design or redesign of an any existing product.

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1. Interpret customer requirements relevant to product functionality.
CO2. Map system interactions among users, subsystems, and external elements.
CO3. Perform systematic product disassembly and document key components and functions.
CO4. Construct functional models (e.g., Bull, Octopus and FAST diagrams) to represent product operation and structure.
CO5. Propose alternative design concepts based on system analysis and benchmarking.
CO6. Demonstrate teamwork, documentation, and presentation skills through lab activities.

Laboratory Requirements:

- Laptop/PC/Raspberry Pi
- Smart assistant devices like amazon echo.
- Automatic BP monitor.
- Digital or analog hearing aid.
- Walkie Talkie units.

- FM Transmitter & Receiver Kits / Bluetooth Speaker.
- IoT device (e.g., Smart Thermometer, Fitness Tracker, Smart Plug)
- Disassembly Toolkit, Multimeter & Oscilloscope.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	3	2	-	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	2	-	-	-	-	-	-	-	-
CO4	-	-	3	-	2	-	-	-	-	-	-	-	-
CO5	-	-	3	3	2	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	3	-	-	-	-
Avg.	**-**	**-**	**2.5**	**2.8**	**2.7**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**

BS24301	Environmental Science and Sustainability	BSC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce the basic concepts of environment, ecosystems.
- To emphasize on the biodiversity of India and its conservation.
- To familiarise with the causes and effects of different types of pollution in the environment.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability.
- To impart knowledge about waste management and their recovery methods.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles.

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Ecosystem and Energy flow – food chain, food web, ecological pyramids-ecological succession. Types of biodiversity: genetic, species and ecosystem diversity – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – endangered and endemic species of India, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Air, Water, Soil, Thermal and Noise Pollutions. Nuclear hazards and human health risks-case study. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection-Air act, Water act, Environmental protection act. Role of an individual in prevention of pollution.

UNIT III SUSTAINABILITY AND MANAGEMENT 9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals - intervention areas- Climate change-global warming, acid rain, Ozone layer depletion- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT IV WASTE MANAGEMENT AND RESOURCE RECOVERY 9

Biodegradable, non-biodegradable wastes, Solid, Hazardous and E-Waste management. Bio-medical waste management, Concept of waste to energy processes (WTE) - Combustion, Pyrolysis, Landfill gas (LFG) recovery. Recycling of spent batteries, end-of-life vehicle (ELV) recycling-Waste engine oil recycling-Solvent recovery, Barriers for material recycling-social, legal and economic factors-Environment impact of waste recycling.

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non- conventional Sources-Ocean energy sources, Geothermal energy, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: To understand the functions of the environment, ecosystems.
CO2: To analyse the threats of biodiversity and their conservation.
CO3: To explain the types of environmental pollution and environment protection acts.
CO4: To recognize the different goals of sustainable development and environmental standards.
CO5: To correlate the different types of waste management and possible resource recovery methods.
CO6: To explain the sustainability practices pertaining to sustainable energy, sustainable habitat and sustainable urbanization.

Suggested Activities:

- Quiz
- Mind Mapping
- Group discussion
- Seminar
- Animated videos

Text Books:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998

References:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. edition 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
5. Erach Bharucha "Text book of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	3	-	-	-	-	2	2	1
CO2	2	1	-	-	-	3	-	-	-	-	2	2	1
CO3	3	2	-	-	-	3	-	1	-	-	2	3	2
CO4	3	2	1	-	-	2	-	-	-	-	2	3	2
CO5	3	2	1	-	-	2	-	1	-	-	2	3	2
CO6	3	2	1	-	-	2	-	1	-	-	2	3	2
Avg.	**2.7**	**1.6**	**1**	**-**	**-**	**2.5**	**-**	**1**	**-**	**-**	**2**	**2.7**	**1.6**

EC24401	Communication Theory	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce the concepts of Amplitude modulation and demodulation with spectral characteristics
- To learn the concepts of Angle modulation
- To understand various pulse modulation techniques
- To impart the knowledge in random process.

UNIT I AMPLITUDE MODULATION 9

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth - AM Generation - Square law and Switching modulator, DSBSC Generation - Balanced and Ring Modulator, SSB Generation - Filter, Phase Shift and Third Methods, VSB Generation - Filter Method, Hilbert Transform, Pre-envelope and complex envelope -comparison of different AM techniques, Superheterodyne Receiver.

UNIT II ANGLE MODULATION 9

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

UNIT III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation and Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process through a LTI filter.

UNIT IV NOISE CHARACTERIZATION 9

Noise sources - Noise figure, noise temperature and noise bandwidth - Noise in cascaded systems. Representation of Narrow band noise -In-phase and quadrature, Envelope and Phase - Noise performance analysis in AM and FM systems - Threshold effect, Pre-emphasis and de-emphasis for FM.

UNIT V SAMPLING AND QUANTIZATION 9

Low pass sampling - Aliasing- Signal Reconstruction-Quantization – Uniform and non-uniform quantization - quantization noise - Logarithmic Companding -PAM, PPM, PWM, PCM - TDM, FDM.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: To explain and differentiate various amplitude modulation techniques such as in terms of modulation index, power relations, and bandwidth.
CO2: To analyze the methods of AM generation and demodulation including square law, switching, balanced and ring modulators, and understand the working of a superheterodyne receiver.
CO3: To analyze and evaluate narrowband and wideband Frequency modulation systems.
CO4: To understand the principles of random processes in communication system design.
CO5: To analyze the noise performance of AM and FM systems.
CO6: To evaluate different pulse modulation techniques.

Suggested Activities:

- MATLAB/Scilab Simulation
- Hardware Implementation
- Receiver Design Project

- Seminar
- Quiz

Text Books:

1. Simon Haykin, "Communication Systems", 5th Edition, Wiley, 2022
2. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2014
3. Simon Haykins,"Digital Communication", Wiley standard Edition, 2006.

References:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2017
2. H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006
3. B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition Pearson Education 2007
4. D.Roody, J.Coolen, ―Electronic Communications, 4th edition PHI 2014.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	2	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	-	2	2	-	-	-	-	-	-	3	-
CO6	3	2	-	2	3	-	-	-	-	-	-	3	2
Avg.	**3**	**2.67**	**2**	**2**	**2.33**	**-**	**-**	**-**	**-**	**-**	**-**	**2.6**	**2**

EC24402 Electromagnetic Fields and Waves PCC L T P C

3 0 0 3

Course Objectives:

- To impart the knowledge on fundamental concepts of electromagnetic fields, and coordinate systems.
- To give insight into electrostatics principles, electric fields, potential, capacitance, and boundary conditions.
- To analyse magnetostatics, magnetic fields, inductance, and energy storage in magnetic materials.
- To derive and apply Maxwell's equations for electromagnetic wave propagation in different media.

UNIT I FUNDAMENTALS OF ELECTROMAGNETIC ANALYSIS 9

Electromagnetics and its importance, Vector Algebra, Rectangular, cylindrical and spherical coordinate systems, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem.

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, Capacitance, Parallel, cylindrical and spherical, capacitors, Electrostatic energy, Poisson's and Laplace's equations.

UNIT III MAGNETOSTATICS 9

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of 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, Maxwell's Amperes law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields, Observing the Phenomenon of wave propagation with the aid of Maxwell's equations.

UNIT V PLANE ELECTROMAGNETIC WAVES 9

Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic Power flow and Poynting vector, Normal incidence and oblique incidence at plane conducting boundary and at a plane dielectric boundary.

Total Periods:45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Relate fundamental concepts of electromagnetic fields and coordinate systems.
CO2: Analyze the principles of electrostatics, including electric fields, potential, and field interactions.
CO3: Analyze capacitance, dielectric behavior, and boundary conditions in electrostatic fields.
CO4: Interpret magnetic field intensity, magnetic circuits, and forces in magnetostatics.
CO5: Apply Maxwell's equations for time-varying fields.
CO6: Analyze the plane wave propagation and power flow in different mediums.

Suggested Activities:

- 3D Animation videos Screening
- DIY Real time Experiments / Projects
- Seminars
- Article Reviews
- Peer Group Assignments

Text Books:

1. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006
2. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015.

References:

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 2002.
2. Kraus and Fleisch, Electromagnetics with applications, McGraw Hill Education; 5th edition, (1 July 2017).
3. Joseph A Edminister, Schaum's Outline of Electromagnetics, McGraw Hill Education; 2nd edition, July 2017
4. Edward C. Jordan and Keith G.Balmain, Electromagnetic Waves and Radiating Systems, Pearson Education, Second edition, 2015.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	2	-	-	-	-	-	-	2	3	-
CO3	3	3	2	2	-	-	-	-	-	-	2	3	-
CO4	3	3	3	2	-	-	-	-	-	-	2	3	-
CO5	3	3	2	2	2	-	-	-	-	-	2	3	2
CO6	3	3	3	2	2	-	-	-	-	-	2	3	2
Avg.	**3**	**2.83**	**2.33**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2.83**	**2**

EC24411 Digital Signal Processing **PCC** **L T P C**

3 0 2 4

Course Objectives:

- To learn the Discrete Fourier Transform (DFT), its properties, and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR and FIR filters, and apply them for filtering unwanted signals in different frequency bands.
- To study the effects of finite precision representation on digital filters.
- To understand the fundamental concepts of multirate signal processing and its applications.
- To implement and analyze DSP algorithms using simulation tools and hardware platforms.
- To Interpret the architecture and application of a digital signal processor.

UNIT I DISCRETE FOURIER TRANSFORM **9**

Discrete Fourier transform (DFT), properties of DFT - periodicity, symmetry, circular convolution, Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method, Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT),Radix-2 Decimation-in-frequency (DIF) Fast Fourier transform .

UNIT II DESIGN OF IIR FILTERS **9**

Design techniques for analog filter: Butterworth and Chebyshev approximations, Frequency transformation; IIR digital filter design (LPF and HPF): Approximation of derivatives, Bilinear transformation, Impulse Invariance method; Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III DESIGN OF FIR FILTERS **9**

Design of FIR filters: symmetric and Anti-symmetric FIR filters; Design of FIR filters using windowing techniques: Rectangular, Hamming, and Hanning, and frequency sampling method; FIR filter structures - linear phase structure, direct form realizations

UNIT IV FINITE WORD LENGTH EFFECT **9**

Fixed and floating point number representation –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 MULTIRATE DIGITAL SIGNAL PROCESSING AND DSP ARCHITECTURE 9

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor, Fixed-Point and Floating-Point DSPs: Architecture, addressing modes, and instruction sets of TMS320C5X and TMS320C6X families.

Periods: 45

List of Experiments:

SIMULATION USING MATLAB / EQUIVALENT SOFTWARE PACKAGES

1. Frequency analysis using DFT
2. Linear and circular convolution
3. Design of Butterworth and Chebyshev IIR filter
4. Design of FIR filter using windowing techniques

DSP PROCESSOR BASED IMPLEMENTATION:

5. Perform MAC operation using various addressing modes
6. Generation of sine, square and triangular signals
7. Design IIR & FIR filter
8. Implementation of up-sampling and down-sampling

Periods: 30

Total Periods: 75

Course Outcomes:

On completion of the course, the students will be able to

CO1: Implement the Discrete Fourier Transform (DFT) of a given signal using Fast Fourier Transform (FFT) techniques.
CO2: Realize digital IIR filters using various transformation techniques and standard structures through simulation and DSP processors.
CO3: Implement FIR filters using different windowing and sampling techniques.
CO4: Examine the effect of quantization on digital filter coefficients and evaluate finite word-length effects in DSP system design.
CO5: Implement multirate filters for signal processing applications using DSP processors.
CO6: Analyze the DSP processor architectures.

Suggested Activities:

- Moodle quiz, Mini project , Group activity in problem solving,Simulation-Based Assignments,Hands-on Hardware Implementation, Journal Review

Text Books:

1. John G. Proakis, Dimitris G Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 2022, 5th Edition, Pearson, USA
2. A.V.Oppenheim,R.W.Schafer and J.R.Buck,-Discrete time signal processing,8th Indian Reprint,Pearson,2010

References:

1. A textbook of Digital Signal Processing, R.S.Kaler, M.Kulkarni, Umesh Gupta, 1st edition, 2019, Dream tech Press, Wiley, India
2. James McClellan, Ronal Schaeffer, Mark Yoder, Digital Signal Processing first, 2016, 2nd edition, Pearson, USA
3. Lizhe Tan, Jean Jiang, Digital Signal Processing: Fundamentals and applications, 3rd edition, 2018, Academic Press, USA
4. S.K.Mitra, Digital Signal Processing, 2013, 4th edition, TMH, New Delhi, India.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	1	3	3
CO2	3	3	3	3	1	-	-	-	-	-	1	3	3
CO3	3	3	3	3	2	-	-	-	-	-	1	2	2
CO4	3	3	2	2	2	-	-	-	-	-	1	2	2
CO5	3	3	2	2	3	-	-	-	-	-	2	2	2
CO6	3	2	2	2	3	-	-	-	-	-	1	2	2
Avg.	**3**	**2.83**	**2.5**	**2.5**	**2.16**	**-**	**-**	**-**	**-**	**-**	**1.16**	**2.33**	**2.33**

EC24412 Linear Integrated Circuits **PCC** **L T P C**

3 0 2 4

Course Objectives:

- To familiarize students with the operational principles, characteristics, and design aspects of operational amplifiers and analog integrated circuits.
- To enable students to design and analyze both linear and non-linear applications of operational amplifiers.
- To introduce the principles and applications of data converters for signal processing.
- To expose students to the functionalities and practical applications of specialized integrated circuits such as timers, PLLs, and analog multipliers.
- To develop skills for designing waveform generation circuits and using IC voltage regulators for various real-time applications.

