

AMRUTVAHINI[®]

Since 1978

Amrutvahini Sheti and Shikshan Vikas Sanstha's
AMRUTVAHINI COLLEGE OF ENGINEERING, SANGAMNER
(An Autonomous Institute and Permanently Affiliated to
Savitribai Phule Pune University, Pune)

Amrutnagar, Sangamner - 422608



Curriculum Structure and Syllabus of Second Year B. Tech. (Electronics and Telecommunication Engineering) 2025 Autonomy- NEP Compliant Pattern



(Effective from Academic Year 2026-27)

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Abbreviation

AEC - Ability Enhancement Course

AICTE - All India Council for Technical Education

CEP - Community Engagement Project

CCE - Comprehensive and Continuous Evaluation ISO - International Organization for Standardization

EEM - Entrepreneurship/Economics/Management Courses

MDM - Multidisciplinary Minor

EOMS - Educational Organization Management System

MOOC - Massive Open Online Course

NEP - National Education Policy

NPTEL - National Program on Technology Enhanced Learning

OE - Open Elective

PCC - Program Core Course

CCC – Cocurricular Course

PEO - Program Educational Objectives

PSO - Program Specific Outcomes

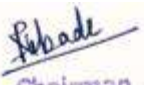
SWAYAM - Study Webs of Active-learning for Young Aspiring Minds

UGC - University Grants Commission

VEC - Value Education Course

VSE - Vocational and Skill Enhancement Course

WK - Knowledge and Attitude Profile


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Institute Vision

To create opportunities for rural students to become able engineers and technocrats through continual excellence in engineering education.

Institute Mission

Our mission is to create self-disciplined, physically fit, mentally robust and morally strong engineers and technocrats with high degree of integrity and sense of purpose who are capable to meet challenges of ever advancing technology for the benefit of mankind and nature.

We, the management, the faculty and staff, therefore promise to strive hard and commit ourselves to achieve this objective through a continuous process of learning and appreciation of needs of time.

Department Vision

To excel in modern trends of Electronics and Telecommunication Engineering through continuous teaching and learning process for nurturing promising engineers.

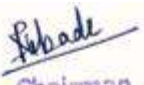
Department Mission

1. To excel as state of art technological hub in the field of Electronics and Telecommunication Engineering.
2. To enrich the students by adopting professional skill sets according to modern technological development.
3. To develop society-oriented value-based learning.

ISO 21001:2018 - EOMS Policy

We, at AVCOE Sangamner, are committed to:

- Provide quality technical education to the rural students
- Provide conducive environment for all round development of the students.
- Develop as a premier institute for technical education & research as per the needs and expectations of all stake holders.
- Comply all applicable requirements.
- Develop students into technocrats having social responsibility.
- Keep abreast about the advances in technology and innovation.
- Enhance industry-institute interaction.
- Managing intellectual property.


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- Maintain hygiene, health and safety for applicable requirements.
- Achieve continual improvement in academic and administrative processes.
- We shall strive to maintain Educational Organizational Management System.

Knowledge and Attitude Profile

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modeling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar Concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

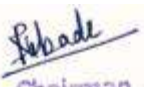
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Program Outcomes (POs)

Engineering Graduates will be able to:

PO1	Engineering knowledge	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	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	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)


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1. Demonstrate and explain the concepts of semi-conductor, p-n junction, diode, transistor, and other electronic control systems.


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Preface

It gives me immense pleasure to present the autonomous syllabus of the Second-Year B.Tech. in Electronics and Telecommunication Engineering (E&TC), introduced for the first time by the department. This curriculum has been carefully designed to meet the changing needs of industry, higher education, and emerging technologies while strengthening the academic foundation of students.

The syllabus emphasizes conceptual understanding, practical learning, skill development, innovation, and problem-solving abilities which complies National Education Policy (NEP) 2020. It includes modern and industry-relevant courses that encourage students to explore advanced areas of electronics, communication systems, and interdisciplinary technologies. Special focus has been given to outcome-based education, hands-on learning, and project-oriented approaches to prepare students for professional challenges and lifelong learning.

I sincerely appreciate the valuable efforts of all faculty members, subject experts, and Board of Studies members who contributed to the successful framing of this curriculum. I am confident that this syllabus will provide students with strong technical knowledge, professional competence, and opportunities for overall growth in the field of Electronics and Telecommunication Engineering.

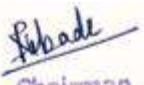
I extend my best wishes to all students and faculty members for the successful implementation of this autonomous curriculum.

Prof. Dr. R. P. Labade

Head, Department of Electronics and Telecommunication Engineering

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Program codes:

The institute has assigned a unique program code to each branch.

Table 1 – Program codes

Sr. No.	Program code	Code
B.Tech (UG) Program		
1	Electronics and Telecommunication Engineering	ET

Subject code nomenclature:

The following nomenclature demonstrates the subject codes:

- **R-Year** (of designing/revising syllabus) – **Program code** (as given in table 1) - **Course Type** (as per NEP) – **Course Number** (101 – FY B. Tech Subject 1, 201 - SY B. Tech Subject 1, 301 - TY B. Tech Subject 1, 401 - B. Tech Subject 1 etc.)

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DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING
S.Y.B.TECH (E&TC) Syllabus Design Team

Sr.No.	Name of the Course	Course Code	Syllabus Design Teams
Semester - III			
1.	Electrical Circuits and Machines	R25-ET-PCC-201	Dr.S.R.Jondhale Er.S.B.Kawade
2.	Digital Circuits and Systems	R25-ET-PCC-202	Dr.S.R.Gagare
3.	Mathematics for Signals and Systems	R25-ET-PCC-203	Dr.R.S.Pawase Er.S.V.Malewar Er.M.A.Maid
4.	Data Structure and Algorithms	R25-ET- MDM -204	Dr.R.S.Pawase Er.Y.V.Bhagwat
5.	Business Analytics	R25-ET- OEC-205	Er.A.A.Bhingardive Er.K.L.Patole
6.	Project Management and Finance	R25-ET-EEM-206	Dr.S.R.Jondhale Dr.M.B.Kadu
7.	Universal Human Values and Ethics	R25-ET-VEC-207	Er.P.R.Gaikwad
8.	Electrical and Digital Circuits Lab	R25-ET-PCC-208	Dr.S.R.Jondhale Er.S.B.Kawade Dr.S.R.Gagare
9.	Data Structure and Algorithms Lab	R25-ET-PCC-209	Dr.R.S.Pawase Er.Y.V.Bhagwat
10.	Community Engagement Program	R25-ET-CEP-210	Dr.R.P.Labade

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S.Y.B.TECH (E&TC) Syllabus Design Team

Sr.No.	Name of the Course	Course Code	Syllabus Design Teams
Semester - IV			
1.	Electronic circuits	R25-ET-PCC-211	Dr.R.P.Labade Er.R.S.Satpute Er.M.A.Maid Er.S.V.Malewar Er.S.S.Gite
2.	Control Systems	R25-ET-PCC-212	Dr.R.P.Labade Er.R.S.Satpute Er.M.A.Maid Er.S.V.Malewar Er.S.S.Gite
3.	Principles of Communication Systems	R25-ET-PCC-213	Dr.M.B.Kadu Er.N.M.Pachore
4.	Object Oriented Programming with JAVA	R25-ET-MDM-214	Er.J.N.Pote
5.	Remote Sensing and GIS	R25-ET-OEC-215	Dr.R.P.Labade
6.	Project Based Learning	R25-ET-VSC-216	Dr.S.R.Jondhale Er.P.R.Gaikwad
7.	Modern Indian Languages (Marathi/Hindi) and Technical Writing	R25-ET-AEC-217	Dr.R.P.Labade Dr.R.S.Pawase Er.P.R.Gaikwad
8.	Entrepreneurship and IPR	R25-ET-EEM-218	Er.V.R.Aware Er.Y.V.Bhagwat
9.	Electronics and Communication Lab	R25-ET-PCC-219	Dr.R.P.Labade Dr.M.B.Kadu Er.M.A.Maid Er.N.M.Pachore
10.	Control Systems and Object-Oriented Programming with JAVA Lab	R25-ET-PCC-220	Er.S.V.Malewar Er.S.S.Gite Er.J.N.Pote
11.	Life Skills, Leadership and Professional Communication	R25-ET-VEC-221	Dr.R.P.Labade

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Guidelines for Examination Scheme:

The evaluation of students shall be based on continuous academic performance in a course based on Comprehensive Continuous Evaluation (CCE) and End Semester Examination (ESE).

Components of the Examination System:

1. Comprehensive Continuous Evaluation (CCE):

- CCE of 40 marks based on all the Units of course.
- To design a Comprehensive Continuous Evaluation scheme for a theory subject of 40 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Table 3: Allocation of marks & structure

Sr. No.	Examination	Conduction Marks	Marks	Coverage of Units
1	CCE –I (Class test – 1)	32	16	Units 1 & Unit 2 (8 Marks/Unit)
2	CCE –II (Assessment tools: Case Study, presentation, Open book test etc.)	32	16	Units 3 & Unit 4 (8 Marks/Unit)
3	CCE –III (Assessment tools: Assignments, seminar, quiz, course project, field visit etc.)	08	08	Unit 5

The distribution of marks across various assessment tools and their mapping to COs is detailed in the table below.

Table 4: Allocation of marks & pattern for 3-Credit subjects

Exam	Assessment	CO1	CO2	CO3	CO4	CO5
CCE1	Written Test (Units 1 & 2)	8	8	–	–	–
CCE2	Continuous Assessment*	–	–	8	8	–
CCE3	Continuous Assessment*	–	–	–	–	8
ESE	Written Examination	12	12	12	12	12
Total	100 Marks	20	20	20	20	20

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Table 5: Allocation of marks & pattern for 2-Credit subjects

Exam	Assessment	CO1	CO2	CO3	CO4
CCE1	Written Test (Units 1 & 2)	10	10	–	–
CCE2	Continuous Assessment*	–	–	10	10
CCE3	Continuous Assessment*	–	–	–	–
ESE	Written Examination	15	15	15	15
Total	100 Marks	25	25	25	25

***Continuous Assessment:** The course instructor may use any suitable assessment tool such as Assignment, Quiz, Seminar, Case Study, Open Book Test, Course Project, Presentation, Field Visit, or Viva-Voce for CCE2 and CCE3.

Timeline for conduction of CCE:

- Weeks 1- 4 : Completion of Unit 1 and 2

Week 5 : Conduct CCE1 1 (16 marks)

- Weeks 6 - 8 : Completion of Unit 3 and 4

Week 9 : Conduct CCE2 as (16 marks)

- Weeks 10 - 12 : Completion of Unit 5

Week 13 : Conduct Seminar/Course project/Presentation/Quiz/Open Book test (8 marks)

Evaluation and Feedback:

- **Unit Test:** Student answer papers will be evaluated promptly, and constructive feedback will be provided highlighting strengths and areas for improvement.
- **Assignments / Case Study:** Student submissions will be assessed as per the given rubric, and meaningful feedback will be provided to help students understand their performance and scope for enhancement.
- **Seminar Presentation:** Students will be evaluated based on content accuracy, delivery, and responses during the Q&A session. Feedback will be shared on communication skills and conceptual understanding.
- **Open Book Test:** Evaluation will focus on the depth of analysis and the ability to apply concepts. Feedback will emphasize students' critical thinking and problem-solving skills.
- **Mini Project:** Students will be assessed on problem identification, design approach, implementation quality, and documentation. Innovation, teamwork, and practical application of concepts will be strongly considered.
- **Field Visit:** Evaluation will be based on the student's report and reflection, focusing on understanding of real-world practices and their relevance to the course outcomes. Marks will reflect clarity, insight, and active participation.

2. End Semester Examination (ESE):

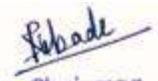
The ESE is a compulsory examination for all students. The ESE examination will be conducted at the end of the semester by the institute Department of Examination and Evaluation (DEE). The ESE will be based on 100% syllabus (Unit 1 to Unit 5). The ESE shall be of 60 marks (12 Marks / Unit) conducted for all theory courses as mentioned in the program structure.

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Syllabus Structure

S.Y.B.Tech (E&TC) Semester-III																	
Course Code	Course Type	Name of the Subject	Teaching Scheme (Hrs./week)					Examination Scheme and Marks						Credit			
			TH	PR	TU T	SL	TOT	CCE	ESE	TW	PR	O R	TOT	T H	PR	OR	TOT
R25-ET-PCC-201	Program Core course - 1	Electrical Circuits and Machines	3	-	-	45	90	40	60	-	-	-	100	3	-	-	3
R25-ET-PCC-202	Program Core course - 2	Digital Circuits and Systems	3	-	-	45	90	40	60	-	-	-	100	3	-	-	3
R25-ET-PCC-203	Program Core course - 3	Mathematics for Signals and Systems	3	-	-	45	90	40	60	-	-	-	100	3	-	-	3
R25-ET- MDM -204	Multidisciplinary Course-1	Data Structure and Algorithms	3	-	-	45	90	40	60	-	-	-	100	3	-	-	3
R25-ET- OEC-205	Open Elective-1	Business Analytics	2	-	-	30	60	40	60	-	-	-	100	2	-	-	2
R25-ET-EEM-206	Entrepreneurship/Economics/ Management course	Project Management and Finance	1	2	-	15	60	25	-	25	-	-	50	1	1	-	2
R25-ET-VEC-207	Value Education Course	Universal Human Values and Ethics	2	-	-	30	60	50	-	-	-	-	50	2	-	-	2
R25-ET-PCC-208	Program Core Course- Lab	Electrical and Digital Circuits Lab	-	2	-	-	30	-	-	25	25	-	50	-	1	-	1
R25-ET-PCC-209	Program Core Course Lab / Multidisciplinary Course-Lab	Data Structure and Algorithms Lab	-	2	-	-	30	-	-	25	25	-	50	-	1	-	1
R25-ET-CEP-210	Community Engagement Project / Field Project	Community Engagement Program	-	4	-	-	60	-	-	50	-	-	50	-	2	-	2
			17	10	0	255	660	275	300	125	50	0	750	17	5	0	22


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Semester - III


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Program:		S. Y. B. Tech (E&TC Engineering)			Semester:		III	
Course:		Electrical Circuits and Machines			Course Code:		R25-ET-PCC-201	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
03	-	-	03	40	60	-	-	
Course Description: This course provides a comprehensive foundation in the analysis of electrical networks and the operational mechanics of electrical machines. It bridges the gap between basic electrical engineering and advanced electronic systems by covering circuit simplification techniques, transient analysis, and two-port network parameters. Furthermore, it explores the construction and performance characteristics of DC and AC machines, extending into specialized modern technologies such as BLDC motors, stepper motors, and Electric Vehicle (EV) architectures.								
Course Relevance: This foundational course is essential for electronics engineers, serving as a prerequisite for advanced topics like Electronic Circuits, Communication Systems, and Automation. It equips students with the analytical skills needed to evaluate circuit stability and transfer functions using Laplace Transforms. By studying special purpose motors and EV block diagrams, students gain industry-aligned knowledge relevant to the rapidly growing electric mobility sector. The inclusion of industrial visits and practical speed control experiments ensures that learners can bridge the gap between classroom theory and real-world engineering applications								
Prerequisite: Basic Electrical Engineering								
Bridge Content: -								
Course Objectives: 1. To apply network theorems and two-port network parameters for the analysis of electrical circuits. 2. To analyze transient responses of RL, RC and RLC circuits under driven and source-free conditions. 3. To explain the construction, operating principles, characteristics and control methods of DC and AC machines. 4. To analyze the performance characteristics and applications of special-purpose motors and electric vehicle drive systems.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcome						Bloom's Level	

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CO1	Apply network theorems and determine two-port network parameters for electrical circuit analysis.	3	
CO2	Analyze transient responses of RL, RC and RLC circuits under source-free and driven conditions.	3	
CO3	Explain the construction, operating principles, characteristics and speed control methods of DC machines.	2	
CO4	Explain the construction, operating principles and performance characteristics of single-phase and three-phase AC machines.	2	
CO5	Analyze the characteristics of special-purpose motors and select suitable electric drives for industrial and electric vehicle applications.	3	
Course Contents			
Unit I	Network Theorems and Two Port Networks	9 Hrs.	CO1
Network Theorems: Superposition, Thevenin’s, Norton’s and Maximum Power Transfer (MPT). Two Port Networks: Terminal characteristics of network, Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of Two Port network parameters.			
Exemplars / Practical Applications and usage: Hybrid (h) parameters are used to create equivalent models of transistors (BJTs)			
Unit II	Transient Analysis of Basic RL, RC and RLC Circuits	9 Hrs.	CO2
Initial conditions, Driven RL and RC circuits, source free RL and RC circuits, properties of exponential response, Natural and Forced response of RL and RC circuits. Introduction to driven & Source free series RLC circuit. Over damped and under damped series RLC circuit.			
Exemplars / Practical Applications and usage: Wireless Charging applications			
Unit III	DC Machines	9 Hrs.	CO3
DC Machines: Construction, working principle, derivation of emf equation, Torque & speed equation of DC Motor. Basic characteristics & different methods of speed control of DC Shunt and Series motor.			
Exemplars / Practical Applications and usage: DC Machines in applications in Drones, Vacuum Cleaners.			
Unit IV	AC Machines	9 Hrs.	CO4
Single phase Induction motor: Construction, working principle, types and applications Three phase Induction motors: Construction, working principle, types, concept of slip, effect of slip on rotor parameters, derivation of torque equation, condition for maximum torque, Torque-slip characteristics.			

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Exemplars / Practical Applications and usage:			
Uses of AC Machines in applications such as Lifts and Elevators, Household appliances.			
Unit V	Special Purpose Motors	9 Hrs.	CO5
BLDC Motor: Types, Construction, working principle, torque-speed characteristics and applications. Stepper Motor: Types, Construction, working principle, different modes of operation, Electric Vehicle: Block diagram, case study of any one electric vehicle with respect to specifications of motor, battery and controller.			
Exemplars / Practical Applications and usage:			
Special purpose motor-based applications such as Drones and Electric Bikes			
Textbooks: 1. Ravish R Singh, "Network Analysis & Synthesis", McGraw-Hill Education, India, 2nd Edition. 2. B.L. Theraja, A.K. Theraja, "Electrical Technology", Vol II, AC & DC Machines, S. Chand Publishing, New Delhi			
Reference Books: 1. I.J Nagarath and D.P Kothari, "Electrical Machines", Tata McGraw-Hill Publication 4th Edition. 2. William H. Hayt, Jack E. Kimmerly and Steven M. Durbin, "Electrical Circuit Analysis", Tata McGraw Hill publication, 7th Edition. 3. V K Mehta and Rohit Mehta, "Principles of Electrical Machines", S Chand Publications, New Delhi. 4. A K Babu, "Electric & Hybrid Vehicle", Khanna Publishing, New Delh.			
MOOCs Links and additional reading material:			
1. NPTEL, "Basic Electrical Circuits," IIT Madras. https://onlinecourses.nptel.ac.in/noc19_ee36/preview 2. NPTEL, "Electrical Machines - I," IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc20_ee60/preview 3. NPTEL, "Electrical Machines - II," IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc21_ee13/preview			

CO-PO-PSO Mappings

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	-	-	-	1	2	-	3	2	2
CO2	2	3	3	2	3	-	-	1	1	2	1	3	3	3
CO3	2	2	3	2	2	-	-	1	1	2	-	3	3	2
CO4	2	3	2	3	2	1	-	1	2	3	1	2	3	3
CO5	2	2	3	2	3	-	1	1	1	2	1	3	3	3
Avg.	2.2	2.4	2.6	2.4	2.2	1.0	1.0	1.0	1.2	2.2	1.0	2.8	2.8	2.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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**Assessment Pattern**

BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	√	√			√	√	√	—	—	√
L4	-	√	-	-	√	-	√	-	-	√
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:
Electronics Circuit, Digital Electronics, Communication system, Automation System etc.