UNIT I OPERATIONAL AMPLIFIER PRINCIPLES AND CHARACTERISTICS 9

Op-Amp Basics: Block diagram and Pin configuration (IC 741); Ideal and Practical Op-Amp characteristics; General Op-Amp stages ;DC and AC performance characteristics ; Slew rate ; Open-loop and Closed-loop configurations

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Linear applications : Voltage Follower, Summing, Scaling amplifiers - Instrumentation amplifier - Integrator and Differentiator - V-to-I and I-to-V convertors, Low pass and High pass First order and Second order active filters, Band Pass active filters

Non-linear applications: Comparators and Zero crossing detector – Schmitt trigger – Half wave and Full wave Precision rectifier – Peak detector – Sample and Hold circuits, Clipping circuits, Clamper circuits.

UNIT III DATA CONVERTERS 9

Digital-to-Analog Converters (DAC): Weighted Resistor, R-2R Ladder Networks, Analog-to-Digital Converters (ADC) : Successive Approximation, Flash, Dual Slope, Sigma-Delta.

UNIT IV SPECIAL FUNCTION ICs 9

Functional block, characteristics, modes & applications of 555 Timer IC; Phase Locked Loop (PLL) : Basic operation of PLL, 566 Voltage Controlled Oscillator IC, 565-Phase Locked Loop IC, Applications of PLL- FSK detection, Frequency multiplier; Analog Multiplier: Gilbert multiplier, AD 633 Analog multiplier IC

UNIT V WAVEFORM GENERATORS AND APPLICATION ICs 9

Waveform Generators : Sine wave generators, Multivibrators, Triangular wave generator; Application ICs: ICL8038 function generator ,IC Voltage regulators: Fixed voltage regulators LM78XX & LM79XX, Variable voltage regulators LM317 & IC723; LM 380 audio power amplifier.

Periods: 45

List of Experiments:

1. Inverting and Non-Inverting Amplifiers
2. Instrumentation Amplifier
3. Integrator and Differentiator Circuits
4. Active Filters (Low-Pass/High-Pass/Band-Pass)
5. Digital-to-Analog Converter (DAC) – R-2R Ladder.
6. Astable and Monostable Multivibrators using 555 Timer.
7. Sinusoidal RC Oscillators.
8. Fixed and Variable Voltage Regulators (LM78XX, LM317)

Periods: 30

Total Periods: 75

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply the basic principles and characteristics of operational amplifiers in practical circuit configurations.
CO2: Implement the designs of various linear and non-linear applications of op-amps.
CO3: Use data converters in practical applications for converting signals between analog and digital forms.
CO4: Apply the learnings of IC 555 timers, phase-locked loops, and multipliers in circuit designs.
CO5: Analyze waveform generators.
CO6: Analyze application ICs for voltage regulation and audio amplification.

Suggested Activities:

- Circuit simulation and analysis
- Quiz and gamified assessments
- Reverse engineering
- Hands-on Mini Projects
- Problem-Based Learning

Text Books:

1. D.Roy Choudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd.,6th Edition, 2021.
2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, 4th Edition, Tata Mc Graw-Hill, 2016

References:

1. Ramakant A. Gayakwad, “OP-AMP and Linear ICs”, 4th Edition, Prentice Hall / Pearson Education, 2015
2. Robert F.Coughlin, Frederick F.Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, Sixth Edition, PHI, 2001.
3. S.Salivahanan & V.S. Kanchana Bhaskaran, “Linear Integrated Circuits”, TMH, 3rd Edition, 2018.

Laboratory Requirements: (for a batch of 30 students)

- Breadboards, Regulated Power Supply (Dual DC, ±15V and ±5V), Multimeters , Function Generators, Oscilloscopes , Digital Storage Oscilloscope, Connecting wires ICs : IC741, IC555, LM78XX, LM317, DRB, Resistors and Capacitors.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	2	-	-	3	1
CO2	3	3	2	1	-	-	-	2	2	-	-	3	1
CO3	3	3	2	1	-	-	-	2	2	-	1	3	1
CO4	3	3	2	1	-	-	-	2	2	-	1	3	1
CO5	3	3	2	1	-	-	-	2	2	-	1	3	1
CO6	3	3	3	2	-	-	-	2	2	-	1	3	1
Avg.	**3**	**3**	**2.2**	**1.2**	**-**	**-**	**-**	**2**	**2**	**-**	**1**	**3**	**1**

CS24414 Object-Oriented Programming ESC L T P C

2 0 2 4

Course Objectives:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of classes and inheritance
- To define exceptions and interfaces and handle strings
- To develop a java application using I/O streams and generics classes
- To use packages and collections in java applications

UNIT I INTRODUCTION TO OOP AND JAVA 6

Overview of OOP – Object oriented programming paradigms – Features of Object-Oriented Programming –Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java

UNIT II CLASSES AND INHERITANCE 6

Defining classes in Java – Constructors-Methods -Access specifiers - Overloading Methods – Objects as Parameters – Returning Objects –Static classes- Static members. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance.

UNIT III INTERFACE, EXCEPTION HANDLING AND STRINGS 6

Interfaces- defining an interface, implementing interface, difference between classes and interfaces and extending interface- Exceptions –- throwing and catching exceptions - built-in Exceptions – User defined Exception. String Manipulations

UNIT IV I/O AND GENERICS 6

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic

UNIT V PACKAGES AND COLLECTIONS 6

Packages – Packages and Member Access – Importing Packages - Collection Interfaces – Collection Classes.

Periods: 30

List of Experiments:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
3. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea ( ) that prints the area of the given shape.
4. Solve the above problem using an interface.
5. Implement exception handling and creation of user defined exceptions.
6. Implement Java programs to read and write programs using Files
7. Develop applications to demonstrate the features of generics classes.
8. Implement Java programs to use collections

Periods: 30

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply the concepts of classes and objects to solve simple problems
CO2: Develop programs using concept of inheritance
CO3: Make use of interface, exception handling mechanisms and strings to solve real world problems
CO4: Build Java applications with I/O packages, generics and multithreading concepts
CO5: Integrate the concepts of using packages and collections

Text Books:

1. Herbert Schildt, "Java the Complete Reference", 9th Edition, McGraw Hill Education, 2014
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

References:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	3	1	-	-	-	1
CO2	3	2	1	-	-	-	-	3	1	-	-	-	1
CO3	3	2	1	-	-	-	-	3	1	-	-	-	1
CO4	3	2	2	-	-	-	-	3	1	-	-	-	1
CO5	3	2	2	1	-	-	-	3	1	-	-	-	1
CO6	3	2	2	1	-	-	-	3	1	-	-	-	1
Avg.	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**	**-**	**1**

EC24422	Project Driven Learning[$]	EEC	L	T	P	C
			0	0	2	1

The Project-Driven Learning course in Electronics and Communication Engineering emphasizes applying core concepts through hands-on project. This pedagogical approach fosters a deeper engagement with the subject, empowering students to effectively integrate the acquired knowledge in project practices.

Through guided project:
A project that provides an integrated application of key concepts from Electronic circuits, Digital electronics, Linear integrated circuits, Signals and systems, Signal processing, Communication systems, Electromagnetic fields, and Control systems.

Course Objectives:

- To enable students to apply core concepts of Electronics and Communication Engineering in the design and execution of practical projects.
- To cultivate problem-solving and critical thinking skills through hands-on activities.
- To foster the integration of theoretical knowledge with real-world engineering practices.
- To encourage independent learning and teamwork through experiential learning activities.

UNIT I PROJECT ORIENTATION & PROBLEM STATEMENT 4

Focus:

- Understand project theme.
- Explore case studies and required domain knowledge.
- Define project scope and goals.

Key Activities:

- Introductory discussion
- Need Analysis
- Background research
- Problem statement writing
- Proposal development

Deliverables:

- Literature review
- Project proposal

UNIT II FOUNDATIONS & GUIDED DEVELOPMENT 4

Focus:

- Hands-on build of modules with guidance.
- Learn core tools, techniques, and frameworks.

Key Activities:

- Step-by-step guided builds
- Tutorials
- Peer demos

Deliverables:

- Working modules
- Progress

UNIT III SEMI-GUIDED CUSTOMIZATION & DESIGN 8

Focus:

- Modify or extend core project features.
- Apply design thinking, logic, and innovation.

Key Activities:

- Choose a feature

- Plan customization
- Peer feedback session

Deliverables:

- Mid-project report and presentation with modified feature
- New feature prototype or plan.

UNIT IV INDEPENDENT IMPLEMENTATION & TESTING 10

Focus:

- Autonomy in development.
- Troubleshooting and testing the project.

Key Activities:

- Feature implementation
- Testing and peer reviews
- Prepare final content

Deliverables:

- Partial demo of the project
- Testing results

UNIT V FINAL PRESENTATION & REFLECTION 4

Focus:

- Showcase project outcomes.
- Reflect on personal learning journey and project impact.

Key Activities:

- Presentation
- Self-assessment and peer feedback
- Discussion

Deliverables:

- Final project submission
- Presentation and demo

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply fundamental concepts of electronics and communication to develop functional project solutions.
CO2: Demonstrate the ability to identify, analyze, and solve engineering problems through practical implementation.
CO3: Integrate theoretical knowledge with practical skills to address real-world challenges.
CO4: Effectively plan, design, and execute projects within defined technical and resource constraints.
CO5: Work independently and collaboratively in teams to complete project-based tasks.
CO6: Communicate technical ideas and project outcomes clearly through oral presentations, reports, and demonstrations.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	3	3	3	2	-	-	-	-	-	2	2	2
CO3	2	2	3	2	2	-	-	-	-	-	3	2	2

CO4	-	2	3	2	2	-	-	-	-	2	2		
CO5	-	-	-	-	-	-	-	3	2	2	2		
CO6	-	-	-	-	-	-	-	2	3	-	2		
AVG	**2.3**	**2.3**	**2.8**	**2.3**	**2.0**	**-**	**-**	**2.5**	**2.5**	**2.0**	**2.2**	**2**	**2**

FC24301 Soft Skills[$] **HSMC** **L T P C**

2 0 0 1

Course Objectives:

- Understand and apply proper etiquette in social, corporate, and online interactions
- Develop effective verbal and nonverbal communication skills, including body language and posture
- Enhance participation in group discussions and structured professional conversations
- Prepare for job interviews with appropriate etiquette, research, and response techniques
- Communicate professionally in written formats such as emails, inquiries, and job offer letters
- Deliver structured and engaging presentations using storytelling and persuasive techniques

UNIT I ETIQUETTE **6**

- Social
- Corporate/Business - Meeting
- Telephone
- Netiquette

UNIT II BODY LANGUAGE AND NONVERBAL COMMUNICATION **6**

- Posture
- Personal grooming
- Facial expression/ gesture/eye contact

UNIT III GROUP DISCUSSION **6**

- Etiquette - Rules of conduct
- GD flow
- Pestel - Political, economic, social, tech, legal, environmental
- Handling unpredictable situation

UNIT IV JOB INTERVIEW – ETIQUETTE **6**

- Pre-interview prep and research
- Responding to non technical questions (star model - situation/task/ action plan/ result)
- Speaking your resume
- Writing inquiries and responding to job offer letters

UNIT V PRESENTATION SKILLS **6**

- Setting the tone/ storytelling
- JAM/ Turn your Court

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Demonstrate professionalism in meetings, telephone calls, and digital communication
CO2: Use appropriate body language, facial expressions, and gestures to enhance communication
CO3: Participate effectively in group discussions, debates, and structured dialogues
CO4: Apply job interview strategies, including answering behavioral questions using the STAR model
CO5: Write clear and professional business correspondence, including inquiries and job offers
CO6: Present ideas confidently with a structured approach, engaging tone, and strong delivery

Suggested Activities:

- **Role-Playing Business Meetings** – Students are assigned different corporate roles (CEO, Manager, Employee) and have them conduct a mock meeting with proper etiquette.
- Group Discussion
- **PESTEL Case Study** – Students analyze a real-world company using PESTEL factors and present their findings.
- **Resume Pitching** – Students present their resumes as a story, explaining their achievements in an engaging way.
- **Turn the Court Debate Organizer** – Students list arguments for and against a topic to prepare for persuasive speaking.

Work Sheets:

1. Business Meeting Etiquette Checklist – A checklist where students identify correct/incorrect meeting behaviors.
2. PESTEL Case Study Template – A table where students analyze a company using Political, Economic, Social, Technological, Environmental, and Legal factors.
3. STAR Method Interview Worksheet – Students write answers to common behavioral questions using the situation, Task, Action, Result format.

References:

1. Pachter, Barbara. The Essentials of Business Etiquette: How to Greet, Eat, and Tweet Your Way to Success. McGraw-Hill, 2013.
2. Pease, Allan, and Barbara Pease. The Definitive Book of Body Language. Bantam, 2004.
3. Gage, Martha. The Power of STAR Method: How to Succeed at Behavioral Job Interviews. Independently published, 2019.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	1	-	1	-	-
CO2	-	-	-	-	-	-	-	-	1	-	1	-	-
CO3	-	-	-	-	-	-	-	1	1	-	1	-	-
CO4	-	-	-	-	-	-	-	-	1	-	1	-	-
CO5	-	-	-	-	-	-	-	-	1	-	1	-	-
CO6	-	-	-	-	-	-	-	1	1	-	1	-	-
Avg.	-	-	-	-	-	-	-	1	-	-	1	-	-

EC24501	Digital Communication	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To analyze the performance limits of communication systems using Information Theory.
- To learn different waveform coding methods for digital signal representation.
- To grasp the basics of error control coding for reliable data transmission.
- To study common digital modulation and communication techniques.
- To gain knowledge of demodulation methods used for signal detection.

UNIT I INFORMATION THEORY AND SCHEMES FOR SOURCE CODING 9

Discrete Memory less source – Information - Uncertainty Information - Entropy: Basic Properties of Entropy - Conditional Entropy, Joint Entropy. Mutual Information - Discrete Memory Less Channels- Channel Capacity - Source Coding Theorem – Shannon-Fano & Huffman codes – Efficiency Calculations.

UNIT II WAVEFORM CODING & REPRESENTATION 9

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester Codes.

UNIT III ERROR CONTROL CODING 9

Channel Coding Theorem - Linear Block Codes - Hamming Codes - Cyclic Codes –Generator Polynomial, Parity Check Polynomial and Calculation of Syndrome - Convolutional Codes - Viterbi Decoder.

UNIT IV DIGITAL MODULATION AND DEMODULATION SCHEME 9

Coherent Binary and Quadrature Modulation Techniques-Noncoherent Binary Modulation Techniques- Comparison-M-ary Modulation Techniques-Power Spectra- Bandwidth efficiency-Effect of Intersymbol interference-Bit versus Symbol Error Probabilities-Synchronisation-Applications.

UNIT V MULTIPLEXING AND MULTIPLE ACCESS 9

Wireless Channels for passband transmission- Frequency Reuse- Channel Assignments- Time and Frequency-Division Multiplexing - Frequency Division Multiple Access- Time Division Multiple Access-Performance comparison of FDMA and TDMA- Code Division Channels-Space Division Multiple Access.

Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply the coding techniques in information theory.
CO2: Comprehend the characteristics of base band transmission schemes.
CO3: Design codes like linear block, cyclic, and convolutional for error detection and correction.
CO4: Assess the performance of error control codes in digital communication.
CO5: Analyze the working principle of various digital modulation schemes.
CO6: Analyze the effectiveness of various demodulation schemes.

Text Books:

1. Simon Haykins, "Digital Communications Systems", Wiley,5th Edition 2019.
2. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press,2003.

References:

1. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications: Fundamentals and Applications", Pearson Education, 2nd Edition, 2009.
2. John G. Proakis, "Digital Communications", McGraw Hill International Edition, 4th Edition,2001.
3. Taub& Schilling, "Principles of Communication Systems", Tata McGraw Hill, 4th Edition,2013.
4. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2nd Edition,2006.
5. Todd K.Moon, "Error Correction Coding: Mathematical Methods and Algorithms", John Wiley & Sons,2005.

MAPPING OF COs WITH POs AND PSOs

COs	Pos											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	1	3	2
CO2	3	3	3	2	1	-	-	-	-	-	1	3	2
CO3	3	3	3	2	1	-	-	-	-	-	1	3	2
CO4	3	3	3	2	1	-	-	-	-	-	1	3	2
CO5	3	3	3	2	1	-	-	-	-	-	1	3	2
CO6	3	3	3	2	1	-	-	-	-	-	1	3	2
Avg.	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

EC24502 Transmission Lines and RF Systems **PCC** **L T P C**

3 0 0 3

Course Objectives:

- To introduce the various types of transmission lines and its characteristics.
- To familiarize students with high frequency transmission line.
- To impart technical knowledge in impedance matching using smith chart.
- To introduce wave behaviour along guiding structures.
- To build competency in developing efficient RF network and amplifier designs for communication applications.

UNIT I TRANSMISSION LINE ESSENTIALS **9**

Lumped vs distributed networks - Primary & secondary line constants - Lossless and lossy transmission lines - Transmission line equations - Characteristic impedance, propagation constant and input impedance - phase velocity - Reflection coefficient, standing waves, Power transfer and mismatch loss - Distortion less line condition. Introduction to planar transmission lines: Strip lines, Slot lines and Microstrip line.

UNIT II HIGH FREQUENCY TRANSMISSION LINES **9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT III IMPEDANCE MATCHING TECHNIQUES 9

Impedance Transformation with λ/4, λ/2 and λ/8 Line Sections - Impedance matching by stub: Single stub method - Double stub matching - Smith chart: Applications.

UNIT IV WAVEGUIDES AND OPTICAL COMMUNICATION 9

Guided Waves Between Parallel Conducting Surfaces – TE and TM waves in Rectangular waveguides - cut-off frequency, phase constant, group and phase velocity, guided wavelength - Power transmission and attenuation in rectangular waveguides. TE and TM waves in circular waveguides, propagation characteristics - Transverse Electromagnetic waves. Optical fibre communication: Key elements - TIR - Mode theory for Circular waveguide.

UNIT V RF NETWORKS AND SYSTEM DESIGN 9

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors, Fundamentals of MMIC, RF Amplifier Design - Stability criteria, Rollett's stability factor, Amplifier power relations, Low noise amplifiers, Power amplifiers.

Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyze the behavior of lumped and distributed networks using transmission line theory.
CO2: Determine input impedance and reflection losses for various line terminations.
CO3: Analyze single and double stub matching networks for given load conditions.
CO4: Examine the impact of frequency and mode on power transmission and attenuation in waveguides.
CO5: Analyze the characteristics of RF semiconductor devices (BJTs, FETs, HEMTs) and apply stability criteria in amplifier design.
CO6: Examine the performance parameters of low-noise and power amplifiers in terms of gain, bandwidth, and noise for efficient RF system design.

Suggested Activities:

- Group Discussion.
- Tutorials.
- Simulation.

Text Books:

1. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2015.
2. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition, 2002.
3. Gred Keiser,"Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.

References:

1. Reinhold Ludwig & Gene Bogdanov, RF Circuit Design: Theory and Applications, 2nd Ed., Pearson, 2021.
2. Gupta, K.C., Microwave Engineering, New Age International, 2019.
3. Richard Chi-Hsi Li, "RF Circuit Design" – A John Wiley & Sons, Inc, Publications.
4. RF and Microwave Circuit Design for Wireless Communications-Lawrence E. Larson- Artech House, 2nd Edition, 2019.
5. T. L. Singh, Microwave and RF Engineering, PHI Learning, 2020.
6. 1.P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India)Private Limited, 2016.

MAPPING OF COs WITH POs AND PSOs

COs	Pos											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2

CO1	3	3	2	2	1	–	–	–	–	1	–	3	–
CO2	3	3	2	2	2	–	–	–	–	1	–	3	1
CO3	2	3	3	2	2	–	–	–	–	2	–	3	1
CO4	3	3	2	2	1	–	–	–	–	1	–	3	–
CO5	3	3	3	2	3	–	–	–	–	2	1	3	2
CO6	3	3	3	3	3	1	–	–	–	2	1	3	3
Avg.	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**1**	**3**	**2**

EC24511 VLSI and Chip Design **PCC** **L T P C**

3 0 2 4

Course Objectives:

- To understand MOS transistor operation, CMOS logic families, and the basics of fabrication and layout.
- To learn combinational circuit design with emphasis on speed and power reduction
- To study sequential circuits, pipelining techniques, and timing analysis.
- To analyze and design datapath components such as adders, multipliers, and shifters.
- To understand memory organization, ASIC design flow, and basic VLSI testing methods.
- To develop practical skills in designing and implementing VLSI circuits and subsystems using CAD tools.

UNIT I MOS TRANSISTOR THEORY **9**

MOS transistors (NMOS, PMOS) – Ideal IV Characteristics - Non-ideal IV effects - CV Characteristics - MOS transistor scaling - CMOS Logic – DC transfer characteristics - CMOS fabrication process - Stick diagram and Layout

UNIT II COMBINATIONAL CIRCUIT DESIGN **9**

Performance parameters: RC delay model, Linear delay model, Logical effort of paths, Power dissipation, Dynamic Power, Static Power.
Circuit families: Static CMOS, Ratioed circuits, Cascode Voltage Switch Logic, Dynamic circuits, Domino logic, Dual-rail Domino logic, Pass transistor logic, Transmission gates, Trade-offs in speed, power, and area of circuit families.

UNIT III SEQUENTIAL CIRCUIT DESIGN **9**

Static latches and registers - Dynamic latches and registers - Pulse registers - Sense amplifier based registers - Pipelining for optimization - Timing parameters and constraints in synchronous circuits.

UNIT IV DATAPATH SUB-SYSTEMS **9**

Adders: Static CMOS full adder, Mirror adder, Ripple carry adder, Carry bypass adder, Carry select adder, Carry lookahead adder - Multipliers: Array multiplier, Carry save multiplier, Wallace tree multiplier, Booth multiplier – one bit shifter - Barrel shifter.

UNIT V SEMICONDUCTOR MEMORIES, ASIC DESIGN AND TESTING **9**

Semiconductor memories: Memory architectures, ROM cells, SRAM and DRAM cells - ASIC design flow – Types of ASICs - Manufacturing test principles: Test vectors, Fault models, Observability, Controllability, ATPG - Design for Testability : Scan design, Built-In Self Test - Boundary Scan testing.

Periods: 45

List of Experiments

1. Design a CMOS inverter and obtain the DC transfer characteristics using VLSI EDA tools. Generate Layout from the schematic.
2. Design and simulate a complex static CMOS gate using VLSI EDA tools.
3. Design and simulate a Latch/Register using VLSI EDA tools.
4. Design, simulate and implement a 8-bit Ripple carry adder on FPGA using HDL.
5. Design, simulate and implement a 4-bit Wallace tree multiplier on FPGA using HDL.
6. Design, simulate and implement a 4-bit Booth multiplier on FPGA using HDL .
7. Design a 6T-SRAM cell using Cadence EDA and analyze its read/write operations.
8. Design a 4-bit synchronous counter using HDL. Perform ASIC design flow steps to generate the GDSII file.
9. Mini Project

Periods: 30

Total Periods: 75

Laboratory Requirements: (for a batch of 30 students)

- Desktop Computers: 30 Nos
- Cadence EDA/Equivalent EDA tool: 10 Nos
- Quartus / Xilinx software: 20 Nos

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyze MOS transistor and CMOS characteristics.
CO2: Design combinational circuits for performance, power efficiency, and area using various circuit families.
CO3: Analyze sequential circuits with timing constraints.
CO4: Analyze adders, multipliers, and shifters in datapath subsystems.
CO5: Analyze memory architectures and VLSI testing techniques.
CO6: Implement arithmetic architectures in digital ASIC design flow.

Suggested Activities:

- Circuit design and debug challenges.
- Collaborative mini projects.
- Lab integrated activities.
- Seminars on emerging technologies and recent advancements.

Text Books:

1. Neil H.E.Weste & David Money Harris, “CMOS VLSI Design: A circuits and Systems perspective”, Fourth Edition, Pearson College Div, 2010
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic “Digital Integrated Circuits: A Design Perspective”, Second Edition, Pearson Education,2016.

References:

1. A.Pucknell, Kamran Eshraghian, “BASIC VLSI Design”, Third Edition, Prentice Hall of India, 2007.
2. Samir Palnitkar,” Verilog HDL:A guide to Digital Design and Synthesis”, Second Edition, Pearson Education,2003

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	2	1	1	1	1	-	1	3	-
CO2	3	2	2	1	2	-	1	1	1	-	1	3	-

CO3	3	2	2	1	2	-	1	1	1	-	1	3	-
CO4	3	2	2	1	2	-	1	1	1	-	1	3	-
CO5	3	2	2	1	2	-	1	1	1	-	1	3	-
CO6	3	2	2	1	2	1	1	1	1	-	1	3	-
Avg.	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**3**	**-**

EC24512 Computer Networks **PCC** **L T P C**

3 0 2 4

Course Objectives:

- To introduce the foundational concepts of network architecture, protocols, and performance metrics.
- To explore the functionality of the link layer, media access control, and internetworking mechanisms.
- To develop a deep understanding of routing algorithms, IP addressing, and multicast communication.
- To examine transport layer protocols, congestion control techniques, and quality of service (QoS) mechanisms.
- To familiarize with application layer protocols, network services, and security fundamentals including firewalls and cryptography.

UNIT I NETWORKING FUNDAMENTALS & LINK LAYER **9**

Overview of Data Communications - Networks – Building Network and its types–Network Models: Protocol Layering – TCP/IP Protocol Suite - 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 & INTERNETWORKING **9**

DLC: Services- HDLC- PPP-MAC: Random Access – Wired LAN: Ethernet (802.3) - Wireless LANs : 802.11 – Bluetooth - Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP).

UNIT III ROUTING **9**

Routing - Unicast Routing :Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and Interdomain protocols – IPv6 Addressing –IPv6 Protocol– Transition from IPv4 to IPv6.

UNIT IV TRANSPORT LAYER **9**

Introduction to Transport layer : Protocols - User Datagram Protocols (UDP) - Transmission Control Protocols (TCP) : Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control - Congestion avoidance (DECbit, RED) – QoS

UNIT V APPLICATION LAYER **9**

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 - Introduction to Software Defined Networks - Network On Chip(NoC)

Periods: 45

List of Experiments

1. Implement the Data Link Layer framing methods
2. Implementation of Error Detection / Error Correction Techniques
3. Implementation of stop and wait and sliding window protocols

4. Study of socket programming and Client – Server model
5. Implementation of Distance vector and Link state routing algorithm
6. Encryption and Decryption.
7. Study of Network Simulator (NS) / Configuring network using Cisco Packet Tracer configure
8. Implement and realize the Network Topology - Bus and Ring using NS2.
9. Implement and perform the operation of CSMA/CD and CSMA/CA using NS2.