Job Mapping:

Job opportunities that one can get after learning this course:

This course is a foundation course for electronics engineers.

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Program:		S.Y.B.Tech (E&TC Engineering)			Semester:		III	
Course:		Digital Circuits and Systems			Course Code:		R25-ET-PCC-202	
Teaching Scheme				Examination Scheme				
Lecture	Practic al	Tutorial	Credit	CCE	ESE	TW	PR	
03	--	-	03	40	60	--	-	

Course Description:

The Digital Circuits & Systems course introduces students to the fundamental principles of digital electronics used in modern computing and communication systems. It covers the analysis and design of digital circuits using Boolean algebra, logic gates, and minimization techniques. Students learn to design, implement, and troubleshoot combinational and sequential logic circuits that form the basis of microprocessors, digital controllers, and embedded systems.

The course includes theoretical concepts along with hands-on practice using logic design tools and simulation software. Topics include number systems, Boolean functions, logic simplification, combinational building blocks, flip-flops, counters, registers, and finite state machines (FSMs). Students also gain exposure to hardware description languages (HDLs) such as VHDL for designing digital circuits.

Relevance:

Digital Circuits & systems plays a central role in modern technology and have become the foundation of almost every electronic device and communication platform. Their importance arises from their accuracy, reliability, programmability, and ability to process large amounts of data efficiently. Digital systems use binary logic, which minimizes errors and ensures consistent performance even in complex applications. Digital systems are highly relevant because they form the backbone of modern electronics, communication, automation, and computing. A strong understanding of digital systems is essential for engineering students as it directly connects to real-world technologies and future innovation.

Prerequisite: Fundamentals of Electronics Engineering (R25-ET-ESC-107)

Bridge Content: –

Course Objectives:

To make students understand:

1. To design different combinational logic circuits such as adder, subtractor, Mux, Demux etc.
2. To design sequential logic circuits using flip such as counters & shift registers.
3. To apply the concepts of sequential circuits in state machines.
4. To understand the digital logic families and system design using programmable logic devices.
5. To understand the concepts of VHDL and its fundamental applications.

Course Outcomes: After learning the course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Design different combinational logic circuits such as adder, subtractor, Mux, Demux etc.	3
CO2	Design sequential logic circuits using flip such as counters & shift registers.	3

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CO3	Apply the concepts of sequential circuits in state machines.	3
CO4	Understand the digital logic families and system design using programmable logic devices.	2
CO5	Understand the concepts of VHDL and its fundamental applications.	2
Course Contents		
Unit I	Combinational Logic Circuit	9 Hrs. CO1
Definition of combinational logic circuit, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for minterms and max-terms (upto 4 variables), don't care conditions, Design Examples: Half Adder, Full adder, Half Subtractor, Full Subtractor, Parallel adder IC and its use as subtractor, Code converters (Binary to Gray, BCD to 7 segment display), 2-bit Comparator, Multiplexers, multiplexer trees, Demultiplexers, Demultiplexer trees and 3: 8 Decoders.		
Exemplar: Arithmetic Logic Unit (ALU), Scientific calculator, computing engines, industrial control systems.		
Unit II	Sequential Logic Circuit	9 Hrs. CO2
Definition of sequential logic circuit, 1-Bit Memory Cell/latch, Clocked SR flip flop, J-K flip flop, M-S J-K flip flop, D and T flip flops. Use of preset and clear terminals in flip flops, Excitation Table for flip flops, Conversion of flip flops, types of counters, Ripple counters, Mod-n counters, up/down counters, 2-bit synchronous counters, Registers, Shift registers, Applications of shift register (ring counters & twisted ring counters), Sequence Generators using flip flops.		
Exemplar: Memories, display boards, Microprocessors, Consumer electronics.		
Unit III	State Machine	9 Hrs. CO3
Moore and Mealy machines, Basic design steps: State diagram, State table, State reduction, State assignment, Finite state machine implementation, Sequence detector. Introduction to Algorithmic state Machines (ASM), Construction of ASM chart for sequential circuits.		
Exemplar: ATM machine, vending machine and traffic lights		
Unit IV	Digital Logic Family and Programmable Logic Devices	9 Hrs. CO4
Digital Logic Family: Performance parameters of digital ICs- fan in, fan out, noise margin, propagation delay, power dissipation. Operation of TTL NAND gate, Totem pole output, Concept of current source and current sink, CMOS Inverter gate, CMOS NAND gate, Comparison of CMOS and TTL logic family. Introduction to LVDS type logic family. Programmable Logic Devices: Architecture of PROM, PAL, PLA and Designing combinational circuits using PLDs. General Architecture and specifications of FPGA and CPLD. Introduction to quantum computing.		
Exemplar: High speed computing boards, automotive electronics		
Unit V	Introduction to VHDL	9 Hrs. CO5

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Introduction to Library, Entity and Architecture Modeling styles, Data objects, Concurrent and sequential statements, Design examples using VHDL for basic gates, full adder, full subtractor, and D & T flip-flops using behavioral modelling style.

Exemplar: Simulation of Hardware Circuits, Embedded System Development

Course Projects:

Design of any one example of combinational or sequential circuits using VHDL.

Text books:

- [1] R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill Publication
- [2] Thomas Floyd, "Digital Fundamentals", Pearson Publication, India
- [3] A. Anand Kumar, "Fundamentals of Digital Circuits", PHI Learning

Reference Books:

- [1] John. F. Wakerly, "Digital Design- Principles and Practices", Pearson Publication
- [2] M. M. Mano, "Digital Design," Prentice Hall India.
- [3] Stephen Brown, "Fundamentals of digital logic design with VHDL" Tata McGraw Hill

MOOCs Links and additional reading material:

- [1] Digital Electronics Circuit: <https://nptel.ac.in/courses/108105132>
- [2] Modern Digital Electronics: <https://www.mheducation.co.in/modern-digital-electronics-9789355321770-india>

CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	-	2	3	2	2	2	2	2
CO2	3	3	3	2	2	2	-	2	3	2	2	2	2	2
CO3	3	3	3	2	-	-	-	-	3	2	2	2	-	-
CO4	3	3	2	2	-	-	-	-	3	2	2	2	-	-
CO5	3	3	2	2	1	-	-	-	3	2	2	2	2	1
Avg.	3	3	2.6	2	1.7	2	-	2	3	2	2	2	2	1.7

1:Slight(Low)

2:Moderate(Medium)

3:Substantial(High)

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**Assessment Pattern**

BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	√	√	√	—	—	√	√	√	—	—
L4	-	-	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

This course serves as a prerequisite for/ maps with the following future courses:

1. Analog and Digital Communication
2. Fundamentals of IoT
3. Embedded System and Edge Computing
4. VLSI Design

Job Mapping: Job opportunities that one can get after learning this course:

1. Hardware Design Engineer
2. Embedded System Engineer
3. VLSI Design Engineer
4. FPGA/VHDL Programmer
5. Testing and Verification Engineer.

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Program:		S.Y.B.Tech (E&TC Engineering)			Semester:		III	
Course:		Mathematics for Signals and Systems			Course Code:		R25-ET-PCC-203	
Teaching Scheme (Hrs/Week)				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
03	-	-	03	40	60	-	-	
Course Description: This course introduces the fundamental concepts of signals and systems, including classification of signals, system properties, and analysis in time and frequency domains using tools such as convolution, Fourier transform, and Laplace transform. It also emphasizes the relationship between mathematical models and physical systems.								
Course Relevance: The course provides essential foundations for advanced subjects like communication, signal processing, and control systems, and is widely applicable in modern technologies such as wireless Communication, multimedia processing, and biomedical engineering. It helps in developing analytical and problem-solving skills required for real-world engineering applications.								
Prerequisite: Calculus like Differentiation and Integration, Complex numbers, Basic Differential Equations								
Bridge Content: -								
Course Objectives: 1. To understand and classify different types of signals and systems. 2. To analyze linear systems using convolution and impulse response in time domain. 3. To represent and analyze signals using Fourier series and Fourier transform. 4. To analyze CT signals and systems using Laplace Transform and DT signals and systems using Z Transforms. 5. To apply statistical concepts and probability theory for the analysis of random signals.								
Course Outcomes: After successful completion of this course, students will be able to:								
CO	Course Outcomes (COs)						Bloom's Level	
CO1	Classify and perform operations on signals and identify system properties.						3	
CO2	Analyze system behavior using convolution and impulse response.						3	
CO3	Represent and analyze signals using Fourier Series and Fourier Transform techniques in the frequency domain.						3	
CO4	Analyze continuous-time and discrete-time systems using Laplace Transform and Z-Transform techniques for system characterization and stability analysis.						3	
CO5	Apply probability and statistical concepts for the analysis and characterization of random signals.						3	

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Course Contents			
Unit I	Basics and Classification of Signals and Systems	9 Hrs.	CO1
Signals: Continuous Time and Discrete Time signals, Basic Elementary signals, Operations on signals: Time Shifting, Time Reversal, Time Scaling, Amplitude Scaling, Signal Addition, Signal Subtraction, Signal Multiplication. Classification of signals: Deterministic, Random, Periodic, Non Periodic, Energy, Power, Causal, Non- Causal, Even and Odd signal. Systems: Introduction, Input-output relation, Static and Dynamic systems, Causal and Non-Causal systems, Linear and Non- Linear systems, Time Variant and Time Invariant systems, Stable and Unstable systems, Invertible and Non- Invertible systems. Definition of Impulse response, System properties in terms of impulse response Exemplars / Practical Applications and Usage: Communication, Control system and signal processing examples, Lumped parameter and distributed Parameter System.			
Unit II	Time Domain Analysis	9 Hrs.	CO2
System Modeling: System representation using differential equations and difference equations, LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral, General method, Simultaneous differential equations. Convolution: Convolution integral, Convolution sum, Numerical on convolution integral and Convolution sum, Properties of convolution, System interconnection, Step response in terms of impulse response. Exemplars / Practical Applications and Usage: Modeling dynamic systems using differential equations, Spring-mass-damper systems, Acoustic Signal Convolution and Echo Formation.			
Unit III	Fourier Series and Fourier Transform	9 Hrs.	CO3
Fourier Series (FS): Introduction, Amplitude and phase response, Dirichlet condition for existence of Fourier series, Orthogonality, Basis functions, FS representation of CT periodic signals using trigonometric and exponential Fourier series, Properties of Fourier Series and their physical significance, Gibbs phenomenon. Fourier Transform (FT): Representation of Aperiodic CT signals, Dirichlet condition for existence of Fourier transform, Evaluation of magnitude and phase response, FT of standard CT signals, Properties and their significance, Interplay between time and frequency domain using sinc function and rectangular signals, Fourier Transform for periodic signals. Exemplars / Practical Applications and Usage: Applications of Fourier series for finding harmonics in spectrums, its adverse effects in Inverters and music signal processing.			
Unit IV	Laplace Transform and Z Transform	9 Hrs.	CO4
Laplace Transform (LT) : Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, Region of Convergence (ROC), Properties of ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, stability considerations in S-domain. Z-Transform (ZT): Introduction, Definition, ROC, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations.			



Exemplars / Practical Applications and Usage: Application of Laplace transforms to the LTI system analysis, RL, RC, RLC Network analysis with step input.			
Unit V	Statistics for Signal Processing	9 Hrs.	CO5
Probability: Experiment, Sample Space, Event, Probability, Conditional Probability and Statistical Independence, Bayes theorem Random variables: Continuous and Discrete random variables, Cumulative distributive function (CDF), Probability density function (PDF), Properties of CDF and PDF. Statistical Averages, Mean, Moments and Expectations, Standard Deviation and Variance. Uniform and Gaussian probability models.			
Exemplars / Practical Applications and Usage: Tossing a coin, throwing of two dies, Playing cards, Noise modeling in communication systems of probability models			
Textbooks:			
1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, Signals and Systems, 2nd ed. Upper Saddle River, NJ, USA, Prentice Hall, 1997. 2. A. Nagoor Kani, Signals and Systems, 2nd ed. New Delhi, India, CBS Publishers & Distributors Pvt. Ltd., 2022. 3. P. Ramesh Babu and R. Anandanatarajan, Signals and Systems, 4th ed. Chennai, India, Scitech Publications Pvt. Ltd., 2010. 4. B. S. Grewal, Higher Engineering Mathematics, 45th ed. New Delhi, India, Khanna Publishers, 2024.			
Reference Books:			
1. M. J. Roberts, Signals and Systems: Analysis Using Transform Methods and MATLAB, 3rd ed. New Delhi, McGraw Hill Education India, 2019. 2. C. L. Phillips, J. Parr, and E. A. Riskin, Signals, Systems, and Transforms, 4th Indian ed., Pearson Education India, 2013. 3. B. P. Lathi, Linear Systems and Signals, 2nd ed. New York, USA, Oxford University Press, 2005. 4. S. Haykin and B. Van Veen, Signals and Systems, 2nd ed. New Delhi, India: Wiley India Pvt. Ltd., 2007. 5. S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th ed. New York, USA, McGraw-Hill Education, 2011.			
MOOCs Links and additional reading material:			
1. NPTEL Course: Principles of Signals and Systems https://nptel.ac.in/courses/108104100 2. NPTEL Course: Signals and Systems https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee28			

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**CO-PO Mapping:**

COs \ POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	3	3	2	2
CO2	3	3	2	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	2	1	2	-	-	3	3	-	3	3	3	3
CO4	3	3	2	2	2	-	-	3	3	-	3	3	3	3
CO5	3	2	2	2	2	-	-	3	3	-	3	3	2	3
Avg.	3	2.6	1.8	1.67	2	-	-	3	3	-	3	3	2.4	2.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	√	√	√	√	√	√	√	√	√	√
L4	-	-	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

Principles of Communication systems, Digital Signal Processing, Image Processing, Computer Vision, Speech Processing etc.

Job Mapping:

This course is a foundation course for Electronics and Telecommunication Engineer.

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Program:		S.Y.B. Tech (E&TC Engineering)			Semester:		III	
Course:		Data Structures and Algorithms			Course Code:		R25-ET-MDM-204	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
03	--	-	03	40	60	--	-	

Course Description:

The Data Structures and Algorithms course introduces students to fundamental data structures such as arrays, stacks, queues, linked lists, trees, and graphs along with searching, sorting, and algorithm analysis techniques. It helps students learn efficient data organization and problem-solving methods in programming.

Relevance:

The Data Structures and Algorithms course builds a strong foundation for software development and advanced computer science subjects. It improves logical thinking, programming efficiency, and problem-solving skills used in real-world applications and industry.

Prerequisite: Fundamentals of Programming Languages, Basics of C Programming

Bridge Content: --

Course Objectives:

1. To understand the significance of data structures and implement searching and sorting methods using the C++ language analyzing time and space complexity.
2. To understand data representation, implementation, and applications of linear and non-linear data structures using C++.

Course Outcomes: After learning the course, students will be able to

CO	Course Outcome	Bloom's Level
CO1	Apply and Implement sorting and searching algorithms on the given data using the C++ language.	3
CO2	Develop applications of stack and queue using arrays.	3
CO3	Implement and Demonstrate the applicability of linked lists.	3
CO4	Build, Represent, and Traverse a Binary Search Tree (BST).	3
CO5	Build, Represent, and Traverse graphs.	3



Course Content			
Unit I	Introduction to data structures and complexity analysis	9 Hrs.	CO1
Overview of Data Structures: Linear vs. Non-linear Data Structures, Basics of array, Implementing Arrays, and Two-Dimensional Array, Abstract Data Types (ADT), Algorithm Analysis: Time and Space Complexity, Asymptotic Notations: Big O, Omega, Theta, Best, Worst, and Average Case Analysis, Searching Algorithms: Linear Search, Binary Search, Sorting Algorithms: Bubble, Selection, Insertion Sorting Algorithms. Exemplar: Data Structures is the study of organizing and storing data efficiently using linear and non-linear structures. It also includes algorithms for searching, sorting, and analyzing time and space complexity.			
Unit II	Stack and Queues	9 Hrs.	CO2
Stack: Concept, Basic Stack operations, Array representation of stack, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation. Queue: Concept, Queue operations, Array representation of queue, Queue as ADT, Circular queue, Priority Queue, Applications of queue. Exemplar: Stack follows LIFO principle with operations like push and pop, used for reversing data and expression evaluation. Queue follows FIFO principle with variations like circular and priority queue, used in scheduling and real-world processing.			
Unit III	Linked List	9 Hrs.	CO3
Pointer: Basic concepts, Pointer declaration and initialization, Dynamic Memory Allocation (malloc, calloc, realloc, free), comparison of sequential and linked organization, Concept of linked organization, Singly Linked List, Stack using linked list, Queue using linked list, Doubly Linked List, Circular Linked List, Linked list as ADT. Stack and Queue implementation using Linked list, Representation and manipulation of polynomial using linked list Exemplar: Pointers store memory addresses and are used with dynamic memory allocation functions like malloc, calloc, realloc, and free. Linked lists are dynamic structures (singly, doubly, circular) used to implement stacks, queues, and polynomial operations efficiently.			
Unit IV	Trees	9 Hrs.	CO4
Introduction to trees: Basic Tree Concepts. Binary Trees: Concept & Terminologies, Representation of Binary Tree in memory, traversing a binary tree. Binary Search Trees (BST): Basic Concepts, BST operations, Concept of Threaded Binary Search Tree, AVL Tree: Basic concepts and rotations of a Tree. Exemplar: Binary Search Trees (BST), Threaded BST, and AVL trees support efficient searching and balancing through operations like insertion, deletion, and rotations			
Unit V	Graphs	9 Hrs.	CO5
Graph: Basic Concepts & terminology. Representation of graphs: Adjacency matrix, Adjacency list. Operations on graph: Traversing a graph. Spanning trees: Minimum spanning tree- Kruskal's Algorithm, Prim's Algorithm and Dijkstra's Shortest Path Algorithm. Exemplar: Graphs are non-linear data structures consisting of vertices and edges, represented using adjacency matrix and adjacency list. They are used for traversal and solving problems like minimum spanning tree and shortest path using Kruskal's, Prim's, and Dijkstra's algorithms.			
Course Projects:			
Course Projects are not limited to following: 1. Student Record Management System 2. Library Management System 3. Hospital Patient Management System 4. Campus Navigation and Route Planner 5. Food Delivery and Order Tracking System 6. Smart Traffic Management System			