Periods: 30

Total Periods: 75

Laboratory Requirements for a batch of 30 students

- C / C++ / Java / Equivalent Compiler
- Network simulator like NS2/ Cisco Packet Tracer
- Desktop Computers – 30 Nos.

Course Outcomes:

On completion of the course, the students will be able to

CO1: Describe the fundamentals of data communication, network types, protocol layering, and the OSI model.
CO2: Explain the functions of the physical and data link layers, including link layer addressing and error detection / correction.
CO3: Analyze media access control techniques and evaluate the performance of wired and wireless networks
CO4: Demonstrate understanding of network layer using addressing and routing techniques.
CO5: Evaluate transport layer protocols and obtain its quality of service
CO6: Illustrate the functioning of application layer protocols and need of network security.

Suggested Activities:

- Quiz
- Mind map
- Peer Group Study
- Role Play

Text Books:

1. Behrouz.A.Forouzan, Data Communication and Networking, Fifth Edition, TMH, 2017.

References:

1. James.F.Kurose and Keith.W.Ross, Computer Networking – A Top – Down Approach, Sixth Edition, Pearson, 2017.
2. Doughlas .E.Comer, Computer Networks and Internets with Internet Applications, Fourth Edition, Pearson Education, 2008
3. Stallings.W., Data and Computer Communication, 9th Edition, Prentice Hall of India, 2011
4. Dimitrios Serpanos, Tilman Wolf, Chapter 13 - Networks on chips, 2011, Pages 239-248, https://doi.org/10.1016/B978-0-12-374494-4.00013-X.
5. Natalie Enright Jerger, Tushar Krishna, and Li-Shiuan Peh, On-Chip Networks, Second Edition, Synthesis Lectures on Computer Architecture, Springer, 2017. Cham. DOI: 10.1007/978-3-031-01755-1.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	3	2	-	-	1	1	-	2	3	2
CO2	3	2	2	3	2	-	-	1	1	-	2	3	2
CO3	2	3	2	2	3	-	-	1	1	-	2	3	2

CO4	3	3	3	2	3	-	-	1	1	-	2	3	2
CO5	3	2	3	2	2	-	-	-	-	-	2	3	2
CO6	2	2	3	3	2	-	-	1	1	-	2	3	2
Avg.	**2.5**	**2.3**	**2.7**	**2.5**	**2.3**	**-**	**-**	**1**	**1**	**-**	**2**	**3**	**2**

EC24513 Microprocessors and Microcontrollers PCC L T P C

2 0 2 3

Course Objectives:

- To introduce the fundamental concepts, architecture, and bus systems of microprocessors.
- To develop the ability to program 8086 using assembly language and understand its system configurations.
- To understand system bus timing and multiprocessor configurations for 8086.
- To provide insights into the architecture and programming of 8051 microcontrollers.
- To familiarize with the key features and interfaces of modern controllers like Node MCU and Raspberry Pi.
- To develop design skills for sensor interfacing and real-time control using ESP32.

UNIT I INTRODUCTION TO MICROPROCESSOR 6

Introduction to microprocessors, Memories, Basic architecture of a Microprocessor, 8086 – Microprocessor architecture, Bus signals.

UNIT II 8086 PROGRAMMING AND MULTIPROCESSOR CONFIGURATION 7

Addressing modes - Instruction set and assembler directives –Basic configurations, System bus timing, Multiprocessor configurations – Coprocessor, closely coupled and loosely Coupled configurations

UNIT III 8051 MICROCONTROLLER 7

Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Programming 8051 using SFRs- Timers - Serial Port and Interrupt Programming.

UNIT IV ADVANCED CONTROLLERS 5

Review of Arduino programming - Introduction to NodeMCU (ESP8266 / ESP32)- key features, GPIO structure, memory organization, and communication interfaces (UART, SPI, I2C, Wi-Fi). Raspberry Pi: The Raspberry Pi Boards - The Raspberry Pi Peripherals.

UNIT V CONTROLLERS AND APPLICATIONS 5

Interfacing and Controlling I/O devices by ESP32: LEDs - Push buttons - Light intensity sensor – Ultrasonic sensor – Temperature sensor- Humidity sensor - Sensor and Actuator interactions

Periods: 30

List of Experiments
Experiments using 8086: (6 hrs)
1. Introduction to Assembly Language programming
2. Arithmetic and Logical operations
3. Code conversion
4. Sorting and String manipulation (Search the byte of number, Ascending and Descending)

Experiments using 8051: (4 hrs)
1. Introduction to Assembly Language programming

2. Arithmetic and logical operations
3. Square and cube for the given number
4. Unpacked BCD to ASCII

Interface Experiments using 8051: (4 Hrs)

1. ADC and DAC
2. Stepper motor

Experiments Using IDE: (6 Hrs)

1. Introduction to High level language programming
2. Port operation
3. Serial data transfer

Node MCU Experiments (6 Hrs)

1. Development environment setup – Installation and programming using Arduino IDE
2. Sensor and actuator interfacing – temperature, humidity, and IR sensors – Data communication using Wi-Fi and MQTT.
3. Cloud connectivity and data visualization using IoT platforms (ThingSpeak, Blynk, Firebase).

Mini Project: (4 hrs)

Design a mini project based on the ESP32 and Raspberry pi.

Periods: 30

Total Periods: 60

Laboratory Requirements: (for a batch of 30 students)

1. 8086 development kit – 20 numbers
2. 8051 Development kit – 20 numbers
3. Node MCU – 10 numbers
4. Sensors – Temperature, Humidity, IR sensors (Required numbers)
5. Desktop PCs – 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the fundamental architecture, memory organization, and bus signals of microprocessors including 8086.
CO2: Apply the instruction set and assembler directives to program the 8086 microprocessor.
CO3: Analyze 8086 bus timings and multiprocessor configurations.
CO4: Demonstrate programming of 8051 microcontroller using SFRs, timers, interrupts, and serial communication in embedded applications.
CO5: Analyze the architecture, memory organization, and communication interfaces of ESP32 and Raspberry Pi for system design.
CO6: Implement ESP32 based real-time embedded applications through sensors and actuators interfacing.

Text Books:

1. R. S. Kaler, Microprocessors and Microcontrollers (2nd Edition, L.K. International) (UNIT I)
2. Krishna Kant, “Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096”. PHI 2007 (UNIT II)
3. David A. Patterson and John L. Hennessey, ―Computer Organization and Design‖, Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT II)
4. Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.(UNIT III)
5. Sami S.H and Kisheen Rao G “The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers”, CRC Press, 2022. (UNIT IV & V)

References:

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007.
2. A.K. Ray, K.M. Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012.
3. Bell C., “Beginning Sensor Networks with Arduino and Raspberry Pi”, Apress, 2013.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	1	-	2	1
CO2	3	3	2	2	1	-	-	-	1	2	-	2	2
CO3	2	3	3	2	3	-	-	-	1	2	-	2	2
CO4	2	3	3	3	3	1	1	2	2	3	2	3	3
CO5	3	3	3	3	3	1	1	2	2	3	2	2	3
CO6	2	3	3	3	3	1	1	2	3	3	3	2	3
Avg.	**2.50**	**3**	**2.50**	**2.33**	**2.60**	**1**	**1**	**2**	**1.80**	**2.33**	**2.33**	**2.17**	**2.33**

EC24521 Communication Systems Laboratory **PCC** **L T P C**

0 0 4 2

Course Objectives:

- To visualize the effects of sampling and TDM
- To implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

List of Experiments:

1. AM Modulator and Demodulator.
2. FM Modulator and Demodulator.
3. Signal Sampling and reconstruction.
4. Time Division Multiplexing.
5. Pulse Code Modulation and Demodulation.
6. Line coding schemes.
7. Pulse Amplitude Modulation, Pulse Width Modulation and Pulse Position Modulation.
8. Delta Modulation and Demodulation.
9. ASK and FSK generation schemes.
10. Simulation of DPSK, QPSK and QAM generation schemes
11. Simulation of ASK, FSK and BPSK detection schemes
12. Simulation of Linear Block and Cyclic error control coding schemes.
13. Simulation of Convolutional coding scheme.
14. Design and simulation of digital modulation schemes using SDR

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyze the process of signal sampling and reconstruction.
CO2: Implementation of Time Division Multiplexing (TDM).
CO3: Demonstrate the modulation and demodulation techniques in Analog communication (AM & FM).
CO4: Implement the Digital Modulation schemes (ASK, FSK, BPSK, DPSK, QPSK, QAM).
CO5: Realize the different line coding, pulse code modulation (PCM), and delta modulation (DM) techniques.
CO6: Simulate the error control coding schemes (Linear Block, Cyclic, Convolutional) and communication links.

Laboratory requirements for a batch of 30 students

1. Trainer kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes
2. CROs/DSOs – 15 Nos
3. Function Generators – 15 Nos
4. MATLAB or equivalent software package for simulation experiments
5. Desktop PCs - 15 Nos

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	1	-	-	1	2	1
CO2	3	3	2	2	2	-	-	1	-	-	1	2	1
CO3	3	3	2	2	2	-	-	1	-	-	1	2	1
CO4	3	3	2	2	2	-	-	1	-	-	1	2	1
CO5	3	3	2	2	2	-	-	1	-	-	1	2	1
CO6	3	3	2	2	2	-	-	1	-	-	1	2	1
Avg.	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**1**

EC24522 Mini Project **EEC** **L T P C**

0 0 2 1

Preamble:

Students gain practical experience in **solving real-world engineering problems** by working in teams. They identify needs, plan and manage the project using structured tools, create a working prototype, and present their results.

Prerequisite:

GE24123 – Design Thinking: Students were able to **discover user needs, ideate, visualize solutions**, and work in teams using the 5-step design thinking process.

BS24321 – System Discovery and Analysis: Students were able to **analyze how existing products** work, build functional models (Bull/Octopus/FAST), and document system interactions.

EC24422 – Project Driven Learning: Students were able to **apply core concepts through guidance by the faculty** and develop working modules and test.

Course Objectives:

- To enable students to identify and define a relevant problem.
- To apply project management tools for Need Analysis, Risk Analysis, Functional Analysis and plan to ensure systematic planning and execution.
- To design, implement, and validate a prototype addressing user needs.
- To foster teamwork, professional ethics, and technical communication through project execution and presentation.

WEEK 1&2: NEED IDENTIFICATION & PROPOSAL (4 hrs)
Students identify a real-world problem in core domain. They conduct a detailed need analysis using the Bull Diagram to define the project's purpose, users, and environment. Prepare a clear problem statement and project proposal.

Key Activities:

- Need Analysis
- Problem statement
- Proposal development

Deliverables:

- Problem statement and proposal

WEEK 3&4: PROJECT PLANNING & RISK MANAGEMENT (4 Hrs)
Students apply project management tools to plan their project timeline and manage potential challenges. They develop a Risk Analysis Matrix to identify and mitigate risks. Construct a PERT Chart to sequence tasks, estimate durations, and define dependencies.

Key Activities:

- Risk Analysis Matrix
- PERT Chart

Deliverables:

- Project plan
- Risk analysis

WEEK 5 to 7: FUNCTIONAL & SYSTEM DESIGN (6 Hrs)
Student teams perform functional and system-level analysis to model their proposed system. Using the Octopus Diagram, they identify system boundaries and external interactions. Through the FAST Diagram, they break down main functions into sub-functions and technical solutions.

Key Activities:

- Octopus Diagram
- FAST Diagram

Deliverables:

- Technical solution and Functional design
- Design documentation

WEEK 7 to 13: IMPLEMENTATION & TRACKING (14 Hrs)
Students transition from design to implementation. They use the Gantt Chart to schedule tasks and track progress.

Key Activities:

- Gantt Chart
- Budget proposal and tracking

Deliverables:

- Working prototype
- Project logbook submission

WEEK 14&15: TESTING, VALIDATION & MARKET STRATEGY (4 Hrs)
Students perform testing and validation to ensure their prototype meets the defined requirements. They do value proposition and pitch their idea through a demonstration and oral presentation.

Key Activities:
- Final demo preparation
- Value proposition canvas

Deliverables:
- Pitch
- Proof of concept (Demo)

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify and define an engineering problem through structured need analysis.
CO2: Apply project management tools such as Risk Analysis, PERT, and Gantt charts to plan and organize project activities systematically.
CO3: Perform functional analysis using Bull, Octopus, and FAST diagrams to derive system requirements and specifications.
CO4: Design, develop, and validate a functional prototype that meets user-defined needs and technical constraints.
CO5: Work effectively as a team, demonstrating collaboration, responsibility, and ethical practices throughout the project lifecycle.
CO6: Communicate technical ideas, project outcomes, and reflections clearly through documentation, reports, and oral presentations.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	1	–	–	1	–	1	3	2
CO2	2	3	3	2	3	1	–	2	2	3	–	3	3
CO3	3	3	3	3	2	–	–	2	2	2	–	3	3
CO4	3	3	3	3	3	2	–	2	2	3	–	3	3
CO5	–	–	2	–	1	2	3	3	2	3	2	2	2
CO6	–	–	2	2	2	–	2	3	3	3	1	2	2
Avg.	2.75	3.00	2.50	2.40	2.00	1.50	2.50	2.40	2.00	2.80	1.33	2.67	2.50

PROFESSIONAL ELECTIVES

PEC2411	Optical Communication	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the fundamentals of optical fiber communication systems
- To analyze transmission characteristics such as attenuation and dispersion
- To explore optical sources and detectors.
- To examine optical receivers and measurement techniques.
- To design optical communication systems and networks

UNIT I INTRODUCTION TO OPTICAL FIBERS 6

Optical Fiber Communication System - Optical Laws and Definitions - Optical Fiber Modes and Configurations - Mode Theory for Circular Waveguides- Single Mode Fibers – Graded Index Fiber Structure

UNIT II TRANSMISSION CHARACTERISTICS OF OPTICAL FIBER 6

Attenuation: Absorption , Scattering , Bending Losses – Signal Dispersion in Fibers : Modal Delay , Factors Contributing to Dispersion , Group Delay , Material Dispersion , Waveguide Dispersion , Dispersion in Single Mode Fibers , Polarization Mode Dispersion

UNIT III OPTICAL SOURCES AND DETECTORS 6

Optical Sources: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation of an LED, Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, Laser Diode Structures and Radiation Patterns, Modulation of Laser Diodes.
Detectors: Physical Principles of Photodiodes - PIN Photodetector - Avalanche Photo Diodes -Photodetector Noise

UNIT IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 6

Fundamental Receiver Operation - Digital Receiver Performance- Optical fiber measurements: Attenuation, Dispersion, Numerical Aperture, Diameter- LED Coupling to Single Mode Fibers - Fiber Splicing

UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 6

Digital Point-to-Point Links - Optical Networks: Network Concepts, Network Topologies, SONET/SDH, High Speed Light wave Links, Optical Ethernet.

Periods: 30

Laboratory Experiments:
1. Determination of Numerical Aperture for fibers
2. Measurement of attenuation and bending losses
3. Frequency response characteristics of fiber optic analog link.
4. BER characteristics of fiber optic digital link
5. DC Characteristics of LED
6. DC Characteristics of PIN Photo diode
7. Mode Characteristics of fibers

Periods: 30

Total Periods: 60

Laboratory requirement for a batch of 30 students

- Trainer kits for
  - carrying out LED and PIN diode characteristics
  - determining the mode characteristics, losses in optical fiber
  - Analyzing Analog and Digital link performance
  - Numerical aperture and Attenuation of fiber
- 2 Mbps PRBS Data source, 10 MHz signal generator, 20 MHz Digital storage Oscilloscope.
- Digital multi meter, optical power meter.
- MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors
- LEDs with ST / SC / E2000 receptacles – 650 / 850 nm
- PIN PDs with ST / SC / E2000 receptacles – 650 / 850 nm

Course Outcomes:

On completion of the course, the students will be able to

CO1: Realize basic elements in optical fibers, different modes and configurations.
CO2: Derive the transmission characteristics associated with attenuation and dispersion techniques.
CO3: Analyze the structural, material, and efficiency aspects of LEDs and LASER diodes for optoelectronic applications.
CO4: Explain the physical principles and operational mechanisms of photodiodes, including PIN and avalanche structures.
CO5: Analyze fiber optic receiver systems, measurements and coupling techniques.
CO6: Design optical communication systems and its networks.

Suggested Activities:

- Quiz
- Mind map
- Peer Group Study
- Journal Review

Text Books:

1. Gred Keiser,"Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.
2. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India)Private Limited, 2016

References:

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. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	1	1	-	1	1	-	2	3	1
CO2	3	3	3	2	1	1	-	1	1	-	2	3	1
CO3	3	3	2	2	1	1	-	1	1	-	2	3	1
CO4	3	3	2	2	1	1	-	1	1	-	2	3	1
CO5	3	3	3	2	-	1	-	-	-	-	2	3	1

CO6	3	3	3	2	-	1	-	-	-	-	2	3	1
Avg.	**3**	**3**	**2.7**	**2.0**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**3**	**1**

PEC2414 Satellite Communication **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To learn the basics of satellite orbits.
- To study about satellite segment and earth segment
- To grasp the knowledge of Link Power budget calculation
- To analyse various satellite access and coding technology.
- To study the applications of satellites.

UNIT I SATELLITE ORBITS **9**

Overview of satellite communications, frequency allocations of satellite services, design considerations of satellite communications, advantages & disadvantages of satellite communications.- Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non-Geo-stationary orbits , Look Angle Determination, limits of visibility, eclipse Sub satellite point, elevation angle calculation, azimuth angle calculation, Sun transit outage-Launching Procedures , launch vehicles and propulsion.

UNIT II SPACE SEGMENT **9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion - communication Payload and supporting subsystems - Telemetry, Tracking and command-Transponders Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN **9**

Basic link analysis, Uplink and Downlink Design equation- Free space loss-Atmospheric effects, Ionospheric scintillation, Rain induced attenuation and interference, system noise temperature- Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING TECHNIQUES **9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, PAMA and DAMA Assignment Methods- compression – encryption, Coding Schemes.

UNIT V SATELLITE APPLICATIONS **9**

INTELSAT Series: INSAT, VSAT,- Mobile satellite services: GSM, GPS, LEO, MEO, Satellite Navigational System, GPS-Position Location Principles, Differential GPS, GPS C/A code accuracy, differential GPS, selective availability - C-Band and Ku-Band Home Satellite TV, Direct Broadcast satellites (DBS/DTH).

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify the satellite orbital parameter.

CO2: Analyse the satellite subsystems.

CO3: Comprehend the characteristics of satellite link power budget.
CO4: Access the performance of various access schemes for satellite services.
CO5: Apply different coding schemes, in satellite communication.
CO6: Analyse various satellite applications.

Text Books:

1. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2017.
2. Timothy Pratt, Charles, W.Bostain,Jeremy E.Allnutt,"SatelliteCommunication",3rd Edition, Wiley Publications,2021.

References:

1. Tri T. Ha, "Digital Satellite Communications", 2nd edition, Mc Graw Hill education, 2017.
2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communications Systems Engineering", 2nd edition , Prentice Hall/Pearson , 2013.
3. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan, 1999.
4. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
5. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 2003.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	1	3	2
CO2	3	3	3	2	-	-	-	-	-	-	1	3	2
CO3	3	3	3	2	-	-	-	-	-	-	1	3	2
CO4	3	3	3	2	-	-	-	-	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	-	-	1	3	2
CO6	3	3	3	2	-	-	-	-	-	-	1	3	2
Avg.	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

PEC2415 Software Defined Radio **PEC** **L T P C**

2 0 2 3

Course Objectives:

- To introduce the concepts of software radios.
- To know about RF implementation challenges for software defined radios.
- To understand the digital generation of signals.
- To learn the software and hardware requirements for software defined radios.

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO 6

Evolution of Software Defined Radio-The Need for Software Radios- Characteristics and Benefits of a Software Radio-Design Principles of a Software Radio- Basics of Cognitive Radio- Comparison of SDR and CR.

UNIT II RF IMPLEMENTATION 6

Radio Frequency implementation: Purpose of RF front-end, Dynamic range, RF receiver front-end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, Hybrid DDS-PLL systems.

UNIT III DIGITAL GENERATION OF SIGNALS 6

Comparison of direct digital synthesis with analog signal synthesis - Approaches to direct digital synthesis - Analysis of spurious signals - Performance of direct digital synthesis systems - Applications of direct digital synthesis.

UNIT IV SMART ANTENNAS 6

Benefits of smart antennas - Structures for beamforming systems - Smart antenna algorithms - Hardware implementation of smart antennas - Digital Hardware Choices-Key hardware elements.

UNIT V HARDWARE AND SOFTWARE FOR SDR & CASE STUDIES 6

DSP Processors: FPGA, ASICs- Trade-offs - Object oriented programming- Object Brokers - GNU Radio-USRP- Case Studies: SPEAK easy, JRTS, SDR-3000.

Periods: 30

List of experiments:

1. Study of SDR hardware kit
2. Design and Implementation of digital modulation schemes using SDR
3. Implementation of synchronization techniques using SDR
4. Channel Coding Techniques using SDR
5. Study of channel estimation techniques using SDR
6. Study of MIMO concepts using SDR

Periods: 30

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to

CO1: Demonstrate an understanding in the evolving paradigm of Software defined radio and technologies for its implementation.
CO2: Compare various digital synthesis procedures.
CO3: Analyze RF front-end architectures considering noise, distortion, and dynamic range.
CO4: Evaluate software-defined radios and hybrid DDS-PLL techniques for RF applications.
CO5: Implement Smart antenna techniques for software defined radio.
CO6: Comprehend various hardware and software requirements for software defined radios.

Text Books:

1. Jeffrey Hugh Reed, “Software Radio: A Modern Approach to Radio Engineering,” Prentice Hall Professional, 2002.
2. Tony J Rouphael, “RF and DSP for SDR,” Elsevier Newnes Press, 2008.

References:

1. P. Kenington, “RF and Baseband Techniques for Software Defined Radio,” Artech House, 2005.
2. Paul Burns, “Software Defined Radio for 3G,” Artech House, 2002.
3. Behrouz. F. Bourjney“ Signal Processing for Software defined Radios”, Lulu 2008.

MAPPING OF COs WITH POs AND PSOs

Cos	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	1	-	1	1	-	1	3	2
CO2	3	3	3	2	2	1	-	1	1	-	1	3	2
CO3	3	3	3	2	2	1	-	1	1	-	1	3	2
CO4	3	3	3	2	2	1	-	1	1	-	1	3	2
CO5	3	3	3	2	2	1	-	1	1	-	1	3	2
CO6	3	3	3	2	2	1	-	1	1	-	1	3	2
Avg.	**3**	**3**	**3**	**2**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**3**	**2**

PEC2421 Advanced Digital Signal Processing **PEC** **L T P C**

2 0 2 3

Course Objectives:

- To introduce the concepts of discrete time random signal processing
- To know about multirate signal processing and its applications
- To understand the spectrum estimation techniques
- To learn the concept of prediction theory and filtering
- To study the applications of adaptive and parametric signal processing

UNIT I MULTIRATE SIGNAL PROCESSING **6**

Convolution – Correlation - Multirate Signal Processing: Decimation, Interpolation, Sampling Rate Conversion by a rational factor –Filter Design and Implementation for sampling rate Conversion-Applications of Multirate Signal Processing

UNIT II LINEAR PREDICTION AND FILTERING **6**

Linear Prediction: Forward and Backward- Wiener filters for filtering and prediction –FIR Wiener Filter – IIR Wiener Filter.

UNIT III ADAPTIVE FILTERING **6**

FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive echo cancellation – adaptive channel equalization – RLS Algorithm.

UNIT IV SPECTRUM ESTIMATION **6**

Estimation of power spectra from finite duration observations of signals – Non parametric methods of spectrum estimation – the Bartlett and the Welch method – Parametric spectrum estimation – AR, MA and ARMA

UNIT V PARAMETRIC METHOD OF POWER SPECTRUM ESTIMATION **6**

AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

Periods: 30

List of experiments:

1. Study of autocorrelation and Cross Correlation of random signals
2. Design and Implementation of Multirate Systems.
3. Design and Implementation of Wiener Filter
4. Design and Implementation of FIR Linear Predictor
5. Design of adaptive filters using LMS algorithm
6. Spectrum Estimation using Bartlett and Welch Methods
7. Mini project

Periods: 30

Total Periods: 60

Laboratory Requirements: (for a batch of 30 students)

Desktop Computers: 30 Nos
Matlab /Equivalent tool: 30 users
DSP Processor – 10 Nos.

Course Outcomes:

On completion of the course, the students will be able to

CO1: Describe multirate signal processing and its applications.
CO2: Analyze discrete-time random signals and their properties.
CO3: Apply linear prediction and filtering techniques.
CO4: Design adaptive filters for signal processing applications.
CO5: Demonstrate spectrum estimation techniques.
CO6: Apply parametric methods for power spectrum estimation.

Suggested Activities

- Collaborative mini projects.
- Lab integrated activities.
- Review recent journal papers.

Text Books:

1. John G. Proakis & Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms & Applications, Fifth Edition, Pearson Education / Prentice Hall, 2025.
2. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993.

References:

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.
2. Haykin, Adaptive Filter Theory, 4th Edition, Pearson Education, New Delhi, 2006.
3. Sophoncles J. Orfanidis, “Optimum Signal Processing “, McGraw Hill, 2000.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	2	-	-	1	1	-	1	2	2
CO2	3	3	-	1	2	-	-	1	1	-	1	2	2
CO3	3	3	2	2	2	-	--	1	1	-	2	3	2
CO4	3	3	3	3	2	-	-	1	1	-	2	3	2
CO5	3	3	2	3	2	-	-	1	1	-	1	2	2

CO6	3	3	2	2	2	-	-	1	1	-	1	2	2
Avg.	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**2**

PEC2422 Image Processing **PEC** **L T P C**

2 0 2 3

Course Objectives:

- To introduce the fundamental concepts of digital image acquisition, representation, and color models.
- To develop understanding of image enhancement and restoration techniques in spatial and frequency domains.
- To impart knowledge of segmentation methods for extracting meaningful structures from images.
- To familiarize students with feature extraction and image compression techniques for efficient image analysis and storage.
- To enable students to apply digital image processing algorithms to real-world problem scenarios.