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**Text books:**

1. E. Horowitz and S. Sahni, *Fundamentals of Data Structures*, 2nd ed. New Delhi, India: Galgotia Book Source. 2005
2. R. F. Gilberg and B. A. Forouzan, *Data Structures: A Pseudocode Approach with C*, 2nd ed. Boston, A, USA: Cengage Learning. 2007

Reference Books:

1. R. Thareja, *Data Structures Using C*, 2nd ed. New Delhi, India: Oxford University Press. 2014
2. Y. Langsam, M. J. Augenstein, and A. M. Tenenbaum, *Data Structures Using C and C++*, 2nd ed. New Delhi, India: PHI Publications. 2009

MOOCs Links and additional reading material:

1. Data Structure using C Programming by Dr. Dipti Verma and Mr. Aditya Tiwari:
https://onlinecourses.swayam2.ac.in/nou23_cs13/preview
2. Data Structures and Algorithms:
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384203240484864010470_shared/overview
3. Programming, Data Structures and Algorithms using C by Prof. Hema A. Murthy, Prof. Shankar Balachandran, Prof. N. S. Narayanaswamy, and Prof. Sudarshan Iyengar
<https://nptel.ac.in/courses/106106127?>

Strength of CO-PO-PSO Mapping

COs \ POs/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	-	-	1	1	-	3	1	2	3
CO2	3	3	2	1	3	-	-	1	1	-	3	1	2	3
CO3	3	3	2	2	3	-	-	1	1	-	3	1	2	3
CO4	3	3	3	2	3	-	-	1	1	-	3	1	2	3
CO5	3	3	3	2	3	-	-	1	1	1	3	1	2	3
Avg.	3	33	2.4	1.6	3	-	-	1		1	3	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	√	√	√	√	√	√	√	√	√	√
L4	-	-	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

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This course serves as a prerequisite for/ maps with the following future courses:

1. Artificial Intelligence and Machine Learning
2. Database Management Systems
3. Software Engineering
4. Advanced Data Structures

Job Mapping:

Job opportunities that one can get after learning this course:

1. Software Developer
2. Data Analyst
3. System Programmer
4. Backend Developer
5. Database Administrator


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Program:		S. Y. B. Tech		Semester:		III	
Course:		Project Management and Finance		Course Code:		R25-ET-HSSM-206	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
01	02	--	01+01	25	--	25	--
Course Description: This course introduces the fundamental concepts of project management and financial management required for planning, executing, monitoring, and evaluating engineering projects. It covers project life cycle, scheduling techniques, cost estimation, risk management, budgeting, and financial analysis tools such as NPV, IRR, and break-even analysis to support effective project decision-making.							
Course Relevance: The course is relevant for developing managerial and financial skills required to plan, execute, and evaluate engineering and technology projects effectively. It helps students understand project scheduling, resource management, cost control, and financial decision-making essential for industry and entrepreneurship.							
Prerequisite:--							
Bridge Content: Basics of balance sheet, Accounting, Stock Market.							
Course Objectives: 1. To introduce the fundamental concepts, objectives, and significance of project management, including 2. 3. project life cycle phases and the role of a project manager. 4. To develop skills in scheduling, resource optimization, risk mitigation, and quality management using tools such as WBS, PERT, and CPM. 5. To introduce the fundamentals of financial management, including its objectives, scope, and importance in project decision-making. 6. To develop the ability to estimate project costs and evaluate financing alternatives for effective project investment decisions.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	Describe the principles of project management, project planning, scheduling, and monitoring.						2
CO2	Apply project planning, scheduling, resource management, and quality management techniques for successful project execution.						3
CO3	Describe financial planning, project financing, and time value of money concepts in project management.						2
CO4	Apply project cost estimation, financing, capital budgeting, financial analysis, and project audit techniques to manage project performance.						3
Course Contents							
Unit 1	Introduction to Project Management				03Hrs.	CO1	
Definition, objectives, and importance of project management, Organizational structure, Project life cycle and phases, Roles and responsibilities of project manager, Project planning, scheduling, and monitoring.							
Exemplars / Practical Applications and usage: Examine the responsibilities of the project manager during different phases of the project.							
Unit 2	Project Planning and Scheduling				05 Hrs.	CO2	
Feasibility study and project identification, Time management techniques, Network analysis: PERT and CPM, Resource allocation and optimization, Work Breakdown Structure (WBS), Risk analysis and mitigation strategies, Quality management.							

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Exemplars / Practical Applications and usage: Feasibility study and planning of a startup or small business project.			
Unit 3	Introduction to Financial Management	03 Hrs.	CO3
Definition, objectives, scope, and importance of financial management, financial planning and forecasting, Sources of project financing, Time value of money.			
Exemplars / Practical Applications and usage: Compare different sources of finance for a startup project.			
Unit 4	Financial Management for Projects	05 Hrs.	CO4
Project Cost Estimation, Project Financing Models, Break-even analysis, Capital budgeting techniques: NPV, IRR, Payback Period, Financial statements and ratio analysis, Project audit and closure.			
Exemplars / Practical Applications and usage: Financial Decision-Making in Engineering Projects			
Textbooks:			
1. H. Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 13th ed. Hoboken, NJ, USA: Wiley, 2022. 2. N. Singh, Project Management and Control. Mumbai, India: Himalaya Publishing House, 2018. 3. I. M. Pandey, Financial Management, 12th ed. Noida, India: Pearson India, 2021. 4. P. Chandra, Project Planning, Analysis, Selection, Financing, Implementation and Review, 9th ed. New Delhi, India: McGraw Hill Education, 2019. 5. E. F. Brigham and J. F. Houston, Fundamentals of Financial Management, 15th ed. Boston, MA, USA: Cengage Learning, 2019.			
Reference Books:			
1. J. M. Nicholas and H. Steyn, Project Management for Engineering, Business and Technology, 5th ed. New York, NY, USA: Routledge, 2017. 2. C. Gray and E. Larson, Project Management: The Managerial Process, 8th ed. New York, NY, USA: McGraw Hill, 2021. 3. R. Chandra, Financial Management and Policy, 10th ed. New Delhi, India: Vikas Publishing House, 2019. 4. P. K. Joy, Total Project Management: The Indian Context. New Delhi, India: Macmillan India, 2015. 5. R. Pinto, Project Management: Achieving Competitive Advantage, 5th ed. Boston, MA, USA: Pearson, 2019. 6. M. Y. Khan and P. K. Jain, Financial Management: Text, Problems and Cases, 8th ed. New Delhi, India: McGraw Hill Education, 2018.			
MOOCs Links and additional reading material:			
1. NPTEL, "Project Management," IIT Kanpur. https://onlinecourses.nptel.ac.in/noc24_mg75/preview. 2. NPTEL, "Project Management for Managers," IIT Roorkee. https://onlinecourses.nptel.ac.in/noc23_mg107/preview. 3. NPTEL, "Financial Management for Managers," IIT Roorkee. https://onlinecourses.nptel.ac.in/noc25_mg23/preview.			

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List of Experiments			
Experiment No. 1	Strategic Planning & SWOT Analysis	2 Hrs.	CO1
Objective: To perform a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis for a tech startup and formulate a one-year strategic roadmap using SMART goals. Associated Task: 1. To list out Strengths & Weaknesses a tech startup. 2. To list out Opportunities & Threats a tech startup. Exemplars and Utility: Help to one-year strategic roadmap using SMART goals of a tech startup.			
Experiment No.2	Organizational Structure Design	2 Hrs.	CO1
Objective: To design a functional and matrix organizational hierarchy for mid-sized electronics manufacturing firm, identifying clear lines of authority and span of control. Associated Task: 1. To identify the major functional departments of a mid-sized electronics manufacturing organization. 2. To design a functional organizational structure showing reporting relationships and chain of command. 3. To design a matrix organizational structure for project-oriented manufacturing operations. 4. To identify the lines of authority, responsibility, and communication in both organizational structures. Exemplars and Utility: Helps students understand organizational hierarchy, authority delegation, communication flow, span of control, and organizational design practices used in electronics manufacturing industries.			
Experiment No.3	Recruitment & Staffing	2 Hrs.	CO1
Objective: To draft a technical Job Description (JD) for an E&TC role and simulate a structured interview process to evaluate candidate suitability and behavioral traits. Associated Task: 1. To identify the roles, responsibilities, qualifications, and skill requirements for a selected E&TC job profile. 2. To prepare a detailed technical Job Description (JD) including job title, duties, required competencies, and eligibility criteria. 3. To develop a structured interview framework comprising technical, aptitude, and behavioural assessment parameters. 4. To assess candidate suitability based on technical knowledge, communication skills, problem-solving ability, and behavioral traits through mock interview sessions.			

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**Exemplars and Utility:**

Helps students understand industrial recruitment practices, technical manpower selection processes, competency mapping, behavioral assessment techniques, and interview evaluation methods used in electronics and telecommunication industries. It also develops professional communication, interviewing, and human resource management skills.

Experiment No.4	Leadership Case Study	2 Hrs.	CO1
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Objective: To analyze the decision-making and leadership styles of successful CEOs in the technology sector.

Associated Task:

1. To identify successful CEOs from the technology sector and study their professional backgrounds and leadership journeys.
2. To analyze different leadership styles (e.g., transformational, transactional, democratic, autocratic, servant leadership) adopted by selected CEOs.
3. To examine the decision-making approaches used by CEOs in strategic, operational, and crisis situations.
4. To compare the leadership characteristics, management practices, and organizational impact of selected technology leaders.

Exemplars and Utility:

Helps students understand leadership theories, strategic decision-making processes, managerial competencies, and organizational behavior through real-world case studies of successful technology leaders. This activity develops analytical thinking, leadership awareness, and management decision-making skills applicable to engineering and technology organizations.

Experiment No.5	Balance Sheet Literacy	2 Hrs.	CO2
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Objective: To examine the Balance Sheet and Profit & Loss statement of a listed Indian technology company to understand its capital structure and revenue streams.

1. To select a listed Indian technology company and collect its latest annual financial statements.
2. To identify and analyze the components of the Balance Sheet, including assets, liabilities, shareholders' equity, and capital structure.
3. To examine the Profit & Loss statement to understand revenue sources, operating expenses, profitability, and earnings.

Exemplars and Utility:

Helps students understand corporate financial statements, capital structure, revenue generation mechanisms, and financial performance analysis of technology companies. This activity develops financial literacy, analytical skills, and managerial decision-making capabilities essential for engineering managers and entrepreneurs.

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Experiment No.6	Costing & Break-Even Analysis	2 Hrs.	CO2
Objective: To calculate the Break-Even Point (BEP) for an electronic product by analyzing fixed and variable costs. Associated Task: 1. To identify and classify the fixed costs, variable costs, and selling price associated with a selected electronic product. 2. To calculate the contribution per unit and contribution margin ratio. 3. To determine the Break-Even Point (BEP) in terms of units and sales revenue. 4. To analyze the effect of changes in cost structure and selling price on the Break-Even Point. Exemplars and Utility: Helps students understand cost-volume-profit (CVP) analysis, pricing strategies, cost behavior, profitability assessment, and financial decision-making in electronics manufacturing and technology-based enterprises. This activity develops analytical and managerial skills essential for entrepreneurship and industrial management.			
Experiment No.7	Digital Financial Ecosystem Literacy	2 Hrs.	CO2
Objective: To understand the ecosystem of Indian stock exchanges (NSE/BSE) and other related modes of Digital Economy such as Digital Gold, Mutual Fund platforms. Associated Task: 1. To study the structure, functions, and operations of major Indian stock exchanges, namely the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). 2. To identify various financial instruments traded on stock exchanges, including equities, bonds, ETFs, and derivatives. 3. To explore digital investment platforms offering services such as stock trading, digital gold investment, and mutual fund investments. Exemplars and Utility: Helps students understand the functioning of capital markets, digital financial ecosystems, investment instruments, and emerging fintech platforms. This activity develops financial awareness, investment literacy, and decision-making skills relevant to entrepreneurship, engineering management, and the digital economy.			

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Experiment No.8	Personal Finance	2 Hrs.	CO2
Objective: To calculate the total taxable income of an individual by categorizing income under various heads (Salary, House Property, Capital Gains, etc.) and applying relevant Chapter VI-A deductions Associated Task: - To identify and classify income under the various heads of income as prescribed under the Income Tax Act. - To compute income from Salary, House Property, Capital Gains, Business/Profession, and Other Sources using given financial data. - To identify eligible deductions under Chapter VI-A and calculate the total deductions available. - To determine the Gross Total Income, Total Taxable Income, and applicable income tax liability. Exemplars and Utility: Helps students understand the fundamentals of personal taxation, income classification, tax planning, and financial decision-making. This activity develops financial literacy, analytical skills, and practical knowledge of taxation concepts that are useful for professionals, entrepreneurs, and engineering manager.			

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	1	2	2	2	3	2	-	1	2
CO2	2	2	2	-	2	1	1	2	2	3	2	-	2	2
CO3	2	2	1	-	-	1	2	2	2	3	2	-	1	2
CO4	2	2	2	-	2	1	1	2	2	3	2	-	2	2
Avg.	2	2	1.5	-	2	1	1.5	2	2	3	2	-	1.5	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

BT Level	CCE				ESE			
	CO1	CO2	CO3	CO4	CO1	CO2	CO3	CO4
	8	8	8	8	12	12	12	12
L1	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√
L3	-	√	-	√	-	√	-	√
L4	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses: Digital Marketing

Job Mapping: Job opportunities that one can get after learning this course: Project Engineer, Project Coordinator, Planning Engineer

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Program:	S. Y. B. Tech			Semester:	III		
Course:	Universal Human Values & Ethics			Course Code:	R25-ET-VEC-207		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
02	-	-	02	50	-	-	-
Course Description: This course provides a foundation for achieving long-term fulfilment by integrating human values, ethical principles, and professional responsibilities with technical education. The course emphasizes self-exploration to help students understand their aspirations, distinguish between material success and lasting happiness, and develop a balanced approach to life. It focuses on harmony within the self, family, society, and nature, fostering values such as trust, respect, responsibility, and cooperation. The course also promotes professional ethics, value-based decision-making, sustainable living, and responsible engineering practices. Ultimately, it equips students with a humane and holistic perspective to lead an ethical, responsible, and purposeful personal and professional life.							
Course Relevance: This course serves as a life-long guide for developing a humane, ethical, and responsible way of living. It helps students distinguish between material success and lasting happiness, enabling them to manage personal and professional challenges with clarity and balance. By fostering values such as trust, respect, responsibility, and cooperation, the course promotes harmonious relationships in family, society, and the workplace. It also provides the foundation for value-based decision-making, professional ethics, and sustainable practices, equipping students to become responsible engineers and socially conscious citizens capable of leading purposeful and fulfilling lives							
Prerequisite: Student Induction Program (SIP)							
Bridge Content: Basic Human Values							
Course Objectives: 1. To understand self-exploration, human values, and basic human aspirations. 2. To explain the coexistence of self and body and the importance of self-regulation and well-being. 3. To develop an understanding of values for harmony in family and society. 4. To understand the interconnectedness and mutual fulfilment in nature and existence. 5. To promote professional ethics and responsible engineering practices.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom’s Level
CO1	Explain the importance of self-exploration, value education, and basic human aspirations for achieving happiness and prosperity in daily life.						2
CO2	Describe the human being as the coexistence of self and body and distinguish between their needs for maintaining harmony and well-being.						2
CO3	Apply the values of trust, respect, and right relationships to establish harmony in family and society.						3
CO4	Apply the understanding of harmony in nature and professional ethics to promote responsible living and ethical engineering practices.						3
Course Content							
Unit 1	Introduction to Value Education				07 Hrs.	CO1	
Understanding Value Education; Self-exploration as the Process for Value Education; Continuous Happiness and Prosperity – the Basic Human Aspirations and their Fulfilment; Right Understanding, Relationship and Physical Facility; Happiness and Prosperity – Current Scenario; Methods to Fulfil the Basic Human Aspirations; Impact of Lifestyle on Mental and Physical Well-being; Value-based Decision Making in Daily Life.							
Exemplars / Practical Applications and Usage: Discussion on modern lifestyle stress despite material growth.							