UNIT I DIGITAL IMAGE FUNDAMENTALS 6

Steps in Digital Image Processing – Components - Elements of Visual Perception - Image Sensing and Acquisition - Image Sampling and Quantization - Relationships between pixels - Color image fundamentals – RGB and HSI models - 2D transforms fundamentals: DFT & DCT

UNIT II IMAGE ENHANCEMENT 6

Gray level transformations - Histogram processing - Smoothing and Sharpening filters in spatial domain and Frequency domains: Ideal, Butterworth and Gaussian filters - Effect of preprocessing on machine learning accuracy

UNIT III IMAGE RESTORATION 6

Degradation model - Noise models - Mean Filters - Order Statistics filters - Adaptive filters - Notch Filters - Inverse Filtering - Wiener filtering

UNIT IV IMAGE SEGMENTATION 6

Edge detection - Edge linking via Hough transform – Thresholding- Region based segmentation : Region growing, Region splitting and merging - Morphological processing: Erosion and Dilation, Segmentation by morphological watersheds - Segmentation for Machine learning based classification.

UNIT V FEATURE EXTRACTION AND IMAGE COMPRESSION 6

Feature extraction: Boundary Representation, Chain codes, Signatures, Boundary descriptors, Regional Descriptors, Topological descriptors - Features as inputs for Machine learning algorithms.
Image compression : Need for data compression, Huffman, Run Length Encoding, Arithmetic coding, JPEG standard

Periods: 30

List of experiments:
Use MATLAB/Equivalent Simulation tool, to perform

1. Contrast Enhancement using Gray-Scale Transformations
2. Image Restoration using Spatial Filtering Techniques
3. Edge Enhancement using Spatial Filters
4. Frequency Domain Processing using DFT and DCT for Denoising and Compression

5. Image Segmentation for Extracting Meaningful Regions
6. Mini Project: Application of Image Processing Techniques

Periods: 30

Total Periods: 60

Laboratory Requirements: (for a batch of 30 students)
Desktop Computers: 30 Nos
Matlab /Equivalent tool: 30 users

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the fundamentals of digital image formation, color models, sampling, and quantization.
CO2: Apply image enhancement techniques in spatial and frequency domains to improve image quality.
CO3: Perform image restoration techniques to reduce noise and recover degraded images.
CO4: Implement image segmentation methods to extract meaningful regions and object boundaries.
CO5: Extract relevant image features and represent images using appropriate descriptor techniques.
CO6: Apply image compression methods to reduce storage while retaining image quality.

Suggested Activities

- Collaborative mini projects.
- Lab integrated activities.
- Review recent journal papers.

Text Books:

1. Rafael.C.Gonzalez, Richard.E. Woods and Steven L. Eddins, "Digital Image Processing using Matlab", 4th Edition, Gatesmark Publishing, 2018.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2015.

References:

1. William K. Pratt, "Introduction to Digital Image Processing", CRC Press, 2013.
2. I Erik Cuevas , Alma Rodriguez, "Image Processing and Machine Learning: Advanced Topics in Image Analysis and Machine Learning" Volume 2,CRC Press, A Chapman & Hall Book, 2024
3. Oge Marques, "Practical Image and Video Processing using MATLAB", Wiley-IEEE Press, 2011, ISBN: 978-0-470-04815-3.
4. Al.Bovik, "The Essential Guide to Image Processing", Academic Press, 2009.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	-	1	1	1	1	1	-	1	3	2
CO2	3	2	2	1	2	1	1	1	1	-	1	3	2
CO3	3	2	2	1	2	1	1	1	1	-	1	3	2
CO4	3	2	2	1	2	1	1	1	1	-	1	3	2
CO5	3	2	2	1	2	1	1	1	1	-	1	3	2
CO6	3	2	2	1	2	1	1	1	1	-	1	3	2
Avg.	**3**	**1.8**	**1.8**	**1**	**1.8**	**1**	**1**	**1**	**1**	**-**	**1**	**3**	**2**

PEC2434	Advanced Antenna Design	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce fundamental antenna concepts
- To develop knowledge on microstrip antennas
- To familiarize students with advanced antenna technologies
- To impart understanding of antennas used in various applications
- To provide insight into terahertz and nano-scale antennas

UNIT I ANTENNA PARAMETERS AND ARRAYS 6

Introduction –Types of Antennas – Radiation Mechanism – Current distribution on wire antennas – Maxwell's equations - Antenna fundamental parameters One Dimensional Arrays,Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level;Two dimensional uniform arrays;smart antennas,switched beam and adaptive arrays, phased arrays.

UNIT II MICROSTRIP ANTENNAS 6

Radiation Mechanism and Excitation techniques : Microstrip dipole; Patch, Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Reconfiguration Mechanisms; Computer Aided Design of Microstrip Antennas, Microstrip Reflect array Antennas, Microstrip antenna for 5G mobile networks.

UNIT III ANTENNAS FOR 5G NETWORKS 6

Advanced antenna for 5G networks, digital and analog beam forming, Multi- antenna features, Multi user MIMO,cell-specific beam forming, UE-specific beam forming, advanced antenna system for network deployments, multi antenna performance in macro network deployments, deployment scenarios and considerations.

UNIT IV ANTENNAS FOR APPLICATIONS 6

Mobile phone antenna, base station, hand set antenna PIFA – Vivaldi Antennas – UWB Antennas - Antennas in Medicine – Leaky Wave Antennas – Plasma Antennas – Wearable Antennas – RFID Antennas - Automotive antennas, Reconfigurable antennas - Metamaterials.

UNIT V TETRAHERTZ AND NANO ANTENNAS 6

Material for Tera Hertz antennas. Tera Hertz sources, Tera Hertz antennas, Planar antenna and arrays, Reflect arrays, Lens antennas, Horn antennas, CNT antennas, Graphene antennas, applications of Tera Hertz antennas. Optical nano antennas and metamaterials.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Apply the operating principles, of different antennas to interpret their behavior and array configurations.
CO2: Design and analyze microstrip antennas and arrays using appropriate excitation techniques.
CO3: Evaluate advanced antenna technologies for 5G networks, including beamforming and multi-antenna systems.
CO4: Identify and compare antennas for practical applications such as mobile systems, medical devices, automotive, wearable and RFID.
CO5: Analyze the materials, design approaches, and performance characteristics of terahertz antennas, including planar arrays.
CO6: Interpret the principles of Nano-antennas and examine their applications with emphasis on metamaterial enhancements.

Suggested Activities

- 3D Animation videos Screening
- DIY Real time Experiments / Projects
- Seminars
- Article Reviews
- Peer Group Assignments

Text Books:

1. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006
2. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015

References:

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 2002.
2. Kraus and Fleisch, Electromagnetics with applications, McGraw Hill Education; 5th edition, (1 July 2017).
3. Joseph A Edminister, Schaum's Outline of Electromagnetics, McGraw Hill Education; 2nd edition, July 2017
4. Edward C. Jordan and Keith G.Balmain, Electromagnetic Waves and Radiating Systems, Pearson Education, Second edition, 2015
5. David Morgan, A Handbook for EMC Testing and Measurement, IET Electrical Measurement Series 8, Paperback Edition 2007
6. Shoogo Ueno and Tsukasa Shigemitsu, Bioelectromagnetism History, Foundations and Applications, CRC Press, Taylor & Francis Group, 1st Edition, 2022

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	2	1	–	–	–	–	–	3	2
CO2	3	3	2	2	2	1	–	–	–	–	–	3	2
CO3	3	2	3	2	3	1	–	–	–	–	–	3	3
CO4	2	2	3	2	2	1	–	–	–	–	–	2	3
CO5	2	3	3	2	3	1	–	–	–	1	1	3	3
CO6	2	3	3	3	3	2	–	–	–	1	–	3	3
Avg.	**2.5**	**2.5**	**2.6**	**2**	**2.5**	**1.2**	**-**	**-**	**-**	**1**	**1**	**2.8**	**2.6**

PEC2435 Radar Technologies **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To provide a strong foundation in radar principles and the influence of system parameters on radar performance.
- To develop analytical understanding of CW, MTI, and Pulse Doppler radar systems.
- To enable learners to examine tracking radar concepts and target state estimation for modern tracking applications.
- To impart knowledge of radar signal processing methods.

UNIT I INTRODUCTION TO RADAR SYSTEM 9

Radar fundamentals: The origin of Radar, Radar principles, Basic Block Diagram, Radar classifications based on Frequencies, Wave form and application, Detection, Range, velocity, Maximum Unambiguous Range - The simple form of the Radar equation, Pulsed radar equation - Detection of Signals in Noise - Receiver Noise, Signal-to-Noise Ratio- Probabilities of Detection and False Alarm - Integration of Radar Pulses, Radar Cross Section of Targets,- Transmitter Power, Pulse Repetition Frequency, Antenna Parameters, System losses.

UNIT II CW, MTI AND PULSE DOPPLER RADAR 9

CW and Frequency Modulated Radar - Airborne Doppler Navigation – Multiple Frequency CW Radar - Applications of CW-radar - MTI Radar: Delay Line Cancellers, Filter characteristics, Blind Speeds ,Staggered Pulse Repetition Frequencies - Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance - Pulse Doppler Radar.

UNIT III TRACKING RADAR 9

Tracking with Radar: Monopulse Tracking, Conical Scan, Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking - Comparison of Trackers - Track while Scan (TWS) Radar- Comparison of Tracker- Target prediction, state estimation- Measurement models: alpha – beta tracker, Kalman Filtering, Extended Kalman filtering - Tracking with surveillance Radar:. Synthetic Aperture Radar (SAR), Drone based Synthetic Aperture Radar, Air Surveillance Radar, Height Finder and 3D Radar.

UNIT IV RADAR SIGNAL PROCESSING 9

Radar Signal Processing Fundamentals - Detection strategies: Optimal detection, Threshold detection, Constant False Alarm Rate detectors, Adaptive CFAR - Pulse compression waveforms, compression gain, LFM waveforms matched filtering, radar ambiguity functions, radar resolution - Detection of radar signals in Noise and clutter, types of clutters, methods to overcome the clutters - detection of non-fluctuating target in noise, Doppler spectrum of fluctuating targets, Range Doppler spectrum of stationary and moving radar.

UNIT V RADAR TRANSMITTERS AND RECEIVERS 9

Radar Transmitter: Linear Beam Power Tubes, Solid State RF Power Sources, Magnetron, Crossed Field Amplifiers, Other RF Power Sources - Electronic Counter and Countermeasures - The Radar Receiver, Receiver noise power, Super heterodyne Receiver, Duplexers and Receiver Protectors - Radar Displays- Radar Antenna: Reflector Antennas , Electronically Steered Phased Array Antennas – Phase Shifters.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Identify the Radar parameters.
CO2: Differentiate various radar types.
CO3: Compare different tracking and filtering schemes
CO4: Apply signal processing in target detection.
CO5: List different types of clutter and methods to overcome the clutter & noise.
CO6: Design simple Radar transmitter and receiver blocks.

Suggested Activities

- Mini Project
- Journal Reviews

Text Books:

1. Habibur Rahman, Fundamental Principles of Radar, CRC press, Taylor and Francis, 2019.
2. M. R. Richards, J. A. Scheer, W. A. Holm, Editors “Principles of Modern Radar, Basic Principles”, SciTech Publishing, 2012.

References:

1. Nathansan, "Radar design principles-Signal processing and environment", PHI, 2nd Edition,2007.
2. M.I.Skolnik , "Introduction to Radar Systems", Tata McGraw Hill 2006.
3. Mark A. Richards, "Fundamentals of Radar Signal Processing", McGraw-Hill, 2005.
4. A. Bekar, M. Antoniou and C. J. Baker, "High-Resolution Drone-Borne SAR using Off-the-Shelf High-Frequency Radars," 2021 IEEE Radar Conference (RadarConf21), 2021, pp. 1–6.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	1	3	2
CO2	3	3	3	2	1	-	-	-	-	-	1	3	2
CO3	3	3	3	2	1	-	-	-	-	-	1	3	2
CO4	3	3	3	2	1	-	-	-	-	-	1	3	2
CO5	3	3	3	2	1	-	-	-	-	-	1	3	2
CO6	3	3	3	2	1	-	-	-	-	-	1	3	2
Avg.	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

PEC2441 Low power IC design **PEC** **L T P C**

2 0 2 3

Course Objectives:

- Introduce the fundamental sources of power dissipation in CMOS circuits.
- Enable students to apply analytical and statistical techniques for estimating power consumption.
- Provide knowledge of various power optimization techniques at algorithm, logic, and circuit levels.
- To study voltage scaling, multiple supply voltage techniques, and methods to minimize switched capacitance for reducing power in digital circuits.
- Develop understanding of low-power arithmetic circuit architectures.
- Familiarize students with techniques for designing low-power SRAM architectures.

UNIT I BASICS OF LOW POWER DESIGN **6**

Power dissipation in CMOS: Short circuit dissipation, Switching power dissipation, Leakage power dissipation, Load capacitance - Transistor leakage mechanisms: Reverse bias current, Weak inversion, Drain induced Barrier Lowering effect, Gate induced drain leakage, punchthrough, Gate oxide tunnelling, Hot carrier injection

UNIT II POWER ESTIMATION **6**

Signal Probability calculation - Probabilistic Techniques for signal activity estimation - Statistical Techniques - Estimation of Glitching power- Circuit level power estimation

UNIT III POWER OPTIMIZATION **6**

Algorithm level, Logical level and Circuit level power optimization techniques - Power reduction techniques in digital circuits : Voltage scaling techniques, Multiple supply voltages and minimizing switched capacitance.