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Unit 2	Harmony in the Human Being	6 Hrs.	CO2
Understanding Human Being as the Co-existence of the Self and the Body; Distinguishing between the Needs of the Self and the Body; The Body as an Instrument of the Self; Understanding Harmony in the Self; Harmony of the Self with the Body; Programme to Ensure Self-regulation and Health; Emotional and Physical Well-being; Healthy Lifestyle Practices. Exemplars / Practical Applications and Usage: Prepare a personal health and self-regulation plan to improve mental and physical well-being.			
Unit 3	Harmony in the Family and Society	6 Hrs.	CO3
Harmony in the Family – the Basic Unit of Human Interaction; Trust as the Foundational Value in Relationships; Respect as the Right Evaluation; Values in Human-to-Human Relationships; Understanding Harmony in Society; Vision for the Universal Human Order; Compassion and Emotional Intelligence; Cooperation and Teamwork in Society; Conflict Resolution and Peaceful Co-existence. Exemplars / Practical Applications and Usage: List important relationships in your life and identify values such as trust and respect in each relationship. Exemplars / Practical Applications and usage: List the important relationships in their life (family, friends, teachers) and identify values like trust and respect in each relationship			
Unit 4	Harmony in the Nature (Existence)	6 Hrs.	CO4
Understanding Harmony in Nature; Interconnectedness and Mutual Fulfilment among the Four Orders of Nature; Realizing Existence as Co-existence at All Levels; Holistic Perception of Harmony in Existence; Sustainable Development and Responsible Consumption; Professional Ethics in the Light of Right Understanding; Ethical Responsibilities of Engineers; Human Values in Technology and Innovation; Strategies for Transition towards Value-based Life and Profession. Exemplars / Practical Applications and Usage: Conduct activities related to tree plantation, waste segregation, water conservation, or e-waste management and submit a report			
Text Books:			
1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81-957703-6-6 (e-book) 2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)			
Reference Books:			
1. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers. 2. A. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak 3. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books. 4. A. N. Tripathy, 2003, Human Values, New Age International Publishers. 5. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press 6. B. L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008. 7. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd. 8. M. K. Gandhi, "The Story of my Experiments with Truth", Discovery Publisher			
MOOCs Links and additional reading material:			

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1. Swayam Course on “Understanding Human Being Nature and Existence Comprehensively” by Dr. Kumar Sambhav, Director, UP Institute of Design (UPID), Noida.
https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. NPTEL Course on “Exploring Human Values: Visions of Happiness and Perfect Society” by Prof.A. K. Sharma, Department of Humanities and Social Sciences, IIT Kanpur.
<https://nptel.ac.in/courses/109104068>
3. Gaur Gopal Das: <https://www.youtube.com/@GaurGopalDas>
4. Sadguru: <https://www.youtube.com/@sadhguru>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	1	-	-	-	2	-	-	1
CO2	-	-	-	-	-	2	1	-	-	-	2	-	-	1
CO3	-	-	-	-	-	2	2	1	1	-	2	-	-	1
CO4	-	-	-	-	-	2	2	1	1	-	2	-	-	1
Avg.	-	-	-	-	-	2	1.5	0.5	0.5	-	2	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern				
BT Level	CCE			
	CO1	CO2	CO3	CO4
	12	13	12	13
L1	√	√	√	√
L2	√	√	√	√
L3	—	—	√	√
L4	—	—	—	—
L5	—	—	—	—
L6	—	—	—	—

This course serves as a prerequisite for / maps with the following future courses:

1. Sustainable Development
2. Humanities and Social Sciences (HSS)

Job Mapping:

Job opportunities that one can get after learning this course:

1. Human Resource (HR) Specialist
2. Public Relations (PR) Manager
3. Counselor / Life Coach
4. Sustainability Consultant

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Program:	S.Y.B.Tech (E&TC Engineering)			Semester:	III		
Course:	Electrical and Digital Circuits Lab			Course Code:	R25-ET-PCC-208		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	25	25
Course Description: The Electrical and Digital Circuits Practical Lab provides hands-on experience in the analysis, design, testing, and implementation of basic electrical circuits, electrical machines, and digital circuits. The laboratory helps students understand the practical operation and performance of electrical machines, digital logic systems, combinational and sequential circuits through experimentation and simulation. Students learn the working principles, control, and applications of DC motors, stepper motors, and electric vehicle (EV) systems while developing troubleshooting, circuit analysis, and system integration skills. The course bridges theoretical concepts with real-world applications in electrical and digital systems, enabling students to analyze, design, and verify practical engineering systems effectively.							
Relevance: The Electrical and Digital Circuits Practical Lab is highly relevant for developing practical knowledge and technical skills in the field of electrical and digital engineering engineering. It helps students understand the real-time operation of electrical machines and digital circuits through experimentation and hands-on practice. The laboratory strengthens theoretical concepts learned in classrooms by applying them to actual circuit design, testing, machine operation and troubleshooting. It helps to build familiarity with DC motors, Induction motors, Stepper motors, and Electric vehicle (EV) systems.							
Course Objective							
1. To Implement the basic electrical circuits and verify the operations using circuit laws and Theorems. 2. To analyze and study the performance characteristics of electrical machines such as DC motors, induction motors, and stepper motors and analyze and select a suitable motor for different applications. 3. To Design and implement combinational logic circuits such as adder, subtractor, code converter, multiplexer. 4. To Design and implement sequential circuits such as counter, register etc.							
Course Outcome: After learning this course, students will be able to:							
CO	Course Outcome					Bloom's Level	
CO1	Implement the basic electrical circuits; verify the operations using circuit laws and parameters.					3	
CO2	Analyze and study the performance characteristics of electrical machines such as DC motors, induction motors, BLDC motors, and stepper motors. And analyze and select a suitable motor for different applications.					3	
CO3	Design and implement given combinational logic circuits such as adder, subtractor, code converter, multiplexer etc.					3	
CO4	Design and implement sequential circuits such as counter, register etc					3	

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List of Experiments			
Group A ((Electrical Circuits): Any 5 to be Performed			
Experiment No. 1	Electric Circuit Analysis using Network Theorems	2 Hrs.	CO1
Objective: To determine the following using Suitable Network Theorems. Associated Task: 1. Currents through various given branches. 2. Voltages across the given branches. 3. Power absorbed or delivered by a given component. Exemplars and Utility: Help to understand circuit analysis using suitable network theorem.			
Experiment No. 2	Transient Analysis	2 Hrs.	CO1
Objective: To carry out the transient analysis and determine the voltage, current expressions for a RL, RC, and RLC. Associated Task: 1. Carry out transient analysis RL circuit. 2. Carry out transient analysis RC circuit. 3. Carry out transient analysis RLC circuit. Exemplars and Utility: Help to understand transient analysis of RL, RC, and RLC circuits.			
Experiment No. 3	Speed control of DC Shunt Motor	2 Hrs.	CO1
Objective: To study speed control of DC shunt motor using armature voltage and field current control method. Associated Task: 1. Set up necessary DC Shunt motor connections carefully. 2. Measure RPM and plot graph of speed versus armature voltage and field current. Exemplars and Utility: Help to understand working principle of DC shunt motor.			
Experiment No. 4	Three Phase Induction Motor	2 Hrs.	CO2
Objective: To study Torque- Speed characteristic of Three phase induction motor. Associated Task: 1. Set up necessary Three phase induction motor connections carefully. 2. Measure Torque & Speed and plot graph of Torque- Speed. Exemplars and Utility: Help to understand working principle of Three phase induction motor.			
Experiment No. 5	Speed Control of a Stepper Motor	2 Hrs.	CO2
Objective: To control speed of a Stepper Motor using PWM and Arduino Microcontroller Associated Task: 1. Interface Stepper Motor with Arduino Microcontroller. 2. Control speed of a Stepper Motor using PWM feature of Arduino Microcontroller. Exemplars and Utility: Help to understand real time application Arduino Microcontroller for motor speed control.			
Experiment No. 6	Case study of an Electric Vehicle (EV)	2 Hrs.	CO2

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Objective: To study motor specifications of any Electric Vehicle (EV).

Associated Task:

1. Learn important blocks in EV.
2. Learn motor specifications of any EV through EV manual.

Exemplars and Utility:

Help to understand EV architecture and motor requirements.

Group B (Digital Circuits) : Any 5 to be Performed

Experiment No. 1	Full Adder And Full Subtractor	2 Hrs.	CO3
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Objective: To design and implement full adder and full subtractor function using IC-74138.

Associated Task:

1. Understand the pin configuration of IC 74138 as 3:8 decoder
2. Design of full adder and full subtractor using 3:8 decoder
3. Implement full adder and full subtractor function using IC-74138.
4. Verify the truth table.

Exemplar and Utility: Arithmetic Logic Unit of processors found in everyday devices like smartphones, laptops, and digital calculators

Experiment No. 2	Binary to Gray code converter	2 Hrs.	CO3
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Objective: To design and implement 3-bit Binary to Gray code converter using IC-74138.

Associated Task:

1. Understand the pin configuration of IC 74138 as 3:8 decoder
2. Design of 3-bit Binary to Gray code converter using 3:8 decoder
3. Implement 3-bit Binary to Gray code converter using IC-74138.
4. Verify the truth table.

Exemplar and Utility: A rotary absolute optical encoder. It track the precise angular position of mechanical shafts in industrial robotics

Experiment No. 3	4-variable function using IC-74153	2 Hrs.	CO3
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Objective: To design and implement the given 4-variable function using IC-74153. Verify its Truth Table.

Associated Task:

1. Understand the pin configuration of IC 74153 as dual 4:1 Multiplexer.
2. Design of given 4-variable function example: $F(ABCD) = \sum m(0,1,3,4,7,9,10,11,13,15)$
3. Implement using IC-74153.
4. Verify the truth table.

Exemplar and Utility: Telecommunications & Internet, Computer Processors (CPUs), Microcontroller Sensors etc.

Experiment No. 4	Decade Counter IC 7490	2 Hrs.	CO4
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Objective: To design and implement MOD-N and MOD-NN using IC-7490 and draw Timing diagram.

Associated Task:

1. Understand the pin configuration of IC 7490 as decade counter IC.
2. Design of 1 digit and 2 digit counter using IC-7490
3. Implement 1 digit and 2 digit counter using IC-7490.
4. Verify its truth table and draw Timing diagram.

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**Exemplar and Utility:**

Digital Clocks and Watches, Industrial Item Counters, LED Chasers & Light Sequencers

Experiment No. 5	Up/down Counter using IC-74191.	2 Hrs.	CO4
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Objective: To design and implement Up/down Counter with mode control using IC-74191 / IC-74193. Draw Timing Diagram.

Associated Task:

1. Understand the pin configuration of IC 74191 as a 4 bit ripple counter.
2. Understand the concept of Up/down Counter.
3. Design and implement 4 bit Up/down Counter using IC-74191.
4. Verify its truth table and draw Timing diagram.

Exemplar and Utility: Multi-Level Parking Garage, Digital Clocks & Timers

Experiment No. 6	Pulse train generator using IC-74194 / IC-7495	2 Hrs.	CO4
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Objective: To design and implement Pulse train generator using IC-74194 / IC-7495 (Use right/left Shift).

Associated Task:

1. Understand the pin configuration of IC 74194 as a 4 bit shift register.
2. Understand the concept of Pulse train generator.
3. Design and implement Pulse train generator using IC-74194.
4. Verify its truth table.

Exemplar and Utility: Stepper Motor Drivers, Electronic Pacemakers, LED Flashes and Optical Triggers

Experiment No. 7	4-bit Ring Counter / Twisted ring Counter	2 Hrs.	CO4
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Objective: To design and implement 4-bit Ring Counter / Twisted ring Counter using shift registers IC-74194 / IC-7495.

Associated Task:

1. Understand the pin configuration of IC 74194 as a 4 bit shift register.
2. Understand the concept of Ring/Twisted ring Counter.
3. Design and implement 4-bit Ring Counter / Twisted ring Counter using shift registers IC- 74194.
4. Verify its truth table.

Exemplar and Utility: Stepper Motor Controllers, Timing and Control Circuits**Text books:**

1. Ravish R Singh, "Network Analysis & Synthesis", McGraw-Hill Education, India, 2nd Edition.
2. B.L. Theraja, A.K. Theraja, "Electrical Technology", Vol II, AC & DC Machines, S. Chand Publishing, New Delhi

3. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill Publication
4. Thomas Floyd, "Digital Fundamentals", Pearson Publication, India

Reference Books:

1. I.J Nagarath and D.P Kothari, "Electrical Machines", Tata McGraw-Hill Publication 4th Edition.
2. William H. Hayt, Jack E. Kimmerly and Steven M. Durbin, "Electrical Circuit Analysis", Tata McGraw Hill publication, 7th Edition.
3. John. F. Wakerly, "Digital Design- Principles and Practices", Pearson Publication
4. M. M. Mano, "Digital Design," Prentice Hall India.

Virtual Lab Source:Vlab: <https://ade-iitr.vlabs.ac.in/>

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**CO-PO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	2	-	-	3	3	-	3	2	3	3
CO2	3	3	3	3	2	-	-	3	3	-	3	2	3	3
CO3	3	3	3	3	2	-	-	3	3	-	3	2	3	3
CO4	3	3	3	2	2	-	-	-	3	-	3	2	3	3
Avg	3	3	3	3	2	-	-	3	3	-	3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Power Electronics, Embedded system, VLSI design and Technology.

Job Mapping:

Job opportunities that one can get after learning this course:

6. Hardware Design Engineer
7. Embedded System Engineer
8. VLSI Design Engineer
9. FPGA/VHDL Programmer
10. Testing and Verification Engineer

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Program:	S.Y.B.Tech (E&TC Engineering)			Semester:	III		
Course:	Data Structures and Algorithms Lab			Course Code:	R25-ET-MDM-209		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	25	25
Course Objective							
1. To understand and implement fundamental data structures using the C programming language. 2. To develop applications using stacks, queues, linked lists, trees, and graphs. 3. To apply searching and sorting techniques for efficient data processing. 4. To design algorithms for solving real-world computational problems using appropriate data structures. 5. To enhance logical thinking, programming, and problem-solving skills through practical assignments and mini projects.							
Course Outcome							
CO1: Apply and implement searching and sorting algorithms using C language. CO2: Develop applications of stack and queue using arrays and linked lists. CO3: Implement singly linked list operations for dynamic data management. CO4: Construct and traverse Binary Search Trees (BST) and analyze their properties. CO5: Build and traverse graphs using BFS and DFS techniques for solving connectivity problems.							
List of Experiments							
Group A : Any 5 to be Performed							
1.Student Management System. Objective Develop a Student Result Management System using an array of structures in C to efficiently manage student records. Associated Tasks 1. Create an array of structures to store student details (Roll Number, Name, Program, Course, Subject Marks, Total, and Average). 2. Implement operations to add, update, search, sort, and display student records. 3. Calculate and display the total marks and average for each student. Exemplar and Utility Exemplar: Student Result Management System. Utility: Enhances skills in structures, arrays, searching, sorting, and record management.							
2. Stack or Queue using Array (Static Implementation) Objective Implement a Stack or Queue using arrays to simulate a parcel handling system in a post office. Associated Tasks 1. Create an array-based implementation of either a Stack (LIFO) or Queue (FIFO). 2. Implement Push, Pop, and Display operations for Stack or Enqueue, Dequeue, and Display operations for Queue. 3. Demonstrate the working of static linear data structures using menu-driven operations. Exemplar and Utility Exemplar: Post Office Parcel Handling System. Utility: Develops understanding of stack, queue, and array-based implementations.							

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**3. Singly Linked List Operations****Objective**

Develop a text editor system using a singly linked list to manage text dynamically.

Associated Tasks

1. Implement insertion and deletion of text lines at the beginning, end, and any specified position.
2. Display the text in forward and reverse order.
3. Reverse the linked list and display the updated text.

Exemplar and Utility

Exemplar: Text Editor System.

Utility: Strengthens concepts of dynamic memory allocation and linked list operations.

4. Binary Search Tree Operations**Objective**

Design an online directory system using a Binary Search Tree (BST) for efficient data organization and searching.

Associated Tasks

1. Create a Binary Search Tree to store names in sorted order.
2. Implement insertion and searching operations on the BST.
3. Perform recursive in-order, preorder, and post-order traversals.

Exemplar and Utility

Exemplar: Online Directory System.

Utility: Builds proficiency in tree-based searching and recursive traversal techniques.

5. Graph Traversal**Objective**

Design a campus navigation system using a graph represented by an adjacency matrix.

Associated Tasks

1. Represent building connections using an adjacency matrix.
2. Implement Breadth-First Search (BFS) for graph traversal.
3. Implement Depth-First Search (DFS) to explore all reachable nodes.

Exemplar and Utility

Exemplar: Campus Navigation System.

Utility: Develops graph representation and traversal algorithm skills.

Group B (Any 5 to be Performed)**1. Pattern Generation****Objective**

Develop a C program to generate different number, alphabet, and asterisk patterns using loops.

Associated Tasks

1. Generate a right-angle triangle and number pyramid using numbers.
2. Generate pyramid patterns using asterisks and alphabets.
3. Generate a diamond-shaped alphabet pattern.

Exemplar and Utility

Exemplar: Pattern Generator.

Utility: Improves understanding of nested loops and pattern logic.


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2. Searching Techniques

Objective

Develop a contact management system to perform efficient searching using linear and binary search techniques.

Associated Tasks

1. Store and display a list of contact names.
2. Implement sequential (linear) search to locate a contact.
3. Sort the contacts and implement binary search.

Exemplar and Utility

Exemplar: Contact Management System.

Utility: Builds skills in searching algorithms and sorting concepts.

3. Sorting Algorithms

Objective

Develop a C program to sort product prices using different sorting algorithms.

Associated Tasks

1. Store product prices in an array.
2. Implement Bubble Sort, Selection Sort, and Insertion Sort.
3. Display the sorted product prices in ascending order.

Exemplar and Utility

Exemplar: Online Store Product Price Sorter.

Utility: Enhances understanding of sorting algorithms and data organization.

4. Stack or Queue using Linked List (Dynamic Implementation)

Objective

Implement a dynamic Stack or Queue using a linked list for service or browser history management.

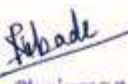
Associated Tasks

1. Create a linked list-based Stack (LIFO) or Queue (FIFO).
2. Implement insertion (Push/Enqueue) and deletion (Pop/Dequeue) operations.
3. Display the contents of the Stack or Queue.

Exemplar and Utility

Exemplar: Service Window or Browser History System.

Utility: Strengthens linked list and dynamic memory management concepts.


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**5A. Balanced Parentheses****Objective**

Develop a C program to verify whether an expression has balanced parentheses using a stack.

Associated Tasks

1. Read an expression containing (), {}, and [] brackets.
2. Implement a stack using an array or linked list.
3. Check and display whether the expression is balanced.

Exemplar and Utility

Exemplar: Expression Validator.

Utility: Reinforces stack operations and expression processing.

OR

5B. Decimal to Binary Conversion**Objective**

Develop a C program to convert a decimal number into its binary equivalent using a stack.

Associated Tasks

1. Read a decimal number from the user.
2. Convert the number into binary using stack operations.
3. Display the binary equivalent.

Exemplar and Utility

Exemplar: Decimal to Binary Converter.

Utility: Demonstrates practical application of stack data structure..

6. Height and Depth in BST**Objective**

Develop a Binary Search Tree (BST) to determine the height of the tree and depth of a specified node.

Associated Tasks

1. Construct a Binary Search Tree using insertion.
2. Calculate the height of the BST.
3. Determine the depth of a specified node.

Exemplar and Utility

Exemplar: BST Analyzer.

Utility: Improves understanding of tree properties and recursive algorithms.

7. Count and Classify Nodes**Objective**

Develop a C program to classify and count different types of nodes in a binary tree.

Associated Tasks

1. Construct a binary tree.
2. Count leaf nodes, internal nodes, and nodes with one child.
3. Display the total count of each node category.

Exemplar and Utility

Exemplar: Binary Tree Node Analyzer.

Utility: Enhances knowledge of binary tree traversal and node classification.

8. Train Ticket Booking System**Objective**

Develop a train ticket booking system using queues to manage confirmed and waiting passengers.

Associated Tasks

1. Implement queues for confirmed bookings and waiting list.
2. Process ticket booking and cancellation requests.
3. Move the first waiting passenger to confirmed status upon cancellation.

Exemplar and Utility

Exemplar: Train Ticket Booking System.

Utility: Demonstrates practical applications of queue data structures in resource management.

Group Assignment

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**Group Assignment Guidelines**

- 1) Make a group of 4 students in a batch (Batch of 20)
- 2) The group will select any of the listed group assignments or propose a similar one with the course teacher's approval
- 3) After completing the assignment, the group will present it during the practical slot.

Distribution of Work in Presentation

- 1) Algorithm / Flowchart
- 2) Program Explanation
- 3) Applications

1. Matchstick Game (AI vs Human)**Objective**

Develop a console-based Matchstick Game in C where the computer follows an optimal strategy to avoid losing.

Associated Tasks

1. Implement game logic for two players with 21 matchsticks.
2. Validate user input and allow selection of 1 to 4 matchsticks per turn.
3. Implement an optimal computer strategy and declare the game result.

Exemplar and Utility

Exemplar: Matchstick Game.

Utility: Enhances skills in control structures, functions, and basic game logic.

2. Tic-Tac-Toe Game (2-Player Console Version)**Objective**

Develop a console-based two-player Tic-Tac-Toe game using a 3×3 grid.

Associated Tasks

1. Create and display the game board using a two-dimensional array.
2. Implement player moves with input validation.
3. Check for win, loss, or draw conditions after each move.

Exemplar and Utility

Exemplar: Tic-Tac-Toe Game.

Utility: Strengthens concepts of arrays, functions, and game programming.

3. Tower of Hanoi (Recursive Approach)**Objective**

Develop a C program to solve the Tower of Hanoi problem using recursion.

Associated Tasks

1. Accept the number of disks as input.
2. Implement the recursive algorithm to move disks between pegs.
3. Display the sequence of moves required to solve the puzzle.

Exemplar and Utility

Exemplar: Tower of Hanoi Simulator.

Utility: Improves understanding of recursion and algorithm design.

4. Banking Transactions Mini Statement Generator**Objective**

Develop a banking transaction system to perform basic account operations and generate a mini statement.

Associated Tasks

1. Store account details and transaction history using structures and arrays.
2. Implement deposit and withdrawal operations with validation.
3. Display the last five transactions as a mini statement.

Exemplar and Utility

Exemplar: Banking Transaction System.

Utility: Develops skills in structures, arrays, and transaction management.

**5. Typing Tutor (Accuracy and Speed Tracker)****Objective****Develop a typing tutor to measure typing speed and accuracy.****Associated Tasks**

1. Display a random sentence for the user to type.
2. Calculate typing speed (WPM) and accuracy percentage.
3. Identify and suggest corrections for misspelled words.

Exemplar and Utility**Exemplar:** Typing Tutor.**Utility:** Enhances string handling, time-based programming, and text processing.

Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	3	–	–	1	1	–	3	1	2	3
CO2	3	3	2	2	3	–	–	1	1	–	3	1	2	3
CO3	3	3	2	2	3	–	–	1	1	–	3	1	2	3
CO4	3	3	3	2	3	–	–	1	1	1	3	1	2	3
CO5	3	3	3	2	3	–	–	1	1	1	3	1	2	3
Avg.	3	3	2.4	2	3	-	-	1	1	1	3	1	2	3

1:Slight(Low)

2:Moderate(Medium)

3:Substantial(High)

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Program:		S..Y.B.Tech (E&TC Engineering)		Semester:		III	
Course:		Community Engagement Project		Course Code:		R25-ET-CEP-210	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
--	04	--	02	--	--	50	-
Course Description: - The Community Engagement Project (CEP) is an experiential learning course that integrates community engagement with engineering practice. The course enables students to interact with local communities, identify real-world problems, and develop appropriate solutions using Electronics and Telecommunication Engineering concepts. - Students will engage in field visits, surveys, awareness activities, and technical solution development. The course ensures continuity from second-year engagement activities and strengthens them through application of Electronics, Digital, and Communication Engineering knowledge.							
Course Relevance: - This course aligns with the vision of the National Education Policy (NEP) 2020 by promoting experiential and community-based learning. It enables students to bridge the gap between theoretical knowledge and real-world engineering applications. - The course is particularly relevant to Electronics and Telecommunication Engineering students as it integrates core courses such as Electronics Circuits, Digital Circuits and Systems, and Principles of Communication Systems into solving societal problems. - Students get an opportunity to design and implement low-cost, sustainable, and technology-driven solutions for challenges related to environmental monitoring, smart agriculture, healthcare, energy systems, and rural development. - The course also enhances employability by developing practical skills in hardware implementation, system design, teamwork, leadership, communication, and innovation, while nurturing social responsibility and ethical engineering practices.							
Prerequisite: - Students should have prior knowledge of - Basic of Electronic Devices and Circuits - Fundamentals of Digital Electronics - Basics of Communication Engineering - Problem-solving techniques							
Bridge Content - Sensors and transducers - Signal conditioning circuits - Microcontrollers and embedded systems - Communication modules (RF, GSM, Wi-Fi, Bluetooth) - Data acquisition and interfacing - Teamwork and technical documentation							

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**Course Objectives:**

After learning the course, students will be able to

1. Understand community needs and societal challenges.
2. Develop social responsibility and ethical values.
3. Apply Electronics and Telecommunication Engineering knowledge to real-world problems.
4. Design low-cost and sustainable engineering solutions.
5. Enhance teamwork, communication, and leadership skills.

Course Outcomes:

CO	Course Outcome	Bloom's Level
CO1	Identify and analyze community problems through field interaction	2
CO2	Understand socio-technical challenges and stakeholder needs	3
CO3	Apply E&TC Engineering concepts to design solutions / interventions	3
CO4	Implement prototype or community-based activity	3
CO5	Evaluate impact and sustainability of solution	4
CO6	Present and document outcomes effectively	3

1.Course Content**Stage 1: Community Engagement**

- Identification of village/urban area
- Interaction with stakeholders (local authorities/NGOs/community members)
- Identification of real-world problems

Stage 2: Survey and Awareness Activities

- Conduct surveys and data collection
- Organize awareness programs (health, environment, energy, digital literacy)
- Field-based learning activities

Stage 3: Technical Integration

- Electronics & Circuits: sensing and measurement systems
- Digital Electronics: control logic and embedded systems
- Communication Engineering: wireless communication and data transfer

Stage 4: Solution Development

- Prototype/model development
- Technical intervention or system design
- Community-oriented implementation

Stage 5: STEM Outreach Activities

- Conduct simple STEM activities for school children
- Demonstrate basic concepts through hands-on experiments
- Develop low-cost models (circuits, sensors, simple robotics)
- Promote scientific thinking and interest in engineering

2.Project Guidelines

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Students will work in groups of 3–4
Each group will be assigned a mentor
Project must be community-based and problem-driven
Solution should include technical contribution from E&TC Engineering domain

Projects must be:

Community-based (rural/urban/local)
Problem-driven (not theoretical)
E&TC Engineering-enabled / Technology based solution

Sample Project Areas: Not limited to

1. Pollution monitoring systems
Students design systems to monitor air, water, or noise pollution using sensors. The data helps in creating awareness and supporting environmental protection.
2. Smart irrigation and water management
Students develop systems for efficient water usage using sensors and automation. This helps farmers optimize irrigation and conserve water resources.
3. Renewable energy applications
Students implement small-scale solutions using solar or other renewable energy sources. These projects promote sustainable energy usage in rural and urban areas.
4. Health monitoring devices
Students design basic devices to monitor health parameters like heart rate or temperature. Such systems support early detection and awareness of health conditions.
5. Disaster alert systems
Students create systems to detect and alert about natural disasters like floods or fires. These solutions improve safety and preparedness in vulnerable areas.
6. Digital literacy and automation systems
Students develop simple digital tools and automation solutions for daily tasks. These projects enhance digital awareness and ease of living in communities.

Mandatory Requirements:

Activity (Log) book (weekly progress record)
Two-page project proposal
Field visit and survey documentation
Community interaction proof
Awareness program execution

Documentation Format:

1. Title Page
2. Certificate
3. Problem Statement
4. Survey and Data Collection
5. Analysis
6. System Design (Block Diagram and Circuit)
7. Implementation
8. Results and Impact
9. Challenges and Learning


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- 10. Conclusion
- 11. References
- 12. Annexure

3. Mode of Evaluation:

The evaluation will be done in two phases:

a) Continuous Evaluation (25 Marks)

Sr. No.	Component	Marks
1	Problem Identification & Survey	05
2	Community Engagement Activity	05
3	Analysis and Planning	05
4	Technical Design	05
5	Implementation Progress	05
Total		25

b) End Evaluation (25 Marks)

Sr. No.	Evaluation Parameters	Marks
1	Workflow Demonstration	05
2	Technical Quality	05
3	Teamwork	05
4	Documentation	05
5	Presentation/Viva	05
Total		25

4. Proposal Format (Two Pages)

Title of Project
 Aim and Objectives
 Problem Statement
 Proposed Methodology
 Expected Outcome
 Timeline

5. Additional Recommendations:

Participation in project competitions/hackathons
 Encourage prototype development and innovation
 Maintain weekly progress through activity (log) book

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**6. Website Links/ Online Resources****1. Smart India Hackathon-2025: Problem Statement Details**

Agriculture / Smart Cities / Healthcare / Education / AI / IoT

<https://www.sih.gov.in/sih2025PS>**2. Smart India Hackathon-2024: Problem Statement Details**

Agriculture / Healthcare / Smart Cities / Sustainability / Transportation / AI / Cybersecurity

<https://www.sih.gov.in/sih2024PS>**3. Open-Source Project Repositories, Project Type: All Domains**URL: <https://github.com>**4. UNESCO: Education for Sustainable Development**<https://www.unesco.org/en/sustainable-development/education>**5. Ashoka: Innovators for the Public**<https://www.ashoka.org>**CO-PO-PSO Mapping**

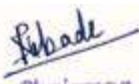
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Avg.	2.17	2.50	1.83	1.33	1.17	2.33	2.00	1.67	2	1.67	1.00	1.83	1.83	2.83

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Semester - IV


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Course Code	Course Type	Name of the Subject	Teaching Scheme (Hrs./week)			SL	Total	Examination Scheme and Marks						Credit			
			TH	PR	TU T			CCE	ESE	TW	PR	OR	TOTAL	TH	PR	OR	TOTAL
R25-ET-PCC-211	Program Core course - 4	Electronic circuits	3	-	-	45	90	40	60	-	-	-	100	3	-	-	3
R25-ET-PCC-212	Program Core course - 5	Control Systems	2	-	-	30	60	40	60	-	-	-	100	2	-	-	2
R25-ET-PCC-213	Program Core course - 6	Principles of Communication Systems	3	-	-	45	90	40	60	-	-	-	100	3	-	-	3
R25-ET-MDM-214	Multidisciplinary Course-2	Object Oriented Programming with JAVA	2	-	-	30	60	40	60	-	-	-	100	2	-	-	2
R25-ET-OEC-215	Open Elective-II	Remote Sensing and GIS	2	-	-	30	60	40	60	-	-	-	100	2	-	-	2
R25-ET-VSC-216	Vocational Skill Course	Project Based Learning	1	2	-	15	60	25	-	-	25	-	50	1	1	-	2
R25-ET-AEC-217	Ability Enhancement Course	Modern Indian Languages (Marathi/Hindi) and Technical Writing	1	2	-	15	60	-	-	50	-	-	50	1	1	-	2
R25-ET-EEM-218	Entrepreneurship/Economics/Management course	Entrepreneurship and IPR	2	-	-	-	30	50	-	-	-	-	50	2	-	-	2
R25-ET-PCC-219	Program Core Course- Lab	Electronics and Communication Lab	-	2	-	-	30	-	-	-	25	-	25	-	1	-	1
R25-ET-PCC-220	Program Core Course Lab / Multidisciplinary Course-Lab	Control Systems and Object Oriented Programming with JAVA Lab	-	2	-	-	60	-	-	-	25	-	25	-	1	-	1
R25-ET-VEC-221	Value Education Course	Life Skills, Leadership and Professional Communication	2	-	-	30	60	50	-	-	-	-	50	2	-	-	2
			18	08	00	255	660	350	300	25	75	00	750	18	04	00	22

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Program:		S.Y.B.Tech (E&TC Engineering)		Semester:		IV	
Course:		Electronic Circuits		Course Code:		R25-ET-PCC-211	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
03	-	-	03	40	60	--	-
Course Description: This course focuses on the analysis and design of analog electronic circuits using MOSFETs and operational amplifiers. It covers amplifier design, feedback systems, oscillators, data converters, PLL, and power supply circuits, enabling students to develop practical circuit design skills for real-world applications.							
Relevance: • Foundation for VLSI design and embedded systems • Widely used in communication, signal processing, and IoT systems • Essential for analog circuit design and power electronics • Supports careers in electronics, semiconductor, and hardware industries							
Prerequisite: Fundamentals of Electronics							
Bridge Content: -							
Course Objectives: 1. To Know about MOSFET characteristics, biasing, and analyze its performance in amplifier circuits. 2. To design MOSFET-based circuits including amplifiers, feedback networks, and oscillators. 3. To develop and analyze op-amp based linear circuits for signal processing applications. 4. To study nonlinear op-amp applications, data converters, and PLL systems. 5. To analyze and compare linear and switching voltage regulator circuits.							
Course Outcomes: After learning the course, students will be able to:							
CO	Course Outcome						Bloom's Level
CO1	Explain MOSFET characteristics and apply them in basic amplifier circuits						3
CO2	Apply concepts of MOSFET circuits, feedback, and oscillators for given specifications.						3
CO3	Apply op-amp principles to build linear signal processing circuits.						3
CO4	Explain the operation of nonlinear circuits, ADC/DAC, and PLL systems.						2
CO5	Explain and apply concepts of linear and switching voltage regulators.						3

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Course Content			
Unit I	MOSFET and Its Analysis	9 Hrs.	CO1
Enhancement MOSFET: MOSFET Biasing, Voltage divide bias, DC Load line, AC equivalent circuit, Parameters. Non ideal characteristics: Finite output resistance, Body effect, Sub-threshold conduction, Breakdown effects, temperature effect, effect of W/L ratio, Common source amplifier & its AC analysis, Frequency response for CS amplifier. Source follower: circuit diagram, comparison with common source. Comparison between BJT & MOSFET			
Exemplar: IC Fabrication, MOSFET Count in Processors of Computers & Cell phones			
Unit II	MOSFET Circuits	9 Hrs.	CO2
<u>Introduction to MOSFET as a basic element in VLSI</u>, MOSFET as switch, CMOS inverter, resistor & diode. Current sink & source, Current mirror. Types of feedback, four types of feedback topologies, Effects of feedback, Voltage series & current series feedback amplifiers and analysis. Barkhausen criterion, Types of Oscillators, RC phase shift oscillator, Crystal Oscillator.			
Exemplar: Real Time Clock (RTC) IC, Quartz Crystal Oscillators in Clock			
Unit III	Operational amplifier and linear Applications	9 Hrs.	CO3
Block diagram, Op amp parameters, Op-amp characteristics (AC & DC). Inverting amplifier (Voltage series), non-inverting amplifier (voltage shunt), Effect on Ri, Ro, gain & bandwidth, Voltage follower, Instrumentation Amplifier, Practical integrator, Practical differentiator, Precision Rectifier. First order Low pass filter and High Pass Filter			
Exemplar: Analog Computers, Signal Conditioning Circuits			
Unit IV	Op-amp Non -Linear Applications & PLL	9 Hrs.	CO4
Comparator, Schmitt trigger, Square & triangular wave generator, PWM Generator DAC & ADC: Weighted resistor and R-2R DAC, SAR, Flash and dual slope ADC Types / Techniques, Characteristics, block diagrams, Circuits, Specifications, Merits, Demerits, Comparisons. PLL: Block Diagram, Characteristics, Phase Detectors, Details of PLL IC 565 Applications, Typical Circuits			
Exemplar: Real world interfacing with IoT			
Unit V	Voltage Regulators	9 Hrs.	CO5
Three terminal voltage regulators: Define, Block diagram of power supply, Types: Fixed and Variable, Block diagram of linear voltage regulator, IC 317 and IC337, Features and specifications, typical circuits, current boosting, Low Dropout Regulator (LDO). SMPS: Block diagram, Types, features and specifications, typical circuits buck and boost converter. Comparison between Linear and Switch mode Power Supply.			
Exemplar: Cell Phone chargers, Adapters, Vehicle Battery charger.			
Text books:			

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1. D. A. Neamen, *Microelectronics: Circuit Analysis and Design*, 4th ed. New York, NY, USA: McGraw-Hill Education, 2025. ISBN-13: 978-1266812583 (International Student Edition) / ISBN-13: 978-0078028205.

2. R. A. Gayakwad and S. Rekha, *Op-Amps and Linear Integrated Circuits*, Revised 4th ed. Noida, India: Pearson Education, 2021. ISBN-13: 978-9353949037

Reference Books:

1. J. Millman and C. C. Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, 2nd ed. New Delhi, India: Tata McGraw-Hill, 2003. **ISBN-13:** 9780074622457 (ISBN-10: 0074622455).

2. P. E. Allen and D. R. Holberg, *CMOS Analog Circuit Design*, 3rd ed. New York, NY, USA: Oxford University Press, 2012. **ISBN-13:** 9780199765072 (Hardcover) / 9780198097389 (Indian Edition)

3. N. S. Salivahanan and S. Kanchana Bhaskaran, *Linear Integrated Circuits*, 3rd ed. New Delhi, India: Tata McGraw-Hill Education, 2018. **ISBN-13:** 978935316178.

MOOCs Links and additional reading material:

1. NPTEL Course “Analog Electronic Circuits”

<https://nptel.ac.in/courses/108/105/108105158/>

2. NPTEL Course on “Analog Circuits”

<https://nptel.ac.in/courses/108/101/108101094/>

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	1	1	-	3	2	-
CO2	3	3	3	2	2	1	-	-	1	1	-	3	2	1
CO3	3	2	3	2	2	-	-	-	2	2	-	2	3	-
CO4	3	3	2	3	2	1	-	1	2	2	-	2	3	2
CO5	3	2	2	2	2	1	1	-	1	1	-	3	2	-
Avg.	3	2.6	2.4	2.2	2	1	1	1	1.4	1.4	-	2.6	2.4	0.6

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern

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BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	√	√	√	-	√	√	√	√	-	√
L4	-	-	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

This course serves as a prerequisite for/ maps with the following future courses:

1. Analog Communication
2. VLSI Design
3. Embedded System
4. Power Electronics

Job Mapping:

Job opportunities that one can get after learning this course:

1. Hardware Design Engineer

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Program:		S.Y. B. Tech			Semester:		IV
Course:		Control Systems			Course Code:		R25-ET-PCC-213
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
02	-	-	02	40	60	-	-
Course Description: Control Systems introduces the principles of modeling, analysis, and design of dynamic systems using mathematical tools such as differential equations, transfer functions, and state-space representation. It enables students to design and analyze real-world engineering systems used in automation, robotics, communication, and power systems.							
Course Relevance: Control Systems is fundamental to modern engineering, enabling the design of systems that operate automatically with accuracy, stability, and efficiency. The course provides essential skills for developing intelligent and adaptive systems used in real-world technologies and advanced research areas.							
Prerequisite: Mathematics for Signals and Systems							
Bridge Content: -----							
Course Objectives: 1. To describe the basic concepts of control systems, including open-loop and closed-loop configurations and their real-world significance. 2. To analyze the control system performance using standard test signals, error analysis, controllers, and modern automation technologies. 3. To analyze the stability and performance of control systems using stability criteria, root locus techniques, and compensator design. 4. To develop the knowledge of frequency response analysis and state-space representation for analyzing the performance and stability of control systems.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	DESCRIBE the basic concepts of control systems including open-loop and closed-loop systems, and model physical systems using transfer functions						2
CO2	ANALYZE the time-domain response of control systems, the performance of P, I, D, PI, PD, and PID controllers, and the role of PLC, IoT, and robotics in modern automation.						4
CO3	ANALYZE the stability and performance of control systems using Routh–Hurwitz criterion, root locus, and lead, lag, and lead–lag compensators.						4
CO4	EVALUATE the frequency domain techniques and state-space representation to assess system stability.						4

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Course Content			
Unit I	Introduction to Control system	6 Hrs.	CO1
Introduction, Open loop and Closed loop systems, Modeling of systems: Differential equations and Transfer function, Block diagram representation and signal flow graphs. Reduction technique: Simplification of block diagram and Mason's gain formula.			
Exemplars / Practical Applications and usage: Washing Machine, Toaster (Open loop system), Air Conditioner with Thermostat Control (Closed loop system)			
Unit II	Time domain Analysis	8 Hrs.	CO2
Standard test signals: Impulse, Step, ramp and sinusoidal inputs. Transient response analysis: First-order and second-order systems, Time domain specifications: Rise time, settling time, peak overshoot, and steady state error. Error analysis: Static error constants and system type. Controllers: Proportional(P), Integral(I), Derivative(D), Proportional Integral (PI), Proportional Derivative (PD), Proportional Integral Derivative (PID) and their effect on steady state error. Automation in Modern Control Systems: Programmable Logic Controller (PLC), IoT based Industrial Automation, Robotics			
Exemplars / Practical Applications and usage: Switching behavior in power electronics, Signal distortion over time			
Unit III	Stability Analysis	8 Hrs.	CO3
Concept of stability: Definition, Characteristic equation of a system, absolute stability, relative stability, conditional stability, Routh-Hurwitz stability criterion. Root locus: Construction of root locus, effect of pole- zero location on system performance. Design using Root locus: Improving transient response and stability. Introduction to compensators: Lead, lag and lead-lag compensation			
Exemplars / Practical Applications and usage: Channel estimation stability, Servo motors in robotics, Load balancing in smart grids			
Unit IV	Frequency Domain Analysis and State Space Representation	8 Hrs.	CO4
Concept of frequency response, comparison with time-domain analysis, frequency domain parameters: resonant peak, resonant frequency, bandwidth, Construction of Polar plot, Bode plot and Nyquist plots, Determination of frequency domain specifications like gain crossover frequency, phase crossover frequency, gain margin, phase margin and stability analysis, relevance of stability in control system-plants. State space representation fundamentals, Solution of homogeneous state equations, Controllability and Observability concepts			
Exemplars / Practical Applications and usage: Use of frequency domain methods in designing controllers and compensators, Modeling RLC circuits and communication systems.			