UNIT IV LOW VOLTAGE, LOW POWER ADDERS AND MULTIPLIERS 6

Parallel adders : Ripple carry adder, carry lookahead adder, carry select adder - Parallel multipliers: Braun multiplier, Baugh-Wooley multiplier, Modified Booth multiplier, Wallace tree multiplier

UNIT V LOW POWER STATIC RAM ARCHITECTURES 6

Organization of a static RAM - MOS Static RAM Memory cell - Banked organization of SRAMs - Reducing voltage swings on bit lines - Reducing power in write driver circuits - Reducing power in sense amplifier circuits - Method for achieving low core voltages from a single supply.

Periods: 30

List of experiments:

1. Power estimation and optimization at algorithmic level.
2. Power estimation and optimization at RTL level.
3. Power estimation and optimization at gate level.
4. Power estimation and optimization at circuit/ transistor levels
5. Mini Project

Periods: 30

Total Periods: 60

Laboratory requirements:

- Personal Computers
- Cadence EDA/Equivalent EDA tool
- Quartus / Xilinx software

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the sources of power dissipation and leakage mechanisms in CMOS circuits.
CO2: Apply probabilistic and statistical techniques to estimate power consumption in digital circuits.
CO3: Compare algorithm-level, logic-level, and circuit-level power optimization strategies.
CO4: Apply suitable power reduction techniques to lower power dissipation in digital circuits.
CO5: Design low-power arithmetic units such as adders and multipliers for optimized performance.
CO6: Analyze SRAM architectures using low-voltage techniques to reduce memory subsystem power.

Suggested Activities

- Collaborative mini projects.
- Lab integrated activities.
- Review recent journal papers about low power.

Text Books:

1. Kaushik Roy, Sharat C. Prasad, “Low Power CMOS VLSI Circuit Design”, John Wiley, & Sons, 2000.
2. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits – Analysis and Design”,TMH, 2011.
3. Kiat-Seng Yeo, Kaushik Roy, “Low-Voltage, Low-Power VLSI Subsystems”, TMH Professional Engineering, 2004.

References:

1. Ming-BO Lin, “Introduction to VLSI Systems: A Logic, Circuit and System Perspective”, CRC Press, 2012.
2. Anantha Chandrakasan, “Low Power CMOS Design”, IEEE Press, /Wiley International, 1998
3. Bellamour, M. I. Elamasri, “Low Power CMOS VLSI Circuit Design”, A Kluwer Academic Press, 1995
4. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic Press, 2002

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	2	1	1	1	1	-	1	3	3
CO2	3	2	2	1	2	-	-	1	1	-	1	3	3
CO3	3	2	2	1	2	-	1	1	1	-	1	3	3
CO4	3	2	2	1	2	-	1	1	1	-	1	3	3
CO5	3	2	2	1	2	1	1	1	1	-	1	3	3
CO6	3	2	2	1	2	1	-	1	1	-	1	3	3
Avg.	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**3**	**3**

PEC2442 VLSI Testing and Design for Testability **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To help students understand why testing is needed and learn basic fault models and test metrics.
- To teach scan design and BIST methods used to test digital circuits and SoCs.
- To introduce memory testing techniques and test interfaces like JTAG and boundary scan.
- To explain design and power-related issues that arise during testing.
- To provide an understanding of how analog and mixed-signal circuits are tested.

UNIT I TEST REQUIREMENTS AND METRICS **9**

Validation platforms : SOC design methodology, IP components, Integration, Clocking, I/Os and interfaces, Device modes, Logic, memories, analog, I/Os, power management - Test requirements : Test handoffs, Testers where DUT and DFT fit into design / framework – Test: ATPG, DFT, BIST,COF, TTR - Test cost metrics and test economics - Logic fault models : SAF, TDF, PDF, IDDQ, STBDG, Dy-BDG, SDD - Basics of test generation and fault simulation - Combinational circuits, Sequential - Specific algorithmic approaches - CAD framework - Optimisations.

UNIT II SCAN DESIGN AND BIST **9**

Scan Design : Scan design requirements, Types of scan and control mechanisms, Test pattern construction for scan, Managing scan in IPs and SOCs, Scan design optimisations, Partitioning, Clocking requirements for scan and delay fault testing, Speed of operation – BIST: Framework, Controller configurations, FSMs, LFSRs, STUMPS architecture, Scan compression and bounds, Test per cycle, Test per scan, Self-testing and self-checking circuits, Online test

UNIT III MEMORY TEST AND TEST INTERFACES **9**

Memory Test : Memory fault models, Functional architecture as applicable to test, Test of memories, Test of logic around memories, BIST controller configuration, Test of logic around memories, DFT and architecture enhancements, Algorithmic optimisations - Test Interfaces : Test control requirements, Test interfaces - 1500, JTAG, Hierarchical, serial control, Module / IP test, SOC test, Board test, System test, Boundary scan.

UNIT IV DESIGN CONSIDERATIONS AND POWER MANAGEMENT DURING TEST **9**

Design considerations, Physical design congestion, Partitioning, Clocks, Test modes, Pins, Test scheduling, Embedded test, Architecture improvements, Test in the presence of security - Power management during test: Methods for low

power test, ATPG methods, DFT methods, Scan methods, Low power compression, Test of power management, Implications of power excursions, Optimisations.

UNIT V ANALOG TEST 9

Test requirements - DFT methods - BIST methods - Test versus measurement - Defect tests versus performance tests - Tests for specific modules - PLL, I/Os, ADC, DAC, SerDes - RF test requirements.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyze the basic test requirements and fault models in digital systems.
CO2: Apply scan design techniques for testing sequential and combinational circuits.
CO3: Implement Built-In Self-Test (BIST) methods for logic and SoC components.
CO4: Explain memory testing strategies and use standard test interfaces such as JTAG.
CO5: Describe low-power test techniques.
CO6: Describe testing approaches for analog and mixed-signal circuits including PLLs, ADCs, DACs, and I/O modules.

Suggested Activities

- Journal/Article review.
- Seminars/Presentations
- Moodle interactive activities

Text Books:

1. M. L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits", Springer, 2006

References:

1. H. Fujiwara, Logic Testing and Design for Testability, MIT Press, 1985.
2. M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, IEEE Press, 1994
3. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004
4. T. Kropf, Introduction to Formal Hardware Verification, Springer Verlag, 2000.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	1	3	2
CO2	3	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO4	3	2	1	-	-	-	-	-	-	-	1	3	2
CO5	3	2	1	-	-	-	-	-	-	-	1	3	2
CO6	3	2	1	-	-	-	-	-	-	-	1	3	2
Avg.	**3**	**2**	**1**	-	-	-	-	-	-	-	**1**	**3**	**2**

PEC2446	VLSI Signal Processing	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- To understand how DSP algorithms are represented and implemented in hardware.
- To learn techniques like pipelining, parallel processing, retiming, folding, and unfolding for improving system performance.
- To study systolic array design for efficient realization of DSP systems.
- To understand fast convolution methods and bit-level arithmetic architectures used in DSP hardware design.

UNIT I DSP SYSTEMS AND ALGORITHMS 9

Introduction - Overview of typical DSP Algorithms - Representations of DSP algorithms: Block diagram - Signal flow graph - Data flow graph - Dependence graph - Pipelining and parallel processing: Introduction, Pipelining and parallel processing of FIR digital filters

UNIT II ITERATION BOUND AND RETIMING 9

Iteration Bound: loop bound and iteration bound, Longest path matrix algorithm for iteration bound computation - Introduction to Retiming - Definition and properties of retiming - Solving system of inequalities – Cutset retiming and pipelining techniques for retiming

UNIT III FOLDING AND UNFOLDING 9

Unfolding: Introduction, Algorithm for unfolding, Properties of unfolding – Folding: Introduction, Folding transformation, Register minimization techniques.

UNIT IV SYSTOLIC ARCHITECTURE DESIGN 9

Introduction - Systolic Array Design Methodology - FIR Systolic Arrays - Selection of Scheduling Vector - Matrix Multiplication and 2D Systolic Array Design

UNIT V CONVOLUTION AND BIT LEVEL ARITHMETIC ARCHITECTURES 9

Fast Convolution: Cook-Toom Algorithm, Winograd Algorithm, Iterated Convolution and Cyclic Convolution – Bit level arithmetic architectures: parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, design of Lyon's bit-serial multipliers using Horner's rule

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Represent DSP algorithms using suitable graphical models.
CO2: Apply pipelining and parallel processing techniques to speed up DSP systems.
CO3: Use iteration bound and retiming concepts to optimize DSP hardware.
CO4: Perform folding and unfolding transformations to reduce hardware resources.
CO5: Design systolic array architectures for DSP applications.
CO6: Apply fast convolution and bit-level arithmetic methods in efficient hardware implementation.

Suggested Activities

- Problem solving sessions.
- Case study discussions.
- Journal/Article review.

Text Books:

1. R. Keshab K. Parhi, " VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.

References:

1. Mohammed Ismail, Terri, Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1993.
2. U. Meyer – Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004
3. Kung. S.Y., H.J. While house T.Kailath, VLSI and Modern signal processing, Prentice Hall,1985 .

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	1	-	-	-	-	-	-	1	3	2
CO3	3	2	2	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	1	-	-	-	-	-	-	1	3	2
CO5	3	2	2	1	-	-	-	-	-	-	1	3	2
CO6	3	2	2	1	-	-	-	-	-	-	1	3	2
Avg.	**3**	**2**	**1.8**	**1**	-	-	-	-	-	-	**1**	**3**	**2**

PEC2454 Wireless Sensor Network Design **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To understand the fundamentals of wireless sensor network
- To gain knowledge on the MAC, Routing Protocols of WSN
- To get exposed to 6LoWPAN technology
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LoWPAN.
- To gain knowledge about operating system related to WSN

UNIT I INTRODUCTION **9**

Principle of Wireless Sensor Network - Introduction to wireless sensor networks: Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4 - Zigbee and Bluetooth - Physical layer characteristics and Communication considerations.

UNIT II MAC AND ROUTING PROTOCOLS **9**

MAC protocols: Fundamentals, low duty cycle protocols and wakeup concepts - Contention and Schedule-based protocols: SMAC, BMAC- Routing protocols: Requirements- Classification: SPIN, Directed Diffusion, LEACH, PEGASIS.

UNIT III 6LoWPAN 9

6LoWPAN: Architecture, protocol stack, Adaptation Layer, Link layers – Addressing – Routing: Mesh-Under, Route-Over- Header Compression: Stateless header compression, Context- based header compression - Fragmentation and Reassembly- Mobility types: Mobile IPv6, Proxy MIPv6, NEMO- Routing: ROLL, Border routing.

UNIT IV APPLICATION LAYER PROTOCOLS 9

Design Issues - Protocol Paradigms: End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms - Web service protocols: REST, MQ telemetry transport for sensor networks (MQTT-S) - Service discovery - Real-time transport and sessions.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Sensor Node Hardware: Berkeley Motes, Programming Challenges, Node-level software platforms: TinyOS, nesC, CONTIKI OS- Node-level Simulators: NS2 and its extension to sensor networks, COOJA, TOSSIM.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Comprehend the fundamentals of Wireless Sensor Network Design concepts
CO2: Analyze the frame formats of MAC and Routing Protocols
CO3: Interpret optimizations incorporated in 6LoWPAN
CO4: Analyze mobility management and routing mechanisms in WSN
CO5: Design protocol and web service paradigms
CO6: Decide a specific programming platform for programming interfaces in WSN

Suggested Activities

- Quiz assessments
- Expert Video lectures
- Hands-on Mini Projects
- Problem-Based Learning

References:

1. Holger Karl , Andreas Willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley Publication, 2007.
2. Anna Forster, “Introduction to Wireless Sensor Networks”, Wiley, 2017.
3. Zach Shelby Sensinode and Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet” John Wiley and Sons, Ltd, Publication, 2011.
4. Philip Levis, “TinyOS Programming”, 2009.
5. Agus Kurniawan, “Practical Contiki-NG: Programming for Wireless Sensor Networks”, Apress, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	1	1	-	1	-	-	-	-	1	2	1
CO2	2	2	1	1	-	-	-	-	-	-	1	2	1
CO3	2	2	1	1	-	-	-	-	-	-	2	2	1
CO4	2	2	1	1	-	-	-	-	-	-	1	2	1
CO5	2	2	1	1	-	-	-	-	-	-	1	2	1

CO6	3	3	3	3	3	-	-	-	-	-	2	2	3
Avg.	**2**	**2**	**1.33**	**1.33**	**3**	**1**	-	-	-	-	**1.33**	**2**	**1.33**

PEC2455 IOT Based System Design **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To understand the basics of IoT.
- To gain knowledge about the various services provided by IoT.
- To familiarize with various communication and networking methodologies in IoT.
- To learn about IoT implementation tools.
- To explore various applications of IoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Rise of the machines – Evolution of IoT – Web 3.0 view of IoT – Definition and characteristics of IoT – IoT Enabling Technologies – IoT Architecture -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects - IoT levels and deployment templates – A panoramic view of IoT applications.

UNIT II MIDDLEWARE AND PROTOCOLS OF IOT 9

Middleware technologies for IoT system: IoT Ecosystem Overview, Horizontal Architecture Approach for IoT Systems, SOA based IoT Middleware- Middleware architecture of RFID, WSN, SCADA, M2M - Zigbee, KNX, BACNet, MODBUS - Challenges Introduced by 5G in IoT Middleware: Technological Requirements of 5G Systems, Perspectives, and a Middleware Approach towards 5G - COMPaaS Middleware.