**Textbooks:**

1. K. Ogata, Modern Control Engineering, 5th ed. Harlow, U.K.: Pearson Education, 2021
2. N. J. Nagrath and M. Gopal, Control Systems Engineering, 5th ed. New Delhi, India: New Age International Publishers.
3. A. Nagoor Kani, Control Systems, 2nd ed. New Delhi, India: McGraw Hill Education, 2017.
4. S. K. Bhattacharya, Control Systems Theory and Applications, 3rd Edition, Pearson, 2013.

Reference Books:

1. J. J. DiStefano III, A. R. Stubberud, and I. J. Williams, Schaum's Outline of Feedback and Control Systems, 2nd ed. New York, NY, USA: McGraw-Hill Education, 1995.
2. J. J. D'Azzo and C. H. Houpis, Linear Control System Analysis and Design: Conventional and Modern, 5th ed. New York, NY, USA: McGraw-Hill Education, 2003.
3. B. C. Kuo and F. Golnaraghi, Automatic Control Systems, 9th ed. Hoboken, NJ, USA: John Wiley & Sons, 2010
4. M. Gopal, Control Systems: Principles and Design, 4th ed. New Delhi, India: McGraw Hill Education (India), 2012.

MOOCs Links and additional reading material:

1. NPTEL Course on “Control Systems”
Link of the Course- https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ee90
2. NPTEL Course on “Control Engineering”
Link of the Course- <https://nptel.ac.in/courses/108106098>

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	-	-	1	3	2	3
CO2	3	3	1	-	2	-	-	-	-	-	1	3	2	3
CO3	3	3	2	2	2	-	-	3	3	-	1	3	2	3
CO4	3	3	2	2	2	-	-	3	3	-	1	3	2	3
Avg.	3	2.75	1.5	2	1.75	-	-	3	3	-	1	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

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BT Level	CCE				ESE			
	CO1	CO2	CO3	CO4	CO1	CO2	CO3	CO4
	10	10	10	10	15	15	15	15
L1	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√
L3	-	√	√	√	-	√	√	√
L4	-	√	√	√	-	√	√	√
L5	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:
Electronics Circuit, Digital Electronics, Communication system, Automation System etc.

Job opportunities that one can get after learning this course:
Control System Engineer in domains like robotics, autonomous vehicles, and industrial automation.

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Program:		S. Y. B. Tech (E&TC Engineering)		Semester:		IV	
Course:		Principles of Communication Systems		Course Code:		R25-ET-PCC-212	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
03	---	--	03	40	60	--	---
Course Description: This course introduces the fundamental concepts of analog and pulse communication techniques. It focuses on amplitude, frequency, and phase modulation, along with pulse modulation methods such as PAM, PWM, PPM, and digital pulse modulation techniques including PCM and DM. Students learn how these modulation schemes are generated, transmitted, and demodulated, and their applications in modern communication systems. Also, it covers the statistical analysis of random signals and noise, including their behavior, spectral characteristics, interference effects, and equalization techniques in communication systems.							
Course Relevance: The course provides essential foundational knowledge required for understanding modern communication systems and prepares students for advanced subjects like digital and wireless communication.							
Prerequisite:							
1. Mathematics for Signals and Systems							
Bridge Content: -----							
Course Objectives:							
1. To understand the principles and performance of amplitude and frequency modulation systems used in communication systems.							
2.To study the generation, transmission, and detection techniques of AM and FM communication systems in time and frequency domains.							
3.To learn sampling theory and pulse modulation techniques used in analog-to-digital conversion.							
4.To understand quantization and digital representation methods including PCM, DPCM, DM, and ADM.							
5.To analyse random processes and the impact of noise in communication systems using statistical and spectral methods.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	Describe and ANALYZE the techniques of generation, transmission and reception of amplitude modulation systems in time and frequency domain						3
CO2	Describe and ANALYZE the techniques of generation, transmission and reception of Frequency modulation systems in time and frequency domain						3
CO3	EXAMINE sampling techniques and analog pulse modulation schemes .						3
CO4	CHARACTERIZE the quantization process and elaborate digital representation techniques (PCM, DPCM, DM and ADM) along with its multiplexing and synchronization techniques.						2
CO5	ANALYZE random processes and noise effects in communication systems using statistical and spectral techniques						3
Course Contents							
Unit I	Amplitude Modulation and Demodulation Techniques				09 Hrs.		CO1
Need of Modulation, Amplitude Modulation (AM), Types of AM, Modulation Index, Spectrum of AM, Double Sideband Suppressed Carrier (DSB-SC) Modulation, Single Sideband Modulation (SSB), Vestigial Sideband Modulation (VSB), Power Efficiency, Envelope Detection, AM receiver.							

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Exemplars / Practical Applications and usage: AM Radio Broadcasting			
Unit II	Frequency modulation and demodulation Techniques	09 Hrs.	CO2
Concept of FM, Modulation index, Spectrum, bandwidth, power and Relationship between Phase Modulation (PM) and Frequency modulation, features of Bessel coefficient, Narrow band and wideband FM, FM modulator and demodulator, FM generation by Armstrong 's method, FM detection using PLL			
Exemplars / Practical Applications and usage: FM Radio Broadcasting, Two-Way Radio Communication.			
Unit III	Analog Pulse Modulation Techniques	09 Hrs.	CO3
Need of analog to digital conversion, sampling theorem for low pass signal in time domain, and Nyquist criteria, Types of sampling- natural and flat top. Pulse amplitude modulation & concept of TDM, Channel bandwidth for PAM, equalization, Signal Recovery. Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM): Generation & Detection.			
Exemplars / Practical Applications and usage: Switch-mode power supplies			
Unit IV	Baseband Digital Transmission	09 Hrs.	CO4
Quantization of Signals: Quantization error, Uniform & Non-Uniform types of Quantization, Mid-rise & Mid-tread Quantizer. Companding: A-law & μ -law. Pulse Code Modulation system: Generation & Reconstruction, Differential Pulse code modulation, Delta Modulation, Adaptive Delta Modulation. Line codes: Properties and spectrum. Digital Multiplexing and hierarchies: AT&T, CCITT, Scrambling & Unscrambling. Synchronization: Carrier Synchronization, Bit Synchronization and Frame Synchronization.			
Exemplars / Practical Applications and usage: Digital Telephony, Digital Television Broadcasting			
Unit V	Random Process & Noise	09 Hrs.	CO5
Random Processes: Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation and Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density. Mathematical Representation of Noise: Some Sources of Noise, Frequency-domain Representation of Noise, Intersymbol Interference, Equalization.			
Exemplars / Practical Applications and usage: Weather Forecasting			
Textbooks:			
1. H. Taub, D. L. Schilling, and G. Saha, Principles of Communication Systems, 4th ed. New Delhi, India: McGraw-Hill Education, 2013. 2. B. P. Lathi and Z. Ding, Modern Analog and Digital Communication Systems, 4th ed. New York, NY, USA: Oxford University Press, 2009.			
Reference Books:			
1. B. Sklar and P. K. Ray, Digital Communications: Fundamentals and Applications, 2nd ed. New Delhi, India: Pearson Education, 2001. 2. G. Kennedy and B. Davis, Electronic Communication Systems, 4th ed. New York, NY, USA: McGraw-Hill, 1992.			

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3. W. Tomasi, Electronic Communications Systems: Fundamentals Through Advanced, 5th ed. Upper Saddle River, NJ, USA: Pearson Education, 2004.
4. A. B. Carlson, P. B. Crilly, and J. C. Rutledge, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, 5th ed. New York, NY, USA: McGraw-Hill, 2010.
5. S. Haykin, Communication Systems, 4th ed. Hoboken, NJ, USA: John Wiley & Sons, 2001.

MOOCs Links and additional reading material:

1. NPTEL Course on “**Digital Communication Systems**” [Link](https://nptel.ac.in/courses/108/102/108102096/) of the Course: <https://nptel.ac.in/courses/108/102/108102096/>
2. NPTEL Course “**Fundamentals of Communication Systems and its Applications1**” https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ec03

Strength of CO-PO-PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	3	1	1	-	1	1	2	3	3	2
CO2	3	2	2	2	3	1	1	-	1	1	2	3	3	2
CO3	3	2	2	2	3	1	1	-	1	1	2	3	3	2
CO4	3	2	2	1	3	1	1	-	1	1	2	3	3	2
CO5	3	2	2	2	3	1	1	-	1	1	2	3	3	2
Avg	3	2	2	1.8	3	1	1	-	1	1	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Table:

BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	√	√	√	-	√	√	√	√	-	√
L4	-	-	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses: Digital communication, Communication Networks

Job Mapping: Job opportunities that one can get after learning this course: RF Engineer, Communication Engineer, Telecomm Engineer

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Program:	S. Y. B. Tech (E&TC Engineering)			Semester:	IV		
Course:	Object Oriented programming with JAVA			Course Code:	R25-ET-MDM-214		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
02	-	-	02	40	60	--	-
Course Description: To provide a comprehensive understanding of object-oriented programming concepts using Java, including problem-solving techniques, program design, and implementation using core and advanced Java features such as multi-threading, exception handling, GUI, and file handling. The course also supports the Multidisciplinary Minor (MDM) framework by enabling students from diverse disciplines to develop computational thinking, programming skills, and software application development abilities applicable in interdisciplinary domains.							
Course Relevance: This course enables students to develop robust, reusable, and scalable software using object-oriented principles. It forms the foundation for advanced programming, software development, and real-world application building.							
Prerequisite: 1. Data Structures 2. Object Oriented Programming Concepts							
Bridge Content: Basic programming constructs, control structures, data types, and fundamental object-oriented principles such as classes and objects.							
Course Objectives: 1. To understand core concepts of object-oriented programming using Java. 2. To develop problem-solving skills using Java programs. 3. To apply OOP principles like inheritance, interfaces, and multi-threading. 4. To build robust applications using exception handling, GUI, and file handling.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	Understand Java fundamentals, data types, operators, arrays, and control structures.						2
CO2	Apply classes, objects, methods, constructors, and other object-oriented programming concepts in Java.						3
CO3	Implement inheritance, abstraction, interfaces, packages, and polymorphism to develop modular applications.						3
CO4	Develop Java applications using multi-threading, exception handling, GUI programming, and file handling techniques.						3

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Course Content			
Unit I	Java Fundamentals and Programming Basics	08 Hrs.	CO1
Introduction to Java: Evolution, importance, features (platform independent, secure, robust, multithreaded), comparison with C/C++. Java Environment: JRE, JVM architecture, JDK. Basic Programming Concepts: Structure of Java program, compilation and execution process. Java Tokens: keywords, identifiers, literals. Data Handling: primitive and non-primitive data types, variables and scope (local, instance, static), 1D and introduction to 2D arrays. Operators and Expressions: arithmetic, relational, logical, bitwise operators, type conversion and casting, operator precedence. Control Statements: if, if-else, switch, for, while, do-while. Exemplars / Practical Applications and usage: Writing simple Java programs, input-output operations, implementing decision-making and looping problems Assignments: 1.Explain features of Java with examples. 2.Write a program using control statements (if/loop).			
Unit II	Classes, Objects and Methods	7 Hrs.	CO2
Class and Object Concepts: defining classes, creating objects, memory allocation for objects, accessing data members and methods. Methods: method definition and calling, parameter passing (call by value), returning values. Constructors: default and parameterized constructors, constructor overloading. Method Overloading. Static keyword (variables and methods), this keyword. Garbage collection mechanism, finalize () method. Final variable, method and class. Exemplars / Practical Applications and usage: Designing real-world entities like Student, Bank Account using classes and objects. Assignments: 1. Explain class and object with suitable examples. 2. Write a Java program demonstrating constructor and method overloading.			
Unit III	Inheritance, Interfaces and Packages	7 Hrs.	CO3
Inheritance: concept, need, single and multilevel inheritance, method overriding, dynamic method dispatch (runtime polymorphism). Abstract Concepts: abstract classes and methods, use cases of abstraction. Interfaces: defining and implementing interfaces, extending interfaces, default and static methods. Packages: creating packages, importing and accessing packages, overview of Java API packages, advantages of packages (reusability and modularity). Exemplars / Practical Applications and usage: Developing hierarchical applications like Employee Management System using inheritance and interfaces. Assignments: 1. Explain inheritance and its types with examples. 2. Demonstrate interface implementation with a program.			



Unit IV	Advanced Java Programming	8 Hrs.	CO4
Multithreading: concept of process and thread, thread lifecycle, creating threads using Thread class, basic thread operations. Exception Handling: compile-time and runtime errors, exception hierarchy, try, catch, finally, multiple catch, throw and throws, custom exceptions. GUI Programming: Graphics class basics, introduction to AWT, components (Button, Label, Text Field, etc.), event handling using Action Listener, introduction to Swing, JFrame, JPanel, JButton, AWT vs. Swing. File Handling: streams, byte and character streams, file creation and manipulation, reading and writing files, buffered streams, random access files.			
Exemplars / Practical Applications and usage: Developing multi-threaded applications like file downloading simulation, handling runtime errors in programs. Designing GUI applications like calculator, student form, and storing data using file handling.			
Assignments: 1. Explain thread lifecycle with example. 2. Write a Java program using exception handling (multiple catch). 3. Develop a GUI-based application using Swing. 4. Write a Java program to read/write data from a file. 5. Develop mini project using OOP concepts			
Course Projects:			
Develop mini project using OOP concepts. Student Management System, Library Management System, Banking System, Quiz Application etc.			
Textbooks: [1] E. Balagurusamy, Programming with Java, 6th ed. New Delhi, India: Tata McGraw-Hill, 2019. [2] H. Schildt, Java: The Complete Reference, 7th ed. New Delhi, India: Tata McGraw-Hill, 2007.			
Reference Books: [1] T. Budd, Understanding Object-Oriented Programming with Java. Upper Saddle River, NJ, USA: Pearson Education. [2] Y. D. Liang, Introduction to Java Programming. Upper Saddle River, NJ, USA: Pearson Education. [3] C. S. Horstmann, Core Java, Volume I—Fundamentals, 11th ed. Hoboken, NJ, USA: Pearson, 2018.			
MOOCs Links and additional reading material: 1. Programming in Java (NPTEL) https://nptel.ac.in/courses/106/105/106105191/ 2. OOP with JAVA Lab: https://onlinecourses.nptel.ac.in/noc25_cs110/preview?utm_source.com			

*Add additional rows as per requirement

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Strength of CO-PO-PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	-	1	2	2
CO2	3	3	2	1	2	-	-	-	-	-	-	2	3	2
CO3	2	3	3	1	2	-	-	-	1	-	-	2	3	3
CO4	2	3	3	2	3	-	-	-	1	1	-	2	3	3
Average	2.5	2.75	2.25	1.33	2.25	-	-	-	1	1	-	1.75	2.75	2.5

Assessment Pattern

BT Level	CCE				ESE			
	CO1	CO2	CO3	CO4	CO1	CO2	CO3	CO4
	10	10	10	10	15	15	15	15
L1	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√
L3	-	√	√	√	-	√	√	√
L4	-	-	-	-	-	-	-	-
L5	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-

This course serves as a prerequisite for / maps with the following future courses:

Advanced Java Programming, Data Structures, Software Engineering, Web Technologies, Mobile Application Development, Artificial Intelligence, Database Management Systems, Cloud Computing, etc.

Job Mapping:

Job opportunities that one can get after learning this course:

This course serves as a **foundation for software development and programming roles**. After completing this course, students can pursue careers such as:

- Java Developer
- Software Engineer
- Application Developer
- Web Developer
- Android Developer
- Software Tester
- System Analyst



Program:		S. Y. B. Tech (E&TC Engineering)			Semester:		IV	
Course:		Project Based Learning			Course Code:		R25-ET-VSEC-216	
Teaching Scheme				Examination Scheme				
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR	
-	02	-	02	-	-	-	50	
Course Description: Project Based Learning (PBL) is a student-centric, experiential, and outcome-oriented learning approach that empowers students to apply engineering fundamentals for solving real-world and interdisciplinary problems through innovative project development. The course encourages active learning, creativity, critical thinking, and design thinking while promoting teamwork, leadership, technical communication, and project management skills. It also enables students to utilize modern tools, emerging technologies, and sustainable engineering practices to develop practical, industry-relevant, and socially impactful solutions.								
Course Relevance: The Project Based Learning (PBL) course helps students connect classroom learning with real-world applications through hands-on project development. It improves problem-solving ability, creativity, teamwork, communication, and technical skills while encouraging innovation and practical thinking. The course also prepares students for industry requirements, higher studies, research, entrepreneurship, and socially responsible engineering practices.								
Prerequisite: - Basic Electronics Engineering - Basic Electrical Engineering								
Course Objectives: - To encourage students to identify and understand real-world engineering and societal problems through observation, interaction, literature survey, and practical exploration. - To enable students to apply the fundamentals of Electronics, Communication, Computing, and interdisciplinary technologies for developing innovative, meaningful, and sustainable solutions. - To develop practical knowledge and hands-on skills in system design, simulation, implementation, testing, and validation using modern engineering tools and technologies. - To nurture teamwork, leadership, communication, technical documentation, time management, and collaborative learning skills through project-based activities. - To inspire creativity, critical thinking, ethical values, environmental awareness, research orientation, and lifelong learning while contributing positively to society through engineering solutions.								
Course Outcomes: After learning the course, students will be able to								
CO	Course Outcomes						Bloom's Level	
CO1	Identify and analyze real-world engineering and societal problems through literature survey, field study, and requirement analysis to define appropriate project objectives.						4	
CO2	Design and develop innovative hardware/software-based solutions using the fundamentals of Electronics, Communication, Computing, and modern engineering tools.						6	
CO3	Analyze, test, and validate the performance of the developed system while applying project management, problem-solving, and technical skills.						5	

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CO4	Demonstrate teamwork, leadership, technical communication, ethical practices, sustainability awareness, and lifelong learning through collaborative project activities.	3
Group Structure:		
Project Based Learning (PBL) activities shall be carried out in mentor-guided groups of 4 to 6 students to promote experiential learning, innovation, teamwork, and practical problem-solving. Students shall collaboratively work on real-world engineering or societal problems through design, implementation, testing, documentation, and presentation activities while developing technical, communication, leadership, ethical, and lifelong learning skills. A faculty mentor shall continuously guide and monitor the progress of the group throughout the project lifecycle.		
PBL Phases:		
Phase 1: Problem Identification - Real-world problem selection - Need analysis - Problem statement formulation Phase 2: Literature Survey & Requirement Analysis - Journal/patent survey - Existing solution analysis - Requirement gathering Phase 3: System Design - Block diagram preparation - Hardware/software selection - Algorithm and workflow design Phase 4: Prototype Development - Coding and interfacing - Simulation/modeling - Hardware implementation Phase 5: Testing & Validation - Functional testing - Performance analysis - Result verification Phase 6: Documentation & Demonstration - Technical report preparation - Poster/presentation - Prototype demonstration and viva		

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**Suggested Domains:****Core Domains:**

- Analog & Digital Electronics
- Embedded Systems
- Communication Engineering
- Signal Processing
- PCB Design

Emerging Technologies

- Internet of Things (IoT)
- Artificial Intelligence & Machine Learning
- Robotics & Automation
- Smart Sensors
- Industry 4.0 Applications

Social & Sustainable Applications

- Smart Healthcare
- Smart Agriculture
- Renewable Energy Systems
- Women Safety Systems
- Environmental Monitoring

Modern Tools Recommended:**Ethical Practices, Teamwork and Project Management**

Students shall follow professional ethics, safety measures, and responsible engineering practices throughout the Project Based Learning (PBL) activities. The projects shall encourage teamwork, collaborative learning, leadership, effective communication, and time management skills among students. Group members are expected to actively participate in planning, implementation, documentation, reviews, poster presentations, and demonstrations while respecting deadlines and individual responsibilities. Students shall also consider social, environmental, legal, and sustainability aspects while developing engineering solutions.

Assessment Structure


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The progress and performance of students in Project Based Learning (PBL) shall be evaluated continuously throughout the semester based on individual contribution, teamwork, innovation, implementation, documentation, and presentation of the project work. Regular reviews and mentor guidance shall help students improve technical, communication, and problem-solving skills during different phases of project development.

Continuous Assessment Components:

Sr. No.	Assessment Parameter	Weightage
1	Problem Identification and Literature Survey	10%
2	Requirement Analysis and Feasibility Study	10%
3	Innovation and System Design	15%
4	Prototype Development and Implementation	20%
5	Testing, Validation and Result Analysis	10%
6	Documentation and Technical Writing	10%
7	Presentation and Demonstration	10%
8	Teamwork, Regularity and Professionalism	5%
9	Ethics, Sustainability and Social Relevance	5%
10	Participation in Competition, Publication or Innovation Activities	5%

Suggested Evaluation Methods:

- Weekly Progress Review
- Mentor Assessment
- Mid-Semester Review
- Final Demonstration and Presentation
- Poster Presentation
- Viva-Voce Examination
- Peer and Team Evaluation

Effective Documentation

Effective documentation is an essential part of Project Based Learning (PBL) and plays an important role in developing technical writing, communication, presentation, and professional skills among students. Students are expected to systematically document all stages of the project work including problem identification, literature survey, requirement analysis, system design, implementation, testing, and result analysis throughout the project lifecycle.

Students shall maintain proper records such as project synopsis, weekly progress logbook, literature survey record, design and implementation documents, testing and result sheets, presentation slides, and poster/prototype details. Regular documentation and review of project activities shall help students improve accountability, teamwork, presentation skills, and professional approach towards engineering project development.

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The PBL final report shall preferably contain:

- Title Page
- Certificate
- Abstract
- Problem Statement
- Aim and Objectives
- Literature Survey
- System Block Diagram and Methodology
- Hardware and Software Requirements
- Implementation Details
- Testing, Results and Discussion
- Conclusion and Future Scope
- References and Appendix (if applicable)

Students are encouraged to use standard technical writing practices, proper referencing methods, and modern documentation tools while preparing reports and presentations.

Learning Resources:

Reference Books / Research Articles

1. John Larmer, John R. Mergendoller, and Suzie Boss, Setting the Standard for Project Based Learning.
2. John Larmer and Suzie Boss, Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences.
3. Erin M. Murphy and Ross Cooper, Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry.
4. M. Krašna, "Project Based Learning (PBL) in Teachers' Education," International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), IEEE.
5. J. Macias-Guarasa et al., "A Project Based Learning Approach to Design Electronic Systems Curricula," IEEE Transactions on Education.


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Web Resources

- IEEE Xplore Digital Library
- Google Scholar
- www.ieee.org
- www.edutopia.org
- www.hackster.io
- www.github.com
- www.howstuffworks.com
- www.wikipedia.org

Suggested Software and Tools

- MATLAB / Simulink
- Scilab
- Proteus / Multisim
- Arduino IDE
- Python
- KiCad / Eagle PCB
- GitHub
- Overleaf / LaTeX
- Mendeley / Zotero


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Program:	S.Y.B.Tech (E&TC Engineering)			Semester:	IV		
Course:	Modern Indian Language and Technical Writing			Course Code:	R25-ET-AEC-217		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	OR
01	02	-	02	25	-	25	-
Course Description: To develop engineering students into proficient multilingual communicators with emphasis on Modern Indian Language (Marathi) proficiency, technical writing, professional documentation, and effective communication skills through practical and activity-based learning							
Course Relevance: The course enables students to develop effective communication and public speaking abilities, enhance professional and technical writing skills, strengthen interpersonal and teamwork competencies, and prepare for placements, seminars, interviews, and project documentation while promoting multilingual communication in technical and professional environments.							
Prerequisite: - Indian Knowledge System. - Professional Communication Skill.							
Bridge Content: The course bridges fundamental communication concepts with practical applications such as presentations, technical writing, professional documentation, and the use of digital tools like LaTeX for effective technical communication							
Course Objectives: - To develop effective oral, written, and professional communication skills in Marathi. - To enhance students' confidence in public speaking, group discussions, presentations, and interpersonal communication. - To improve technical writing abilities including report writing, official correspondence, technical documentation, and the use of Marathi technical terminology in engineering. - To encourage teamwork, leadership qualities, and the effective use of modern digital and AI-based tools for technical and professional communication.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcomes					Bloom's Level	
CO1	Demonstrate the relationship between language, personality development, democratic values, and mass media, and apply Marathi language skills for news writing, proofreading, and script writing for various media platforms.					2	
CO2	Analyze the role of new media and social media in contemporary communication and demonstrate responsible digital communication practices through media literacy and content creation.					3	
CO3	Prepare professional and technical documents such as emails, notices, agendas, minutes, resumes, and biodata by applying the principles of effective technical communication and ethical writing practices.					3	

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CO4	Develop technical reports, presentations, and project-related documentation using LaTeX, translation and localization techniques, AI-assisted tools, and team-based communication skills.	3	
Unit I	Language and Communication	7 Hrs.	COs Mapped:CO1
Component 1: Language and Communication (Marathi) 1. Relationship between Language and Personality Development. 2. Life Skills in Democracy and Mass Media. Component 2: Writing for Mass Media (Marathi) 1. News Writing and Proofreading for Newspapers. 2. Script Writing for Radio Broadcasting. 3. Script Writing for Television Documentaries.			
Unit II	New Media and social media	7 Hrs.	COs Mapped: CO2
Component 1: New Media and Social Media (Marathi) 1. Language, Day-to-Day Communication, New Media, and Social Media. 2. Types of New Media and Social Media: - Blogs - Facebook - Twitter (X) 3. Media and Social Media Literacy: (Marathi) - Awareness - Precautions - Usage			
Unit III	Technical Writing	7 Hrs.	COs Mapped: CO3
1. Technical Communication: Concept, Need, and Scope 2. Principles of Effective Technical Writing 3. Professional Correspondence: - Professional Emails - Notices - Agenda Preparation - Minutes of Meetings 4. Resume and Biodata Writing 5. Ethics in Technical Communication 6. AI-Assisted Writing, Proofreading, and Editing Tools			
Unit IV	Technical Report Writing	7 Hrs.	COs Mapped: CO3
1. Technical Report Writing: - Structure and Format - Abstract, Introduction, Conclusion, References 2. Technical Documentation using LaTeX			

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3. Technical Content Translation and Localization
4. Technical Presentation Design and Delivery
5. Use of AI Tools for Presentation Development
6. Team-Based Communication and Project Presentation Skills
7. Documentation for Projects, Seminars, and Business Proposals

Suggested List of Assignments

1. **Marathi Bhasheche Mahatva ani Itihas** – Students will explain the importance, historical development, cultural significance, evolution, and role of Marathi language in effective communication through written assignments or oral presentations.
2. **Marathi Self-Introduction and Professional Communication Activity** – Students will introduce themselves in Marathi in formal and informal situations to develop confidence in oral communication, pronunciation, interpersonal interaction, and professional communication skills.
3. **Group Activity: Group Discussion / Road Show / Skit Play / One-Act Play** – Students will participate in structured group discussions and team-based activities such as road shows, skits, and one-act plays to improve communication skills, creativity, teamwork, leadership qualities, analytical thinking, and stage confidence.
4. **Book Review and Blog Writing Activity** – Students will read any novel, fiction, or literature book of their choice and prepare a review or blog post for publication on a suitable digital or social media platform. The activity will enhance analytical thinking, writing ability, creativity, originality, and audience engagement.
5. **Letter, Application, and Professional Email Writing** – Students will draft formal letters, applications, and professional emails for different academic and workplace situations such as leave requests, invitations, enquiries, and official communication. Assessment will focus on format, tone, structure, clarity, etiquette, and proofreading.
6. **Notice, Agenda, and Minutes Writing** – Students will prepare notices, meeting agendas, and minutes of meetings to understand institutional documentation practices and formal communication procedures.
7. **Technical Report Writing using LaTeX** – Students will prepare a structured technical report using LaTeX including Title Page, Abstract, Table of Contents, Introduction, Methodology/Content, Conclusion, and References. Reports may be based on field visits, mini-projects, technical case studies, or business proposals.
8. **Technical Presentation Development using AI Tools** – Students will design and deliver technical presentations on selected topics using AI-powered tools for PPT creation. Emphasis will be given to content accuracy, logical organization, data visualization, slide design, technical understanding, and confident communication.
9. **Translation of Technical Content (English ↔ Marathi)** – Students will translate technical paragraphs, notices, engineering-related content, or professional documents between English and Marathi to improve multilingual communication abilities and technical terminology usage.
10. **Resume / Biodata Preparation** – Students will prepare professional resumes and biodata highlighting academic qualifications, technical skills, achievements, and career objectives using standard professional formats.
11. **AI-Based Technical Writing and Editing Activity** – Students will use AI-enabled digital tools for drafting, proofreading, editing, and improving technical documents, blogs, presentations, and professional communication content.
12. **Team-Based Communication Activity / Role Play and Project Presentation** – Students will perform collaborative communication tasks, role plays, and project presentations using modern digital tools to strengthen teamwork, coordination, leadership, interpersonal communication, problem-solving, technical writing, and presentation skills.



Textbooks:
1. Internet – Dr. Ashok Bande, Manorama Publication, Mumbai 2. Business Marathi – Dr. L. N. Tambolikar, Phadke Publication, Kolhapur 3. Communication Skills – Sanjay Kumar & Pushp Lata 4. Technical Communication – Meenakshi Raman & Sangeeta Sharma
Reference Books:
1. Applied Marathi – Editors: Dr. Naresh Mehta, Santosh Gore, Sujata Gore 2. Introduction to Information Technology – Digish J. O. Limbaji
MOOCs Links and additional reading material:
1. https://www.latex-project.org 2. https://www.geeksforgeeks.org

This course serves as a prerequisite for / maps with the following future courses:
1. Professional Communication and Technical Documentation 2. Project Work, Seminar, and Presentation Skills 3. Entrepreneurship Development and Team-based Projects.
Job Mapping: Technical Writer, Content Writer, Communication Specialist, Business Analyst, Trainer, Customer Support Executive, and roles requiring presentation and documentation skills across industries.


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Program:		S.Y.B.Tech (E&TC Engineering)		Semester:		IV	
Course:		Entrepreneurship and IPR		Course Code:		R25-ET-EEM-218	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CC E	ESE	TW	PR
02	-	--	2	50	--	-	--
Course Description: This course introduces the fundamentals of entrepreneurship, startup ecosystem, innovation, business planning, and Intellectual Property Rights (IPR). The course focuses on entrepreneurial opportunities in engineering and technology domains, startup development process, funding support, government initiatives, and basics of IPR including patents, copyrights, trademarks, industrial designs, and cyber laws. The course also emphasizes real-world startup case studies and innovation practices for engineering students.							
Course Relevance: This course helps students develop entrepreneurial thinking, innovation capability, and awareness about startup opportunities in engineering and technology sectors. It also provides knowledge about Intellectual Property Rights (IPR) required for protecting innovative ideas, products, and technology-based solutions							
Prerequisite: 1.Basic understanding of engineering and technology. 2.Interest in innovation, startups, and entrepreneurship.							
Bridge Content: --							
Course Objectives: 1. To introduce the fundamentals of entrepreneurship and the startup ecosystem. 2. To develop understanding of innovation, idea generation, and business models. 3. To create awareness about startup funding, government initiatives, and entrepreneurial opportunities. 4. To understand Intellectual Property Rights (IPR) and their applications in engineering and technology. 5. To encourage students to analyze real-world startup and IPR-related case studies.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome						Bloom's Level
CO1	Understand fundamentals of entrepreneurship, startup ecosystem.						2
CO2	Identify innovative business ideas and startup opportunities.						3
CO3	Explain business models, funding methods, and government support schemes.						2
CO4	Describe different types of Intellectual Property Rights and their applications.						2
CO5	Analyze real-world startup and IPR-related case studies.						3
Course Contents							
Unit I	Entrepreneurship Fundamentals and Startup Ecosystem				08 Hrs.	CO1	
Introduction to entrepreneurship, characteristics and qualities of entrepreneurs, types of entrepreneurship, role of entrepreneurship in economic development, startup ecosystem in India, entrepreneurship opportunities in engineering and technology sector, challenges faced by startups, startup lifecycle, and support organizations for startups.							
Exemplars / Practical Applications and usage: Study of successful startups, identification of entrepreneurial characteristics, analysis of startup ecosystem, and understanding support systems such as incubators and accelerators.							

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Unit II	Innovation, Idea Generation and Business Models	08 Hrs.	CO2
Innovation and creativity, idea generation techniques, design thinking basics, opportunity identification, market analysis, feasibility study, business model concepts, Business Model Canvas (BMC), value proposition, customer segments, revenue generation methods, and basics of startup planning.			
Exemplars / Practical Applications and usage: Preparation of innovative startup ideas, Business Model Canvas creation, market opportunity analysis, and idea validation for engineering applications.			
Unit III	Startup Funding, Government Initiatives and Entrepreneurial Case Studies	08 Hrs.	CO3
Sources of startup funding, bootstrapping, angel investors, venture capital, crowdfunding, bank loans, MSME schemes, Startup India, Make in India, Atal Innovation Mission (AIM), government support for startups, startup registration basics, entrepreneurial ethics, and study of successful Indian startup case studies.			
Study of startup funding methods, application of Startup India and MSME schemes, analysis of Indian startup success stories such as boAt, Zerodha, and technology-based startups.			
Unit IV	Intellectual Property Rights (IPR) and Cyber Laws	08 Hrs.	CO4
Introduction to Intellectual Property Rights (IPR), need and importance of IPR in engineering and technology, patents, copyrights, trademarks, industrial designs, trade secrets, basics of patent filing process, patent search basics, IPR issues in electronics and communication engineering, cyber laws, ethical practices in innovation, plagiarism, and technology protection.			
Patent search practice, study of patent and trademark case studies, analysis of IPR-related disputes, and understanding cyber laws and ethical engineering practices.			
Textbooks:			
1. Khanka S. S., Entrepreneurial Development, S. Chand Publication. 2. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House. 3. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning. 4. Nandan H., Fundamentals of Entrepreneurship, PHI Learning.			
Reference Books:			
1. Robert D. Hisrich, Michael Peters, Entrepreneurship, McGraw Hill Education. 2. David H. Holt, Entrepreneurship: New Venture Creation, Prentice Hall. 3. P. Narayanan, Intellectual Property Law, Eastern Law House. 4. Arya Kumar, Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Pearson. 5. WIPO Study Material on Intellectual Property Rights.			
MOOCs Links and additional reading material:			



1. Entrepreneurship Essentials by Prof. Manoj Kumar Mondal, IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2. Entrepreneurship by Prof. C. Bhaktavatsala Rao, IIT Madras
https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. NPTEL Entrepreneurship Course
https://onlinecourses.nptel.ac.in/noc20_mg35
4. Intellectual Property Rights (IPR)
https://onlinecourses.nptel.ac.in/noc20_hs16
5. Patent Law for Engineers and Scientists
https://onlinecourses.nptel.ac.in/noc21_hs18

Strength of CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	2	1	1	1	1	2	1	1	-
CO2	2	3	2	1	1	2	1	1	2	1	3	1	2	1
CO3	2	2	2	1	1	2	1	1	2	2	3	1	1	-
CO4	1	2	1	-	-	3	1	3	-	1	1	2	2	1
CO5	2	3	2	2	1	2	1	2	2	2	3			
Avg.	1.80	2.20	1.60	0.80	0.60	2.20	1.00	1.60	1.40	1.40	2.40	1.25	1.50	0.50

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Innovation Management, Start-up and Entrepreneurship Development, Intellectual Property Management, Technology Commercialization, Project Management, Business Incubation and Start-up Support Systems, and Final Year Project / Capstone Project

Job Mapping: This course maps to careers in startups, entrepreneurship, innovation management, business development, intellectual property management, patent analysis, research and development, and technology commercialization domains.