UNIT III COMMUNICATION AND NETWORKING 9

IoT Access Technologies: Physical and MAC layers, Topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: 6LoWPAN, Routing over Low Power and Lossy Networks – Transport mechanisms: Tunnelling, Protocol Translation –Application Layer Protocols: CoAP and MQTT- Data aggregation & dissemination.

UNIT IV IOT IMPLEMENTATION TOOLS 9

Introduction to Python- Introduction to different IoT tools- Developing applications through IoT tools - Developing sensor-based applications through embedded system platform- Implementing IoT concepts with python- Implementation of IoT with Raspberry pi.

UNIT V IOT APPLICATIONS 9

Case Studies: Home automation - Smart cities – Environment – Energy – Retail – Logistics – Agriculture – Industry - Health and life style

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Articulate the main concepts, key technologies, strength and limitations of IoT.
CO2: Describe the middleware approaches for IoT and 5G systems

CO3: Compare the middleware architectures and protocols for IoT
CO4: Analyze the networking and inter-sensor communication in IoT.
CO5: Implement IoT concepts using python and Raspberry Pi
CO6: Analyze case studies on real time applications of IoT

Suggested Activities

- Quiz assessments
- Journal review
- Hands-on Mini Projects
- Problem-Based Learning

Text Books:

1. Honbo Zhou, "Internet of Things in the cloud:A middleware perspective", CRC press, 2012.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", VPT, 1st Edition, 2015.

References:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies,
2. Platforms, and Use Cases", CRC Press, 2017.
3. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, "Internet of
4. Things (IoT) in 5G Mobile Technologies" Springer International Publishing Switzerland 2016.
5. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer-Verlag Berlin Heidelberg, 2011.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	1	1	-	-	-	-	-	-	1	2	1
CO2	2	2	1	1	-	-	-	-	-	-	2	2	1
CO3	2	2	1	1	-	-	-	-	-	-	1	2	1
CO4	2	2	1	1	-	1	-	-	-	-	1	2	1
CO5	3	3	3	3	3	1	-	-	-	-	2	2	2
CO6	3	3	3	3	3	1	1	-	-	-	2	2	3
Avg.	2.17	2.17	1.67	1.67	3	1	1	-	-	-	1.50	2	1.5

PEC2463 MEMS Design **PEC** **L T P C**

2 0 2 3

Course Objectives:

- To introduce MEMS device principles using analytical and virtual modeling tools.
- To familiarize students with microsystem fabrication processes
- To enable students to analyze electromechanical behavior of microstructures
- To develop design for thermal, electrostatic, and piezoelectric MEMS devices.
- To expose students to real-world MEMS applications

UNIT I MICROSYSTEM AND FABRICATION TECHNIQUES 6

Overview: MEMS and Microsystem, Evolution of Microfabrication, Microsystems and Microelectronics, Microsystems and Miniaturization, Scaling Law - Microsystems Fabrication Processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical Vapor Deposition, Sputtering, Deposition by Epitaxy, Etching.

UNIT II ELECTRIC AND MECHANICAL CONCEPTS 6

Conductivity of semiconductors - Crystal planes and orientations - stress and strain - flexural beam bending analysis under simple loading conditions - Dynamic system - resonant frequency and quality factor.

UNIT III ELECTRO STATIC SENSING AND ACTUATION 6

Parallel plate capacitor: Capacitance of Parallel Plates, Equilibrium position of electrostatic actuator under bias, Pull-In Effect of Parallel-Plate Actuators - Interdigitated finger capacitors.

UNIT IV THERMAL AND PIEZOELECTRIC PRINCIPLES 6

Thermal Sensing and Actuation: Fundamentals of thermal transfer, Sensors and actuators based on thermal expansion, Thermal couples, Thermal resistors - Piezo electric sensing and actuation: Mathematical description of piezoelectric effects, Cantilever piezoelectric actuator model, properties of piezoelectric materials – Quartz, PZT,PVDF, ZnO.

UNIT V CASE STUDIES OF MEMS PRODUCTS 6

Comb drive actuator - Infrared Sensor - Piezo electric Tactile Sensor - Blood Pressure (BP) sensor – Microphone - Acceleration sensors – Gyros – RF MEMS.

Periods: 30

List of experiments:

1. Calculation of beam deflection under static load
2. Calculation of free vibration of a micro-beam
3. Model a parallel plate sensor/actuator
4. Design of comb drive actuator
5. Design of thermal bimorph actuator
6. Design and Simulation of piezo electric sensor under stress
7. Film Deposition / Wet Etching

Periods: 30

Total Periods: 60

Laboratory Requirements:

- MEMS Simulation Software
- Desktop Computers

Course Outcomes:

On completion of the course, the students will be able to

CO1: Explain the fundamental principles of Micro systems and devices.
CO2: Demonstrate understanding of microsystem fabrication techniques such as lithography, deposition, and etching.
CO3: Analyze the electromechanical characteristics of microstructures such as beams, capacitive plates, and comb drives.
CO4: Design and simulate electrostatic MEMS devices to meet specified performance parameters.
CO5: Design and simulate thermal and piezoelectric MEMS devices to meet specified performance parameters.
CO6: Evaluate the influence of material properties, geometry, and scaling effects on MEMS device.

Text Books:

1. Tai Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata Mcgraw Hill, 2017.
2. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2011.

References:

1. Murty B.S, Shankar P, Raj B, Rath, B.B, Murday J, Textbook of Nanoscience and Nanotechnology, Springer publishing, 2013.
2. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures", CRC Press, 2002
3. Vinod Kumar Khanna Nanosensors: Physical, Chemical, and Biological, CRC press,2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	2	3	2
CO2	3	2	-	2	3	-	-	-	-	-	2	3	2
CO3	3	3	2	2	3	-	-	-	-	-	2	3	3
CO4	3	2	3	2	3	-	-	-	-	-	2	3	3
CO5	3	2	3	2	3	2	-	-	-	-	2	3	3
CO6	3	3	2	3	3	-	-	-	-	-	3	3	3
Avg.	3.0	2.3	2.5	2.2	2.8	2.0	-	-	-	-	2.2	3.0	2.7

PEC2464 Sensors and Actuators **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To understand the characteristics of the measurement system
- To gain knowledge about the variable resistance sensors, variable inductance sensors and special sensors
- To design the actuator for automotive application
- To design temperature control actuators and controllers for automotive application

UNIT I INTRODUCTION TO MEASUREMENTS AND TRANSDUCERS 9

Principle of transduction: Classification of transducers - Sensors and Actuators: Functions, Classifications, Main technical requirement and trends - Need for Calibration - Classification of errors- Error analysis- Limiting error- Probable error - Propagation of error- Odds and uncertainty- Static characteristics and Dynamic characteristics.

UNIT II VARIABLE RESISTANCE AND INDUCTANCE SENSORS 9

Principle of operation- Construction details- Characteristics and applications of Resistive potentiometer: Strain gauges, Resistive thermometers, Thermistors and Piezoresistive sensors- Inductive potentiometer: Variable reluctance transducers and LVDT.

UNIT III SPECIAL SENSORS 9

Principle of operation- Construction details- Characteristics of Variable air gap type, variable area type and variable

permittivity type capacitive transducer: Application: Capacitive Microphone - Piezoelectric, Magneto-strictive, Hall Effect, Digital Encoding and Optical displacement transducer – Automotive climate control: Humidity. Rain, Solar, Light and Antiglare sensor.

UNIT IV AUTOMOTIVE ACTUATORS 9

Principle of operation - Construction details - Characteristics of Electromechanical actuators and Fluid-mechanical actuators - Electrical machines: DC and AC machines, Duty-type ratings – Location and operation of Solenoid, Relay and Stepper motor in Automotives.

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS 9

Fundamentals of HVAC system- Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Controller for Fixed and variable displacement type air conditioning system

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Comprehend the characteristics and errors in measurements using sensors
CO2: Design measurement equipment system using variable resistance and inductance sensors
CO3: Analyze the variable capacitance transducer
CO4: Design measurement equipment system using special sensors
CO5: Generate new ideas in designing the actuators for automotive application
CO6: Design temperature control actuators and controllers for vehicles and air conditioning system

Suggested Activities:

- Quiz
- Role play
- Journal Review

Text Books:

1. Doebelin's Measurement Systems: 7th Edition (SIE), Ernest O. Doebelin Dhanesh N.Manik McGraw Hill Publishers, 2019.
2. Robert Brandy, “Automotive Electronics and Computer System”, Prentice Hall,2001
3. William Kimberley,” Bosch Automotive Handbook”, 11th Edition, Robert Bosch GmbH, 2022.
4. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2014, ISBN No: 978-3-658-01783-5.

References:

1. James D Halderman, “Automotive Electrical and Electronics” , Prentice Hall, USA, 6th Edition,2020
2. Tom Denton, “Automotive Electrical and Electronics Systems,” 5th Edition, 2017, SAE International.
3. Patranabis.D, “Sensors and Transducers”, 2nd Edition, Prentice Hall India Ltd,2003
4. William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	2	-	-	-	-	1	2	1
CO2	3	2	2	-	-	2	-	-	-	-	1	2	1
CO3	3	2	2	-	-	2	-	-	-	-	1	2	1

CO4	3	2	2	-	-	2	-	-	-	-	1	2	1
CO5	3	2	2	-	-	2	-	-	-	-	1	2	1
CO6	3	2	2	-	-	2	-	-	-	-	1	2	1
Avg.	**3**	**2**	**2**	-	-	**2**	-	-	-	-	**1**	**2**	**1**

PEC2466 Concepts in Mobile Robots **PEC** **L T P C**

3 0 0 3

Course Objectives:

- To introduce mobile robotic technology and its types in detail.
- To learn the kinematics of wheeled and legged robot.
- To familiarize the intelligence into the mobile robots using various sensors.
- To acquaint the localization strategies and mapping technique for mobile robot.
- To aware the collaborative mobile robotics in task planning, navigation and intelligence.

UNIT I INTRODUCTION TO MOBILE ROBOTICS **9**

Introduction – Locomotion of the Robots – Key Issues on Locomotion – Legged Mobile Roots – Configurations and Stability – Wheeled Mobile Robots – Design Space and Mobility Issues – Unmanned Aerial and Underwater Vehicles.

UNIT II KINEMATICS **9**

Kinematic Models – Representation of Robot – Forward Kinematics – Wheel and Robot Constraints – Degree of Mobility and Steerability – Manoeuvrability – Workspace – Degrees of Freedom – Path and Trajectory Considerations – Motion Controls - Holonomic Robots.

UNIT III PERCEPTION **9**

Sensor for Mobile Robots – Classification and Performance Characterization – Wheel/Motor Sensors – Heading Sensors - Ground-Based Beacons - Active Ranging - Motion/Speed Sensors – Camera - Visual Appearance based Feature Extraction.

UNIT IV LOCALIZATION **9**

Localization Based Navigation Versus Programmed Solutions - Map Representation -Continuous Representations - Decomposition Strategies - Probabilistic Map-Based Localization - Landmark-Based Navigation - Globally Unique Localization - Positioning Beacon Systems - Route-Based Localization - Autonomous Map Building - Simultaneous Localization And Mapping (SLAM).

UNIT V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS **9**

Introduction - Competences for Navigation: Planning and Reacting - Path Planning - Obstacle Avoidance - Navigation Architectures – Control Localization - Techniques for Decomposition -Case Studies – Collaborative Robots – Swarm Robots.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to

CO1: Analyze the appropriate mobile robotic technology for a desired application.
CO2: Analyse kinematic models for both wheeled and legged robotic systems
CO3: Apply sensor data to enhance decision-making in mobile robots
CO4: Optimize localization and mapping frameworks for autonomous mobile robot

CO5: Implement collaborative planning techniques in mobile robots for specific tasks
CO6: Develop advanced collaborative mobile robots capable of autonomous navigation and intelligent task execution in targeted domains.

Text Books:

1. Roland Siegwart and IllahR.Nourbakish, "Introduction to Autonomous Mobile Robots" MIT Press, Cambridge, 2004.

References:

1. Dragomir N. Nenchev, Atsushi Konno, TeppeiTsujita, "Humanoid Robots: Modelling and Control", Butterworth-Heinemann, 2018
2. MohantaJagadish Chandra, "Introduction to Mobile Robots Navigation", LAP Lambert Academic Publishing, 2015.
3. Peter Corke, "Robotics, Vision and Control", Springer, 2017.
4. Ulrich Nehmzow, "Mobile Robotics: A Practical Introduction", Springer, 2003.
5. Xiao Qi Chen, Y.Q. Chen and J.G. Chase, "Mobile Robots - State of the Art in Land, Sea, Air, and Collaborative Missions", Intec Press, 2009.
6. Alonzo Kelly, Mobile Robotics: Mathematics, Models, and Methods, Cambridge University Press, 2013, ISBN: 978-1107031159

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	-	1	1	3	2
CO2	3	3	3	2	2	1	-	-	-	2	1	3	3
CO3	2	3	2	2	3	1	-	-	-	2	1	3	2
CO4	2	3	3	3	3	1	-	-	-	2	1	3	3
CO5	2	3	3	3	3	1	-	-	-	3	1	3	3
CO6	2	2	3	3	3	2	-	-	-	3	2	3	3
Avg.	**2**	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**2**	**1**	**3**	**3**