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Program:	S. Y. B. Tech			Semester:	IV		
Course:	Electronics and Communication Lab			Course Code:	R25-ET-PCC-219		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	-	50

Course Description:

This laboratory course provides hands-on exposure to the design, implementation, testing, and analysis of analog electronic circuits and communication systems. Students perform experiments involving MOSFET amplifiers, feedback amplifiers, operational amplifier applications, instrumentation amplifiers, voltage regulators, digital-to-analog converters, and analog/digital communication techniques such as AM, FM, sampling, PCM, DM, and ADM. The course bridges theoretical concepts with practical implementation, enabling students to develop circuit design, troubleshooting, measurement, simulation, and communication system analysis skills. The case study component further enhances students' ability to apply engineering principles to real-world electronic and communication system applications.

Relevance:

This laboratory course is essential for Electronics and Telecommunication Engineering students as it provides practical exposure to the design, implementation, testing, and analysis of analog electronic circuits and communication systems. Through hands-on experiments involving MOSFET amplifiers, feedback circuits, operational amplifiers, voltage regulators, DACs, modulation and demodulation techniques, sampling, and digital communication systems, students gain the skills required to bridge theoretical concepts with real-world engineering applications. The course enhances circuit design, troubleshooting, measurement, and technical documentation abilities while preparing students for advanced studies in analog and communication engineering and careers in electronics hardware, embedded systems, communication, testing, and research domains.

Course Objective

1. To design and implement analog electronic circuits using MOSFETs, feedback techniques, operational amplifiers, and voltage regulators.
2. To build and test Op-Amp-based circuits such as integrators, waveform generators, instrumentation amplifiers, and digital-to-analog converters for specified applications.
3. To design and implement analog communication circuits for generation and detection of AM and FM signals.
4. To design and perform communication system experiments involving sampling, PCM, DM, and ADM techniques for signal transmission and recovery.

Course Outcome : After learning this course, students will be able to:

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CO	Course Outcome	Bloom's Level
CO1	Design MOSFET-based analog electronic circuits.	3
CO2	Construct Op-Amp-based signal processing, instrumentation, and data conversion circuits.	3
CO3	Demonstrate working of Analog and Digital modulation Techniques.	3
CO4	Execute analysis of noise in communication system using simulation software.	3

Text books:

1. Donald Neaman, Electronic Circuits - Analysis and Design, Mc Graw Hill, 3rd Edition.
2. Ramakant Gaikwad, Op Amps & Linear Integrated Circuits, Pearson Education.
3. Taub, Schilling and Saha, Principles of Communication Systems, McGraw-Hill, 4th Edition.
4. B P Lathi, Zhi Ding, Modern Analog and Digital Communication System, Oxford University Press, 4th Edition.

Reference Books:

1. Millman Halkias, Integrated Electronics.
2. Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, Oxford, 2nd Edition.
3. Bernard Sklar and Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications", Pearson Education 2nd Edition.
4. G. Kennedy and B. Davis, *Electronic Communication Systems*, 4th ed. New York, NY, USA: McGraw-Hill, 1992.

Virtual Lab Source:

Basic Electronics Virtual Lab: <https://ade-iitr.vlabs.ac.in/>

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	3	3	-	3	2	3	3
CO2	3	2	3	3	2	-	-	3	3	-	3	2	3	3
CO3	3	2	3	3	2	-	-	3	3	-	3	2	3	3
CO4	3	3	3	2	2	-	-	-	3	-	3	2	3	3
Avg	3	2	3	3	2	-	-	3	3	-	3	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Power Electronics, Embedded system, Wireless Communication

Job Mapping:

Job opportunities that one can get after learning this course:

1. Hardware Design Engineer
2. Technical Support Engineer
3. Communication Systems Engineer
4. Testing and Verification Engineer

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List of Experiment			
Group A (Electronics Circuits): Any 5 to be Performed			
Experiment 1:	Design & build single stage CS configuration & verify DC operating point	02 Hrs	CO1
Objective: Design, build, and verify the DC operating point (Q-point) of a single-stage Common Source (CS) MOSFET amplifier.			
Associated Task: - Design the CS amplifier circuit, - Calculate biasing values, assemble the circuit, measure the DC voltages (V_G, V_S, V_D) and drain current (I_D), then compare the measured values with theoretical calculations.			
Exemplars: Single-stage MOSFET CS amplifier used for voltage amplification in audio amplifiers, sensor interface circuits, and analog signal conditioning.			
Utility: Helps in understanding MOSFET biasing, verifying the Q-point, and developing practical skills in analog circuit design, testing, and troubleshooting.			
Experiment 2:	Implement current series feedback amplifier & measure R_{if} , R_{of} , G_{mf}	02 Hrs	CO1
Objective: Implement a current-series feedback amplifier and measure its input resistance (R_{if}), output resistance (R_{of}), and transconductance gain (G_{mf}).			
Associated Task: - Design the current-series feedback circuit, assemble it on a breadboard, Calculate the modulation index - Apply the input signal, measure R_{if}, R_{of}, and G_{mf} using standard test methods, and compare the measured values with theoretical calculations.			
Exemplars: - Transistor current-series feedback amplifier - Emitter-degenerated BJT amplifier - Current-controlled voltage amplifier stage			
Utility: Used to increase input resistance, improve stability, reduce distortion, and obtain predictable amplifier gain in analog electronic circuits.			
Experiment 3	To design, build & test integrator using Op-amp and comment on result	02 Hrs	CO1
Objective: Design, construct, and test an Op-Amp integrator circuit and verify its integration operation.			
Associated Task: - Design the integrator circuit, select suitable R and C values, assemble the circuit - Apply input signals, observe the output waveform using a CRO/oscilloscope, and compare the practical results with the expected integrated output.			

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**Exemplars:**

Op-Amp RC integrator

Utility:

Helps in understanding the integration function of Op-Amps, waveform conversion (square-to-triangular), and develops practical skills in analog circuit design, testing, and analysis.

Communication

Experiment 4	Design, build & test square and triangular waveform generator using Op-Amp.	02 Hrs	CO1
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Objective:

Design, construct, and test an Op-Amp-based square and triangular waveform generator and verify the generated waveforms.

Associated Task:

- Design the waveform generator circuit.
- Select suitable resistor and capacitor values, assemble the circuit.
- Apply the power supply, observe the square and triangular waveforms on the CRO/oscilloscope, and compare the practical results with the expected output.

Exemplars:

- Op-Amp a stable multivibrator
- Square-wave generator
- Function Generator

Utility:

Helps in understanding waveform generation using Op-Amps, frequency control, and develops practical skills in analog circuit design, testing, and waveform analysis.

Experiment 5	Design, build & test 2 or 3-bit R-2R ladder DAC.	02 Hrs	CO2
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Objective:

To design, build, and test a 2-bit/3-bit R-2R ladder DAC and verify the digital-to-analog voltage conversion for different binary inputs.

Associated Task:

- Construct the R-2R ladder circuit.
- Apply binary inputs, measure the corresponding analog output voltage, and compare the measured values with theoretical calculations.

Exemplars:

Apply binary inputs such as **00, 01, 10, 11** (2-bit) or **000 to 111** (3-bit) and observe the stepwise increase in output voltage.

Utility:

Used in digital signal processing, audio systems, microcontroller interfacing, waveform generation, and embedded system applications where digital data must be converted into analog signals.

Experiment 6	To design, build & test three Op amp Instrumentation amplifiers for typical application	02 Hrs	CO2
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Objective:

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To design, build, and test a three Op-Amp instrumentation amplifier and verify its high-gain differential amplification with high input impedance.

Associated Task:

- Construct the instrumentation amplifier circuit.
- apply differential input signals, measure the output voltage, and verify the amplifier gain and common-mode noise rejection.

Exemplars:

- Amplify a small differential signal from a **strain gauge**
- Thermocouple
- **bridge sensor** and observe the amplified output

Utility:

Used in **sensor signal conditioning, biomedical instrumentation (ECG/EEG), industrial measurement systems, and data acquisition applications** where accurate amplification of low-level signals is required.

Experiment 7	Design & implement adjustable voltage regulator using IC LM317/LM337	02 Hrs	CO2
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Objective: To design, implement, and test an adjustable positive/negative voltage regulator using IC LM317/LM337 and verify the regulated output for different voltage settings.

Associated Task:

- Assemble the regulator circuit.
- Adjust the output voltage using resistors/potentiometer.
- Verify the output using a digital multimeter.

Exemplars:

- Set the output to **+5 V, +9 V, or +12 V (LM317)** and **–5 V or –12 V (LM337)**
- Computer System
- Communication System Toolbox
- PCM and DM Simulation Programs

Utility:

Used in **regulated power supplies, laboratory power sources, electronic testing, battery charging circuits, and embedded system power applications.**

Group B (Principal of Communication Systems): Any 5 to be Performed

Experiment 1:	AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal and Observe Spectrum.	02 Hrs	CO1
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Objective:

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To Demonstrate working of AM (DSB-FC) generator and calculate its modulation index by graphical method, calculate power of AM Wave for different modulating signal and Observe its Spectrum.

Associated Task:

- Set up the AM (DSB-FC) generation circuit
- Measure the modulation index graphically
- Calculate the total transmitted power
- Observe and analyze the frequency spectrum

Exemplars and Utility:

Helps in understanding and analyzing AM transmitter performance

Experiment 2:	Study of Frequency modulator & demodulator, calculation of modulation index & BW of FM.	02 Hrs	CO2
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Objective:

To Study Frequency modulator & demodulator, calculation of modulation index & BW of FM.

Associated Task:

- Study the operation of the FM modulator and demodulator
- Calculate the modulation index
- Determine the bandwidth of the FM signal

Exemplars and Utility:

Develop the ability to calculate the **modulation index** and **bandwidth** of an FM signal and relate them to system performance

Experiment 3	Verification of Sampling Theorem in time domain (Flat top & Natural sampling)	02 Hrs	CO3
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Objective:

To study and verify the Sampling Theorem by generating and observing natural and flat-top sampled signals in the time domain.

Associated Task:

- Set up the sampling circuit and generate natural sampling and flat-top sampling
- Vary the sampling frequency and verify the **Nyquist Sampling Theorem**
- Reconstruct the sampled signal and analyze the quality of the recovered signal under different sampling conditions.

Exemplars

Digital Oscilloscopes

Utility:

Provides practical knowledge of natural sampling and flat-top sampling techniques used in digital communication

Experiment 4	Study of DM: Generation and detection	02 Hrs	CO4
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Objective:

To study the generation of Delta Modulated (DM) signal, observe the staircase approximation produced by the DAC, and analyze the reconstruction of the original signal using a Low Pass Filter (LPF).

Associated Task:

- Measure and record the sampling clock frequency, input sine wave frequency, and

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amplitude.

- Observe and compare the input signal, DAC output, and DM output on the DSO.
- Sketch the DM waveform and staircase DAC output.
- Connect the LPF, observe the reconstructed signal, and compare it with the original input signal.
- Comment on the accuracy of signal tracking and identify any distortion or noise observed in the DM system.

Exemplars:

- Digital Telephone Systems
- Telemetry Systems for Remote Monitoring

Utility:

Provides practical knowledge of Delta Modulation, including signal tracking using a staircase waveform, generation of DM pulses, observation of slope overload distortion and granular noise, and reconstruction of the original signal using a Low Pass Filter.

Experiment 5	Study of ADM: Generation and detection	02 Hrs	CO4
Objective: To study the generation of Adaptive Delta Modulated (ADM) signal, observe the staircase approximation produced by the DAC, and analyze the reconstruction of the original signal using a Low Pass Filter (LPF).			
Associated Task: • Measure and record the sampling clock frequency, input signal frequency, and amplitude. • Observe and compare the input signal, ADM output, and staircase output on the DSO. • Sketch the ADM waveform and corresponding staircase approximation. • Observe the reconstructed signal after the LPF and compare it with the original input signal. • Comment on the adaptive step-size operation of ADM and compare its performance with conventional Delta Modulation in terms of distortion and signal tracking.			
Exemplars: • Mobile Communication Systems (Cellular Networks) • VoIP (Voice over Internet Protocol) Applications			
Utility: Provides practical knowledge of Adaptive Delta Modulation, demonstrating adaptive step-size variation for improved signal tracking, reduction of slope overload distortion, efficient encoding of analog signals, and accurate signal reconstruction in digital communication systems.			
Experiment 6	Generate white noise and calculate Signal to Noise Ratio and Noise Figure of a system.	02 Hrs	CO5
Objective: To generate white Gaussian noise, analyze it in time and frequency domain , and calculate the Signal-to-Noise Ratio (SNR) and Noise Figure (NF) of a given communication system.			

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**Associated Task:**

- Generate White Gaussian Noise using MATLAB.
- Plot the noise signal in the time domain.
- Obtain and analyze its frequency spectrum using FFT.
- Calculate the Signal-to-Noise Ratio (SNR).
- Determine the Noise Figure (NF) of the system.
- Comment on the effect of noise on system performance.

Exemplars:

- Satellite Communication Systems
- Wireless Communication Systems (Wi-Fi/Cellular Networks)

Utility:

Provides practical understanding of White Gaussian Noise (WGN) generation, time and frequency domain analysis, and evaluation of communication system performance using SNR and Noise Figure (NF).

Experiment 7	Write a program to calculate Signal to noise ratio for PCM system & DM system	02 Hrs	CO3
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Objective: To write a program to calculate Signal to noise ratio for PCM system & DM system.

Associated Task:

- Develop MATLAB programs to calculate the SNR of PCM and DM systems.
- Simulate PCM and DM for a given input signal.
- Compute and compare the SNR values obtained for both systems.
- Analyze the effect of quantization and modulation parameters on SNR.
- Comment on the relative performance of PCM and DM based on the obtained results.

Exemplars:

- Digital Telephone Networks (PCM-based Telephony)
- Voice Communication in Telemetry Systems

Utility:

Provides practical understanding of Signal-to-Noise Ratio (SNR) analysis in Pulse Code Modulation (PCM) and Delta Modulation (DM) systems, enabling performance comparison of digital communication techniques using MATLAB.

Group C (Case Study): Any 1 to be Performed

Design of linear regulated variable power supply.

Experiment 1	Design of linear regulated variable power supply.	02 Hrs	CO2
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Objective: To design, build, and test a linear regulated variable power supply and verify stable, adjustable DC output voltage.

Associated Task:

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- Assemble the power supply using a transformer.
- Rectifier, filter, and voltage regulator.
- Adjust the output voltage, and verify regulation under different load conditions.

Exemplars

Design a **0–12 V** or **0–15 V** variable DC power supply and measure the output voltage at different settings.

Utility

Used for electronic circuit testing, laboratory experiments, embedded system development, and powering analog and digital circuits with a stable DC supply.

Experiment 2	Survey related any communication system	02 Hrs	CO4
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Objective: To study different types of communication systems and their applications. Compare their performance, advantages, and limitations.

- Select and study any one communication system (AM, FM, PCM, TV, Satellite, Mobile Communication, Marine, etc.).
- Collect information regarding its working principle, applications, advantages, and limitations.
- Compare the selected system with another communication technique.
- Prepare a brief report and presentation of the survey findings.

Exemplars:

- **AM Broadcasting System** – Medium Wave (MW) and Short Wave Radio Broadcasting
- **FM Communication System** – FM Radio Broadcasting
- **PCM System** – Digital Telephone Networks
- **Satellite Communication System** – DTH Television and GPS Services
- **Cellular Communication System** – 4G/5G Mobile Networks
- **Wireless Communication System** – Wi-Fi Networks
- **Bluetooth Communication System** – Wireless Headphones and IoT Devices

Utility

Provides practical exposure to communication technologies, enhances technical literature review skills, and develops the ability to analyze, compare, and report on various communication systems and their real-world applications.

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Program:		S. Y. B. Tech (E&TC Engineering)		Semester:		IV	
Course:		Control Systems and OOP with JAVA Lab		Course Code:		R25-ET-PCC-220	
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
-	02	-	01	-	-	-	25
Course Description: The Object-Oriented Programming with Java Laboratory course is designed to provide hands-on experience in developing Java applications using object-oriented programming principles. The course covers fundamental programming concepts, classes and objects, constructors, inheritance, polymorphism, interfaces, packages, exception handling, multithreading, graphics programming, and file handling. Through practical experiments and a mini-project, students develop problem-solving skills and gain proficiency in designing, implementing, testing, and debugging Java-based software solutions for real-world applications.							
Relevance: The Object-Oriented Programming with Java Laboratory course develops programming and problem-solving skills using Java, a widely used object-oriented programming language. It provides practical knowledge of software design concepts such as classes, inheritance, polymorphism, interfaces, packages, exception handling, multithreading, graphics, and file handling. Through hands-on laboratory experiments and mini-project development, students learn to design, implement, test, and debug efficient software applications. The course builds a strong foundation for advanced technologies such as web development, mobile applications, cloud computing, and software engineering. Additionally, it enhances employ-ability and supports multidisciplinary learning by enabling students to apply programming skills to solve real-world engineering problems.							
Course Objective							
1. To introduce students to the fundamentals of Java programming and object-oriented programming concepts for developing structured software applications. 2. To provide hands-on experience in implementing advanced Java features such as packages, interfaces, exception handling, multithreading, GUI programming, and file handling. 3. To develop problem-solving, programming, and software development skills through laboratory experiments and mini-projects for real-world applications.							
Course Outcomes: After learning this course, students will be able to:							

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CO	Course Outcome	Bloom's Level
CO1	Apply MATLAB-based simulation and analysis techniques to evaluate the time-domain and frequency-domain performance, stability, root locus, and controller characteristics of control systems.	3
CO2	Apply Java programming constructs and object-oriented programming concepts such as classes, objects, constructors, inheritance, polymorphism, interfaces, packages, exception handling, multithreading, GUI programming, and file handling to develop robust and user-friendly software applications.	3
CO3	Analyze real-world problems and identify suitable Java-based approaches, programming practices, testing strategies, and teamwork requirements to design and develop effective software solutions.	4
List of Experiments		
Group A: Control Systems: Any 4 to be Performed		
1. Simulation and Time Response Analysis of First-Order and Second-Order Systems using MATLAB 2. Stability Analysis of Control Systems using MATLAB 3. Root Locus Analysis of Control Systems using MATLAB 4. Frequency Response Analysis using Bode Plot in MATLAB 5. Frequency Response Analysis using Nyquist Plot in MATLAB 6. Simulation and Performance Analysis of P, PI, PD and PID Controllers using MATLAB		
Group B: OOP with JAVA : Any 4 to be Performed		
1. Write simple Java programs to: i) Find factorial of a number ii) Display first 50 prime numbers iii) Find sum and average of N numbers 2. Write a Java program to implement a Calculator using switch-case to perform: addition, subtraction, multiplication, division, factorial. 3. Write a Java program to find all roots of a quadratic equation. 4. Create a class Rectangle with data members: length, width, area, colour. Create two objects and compare area and colour. 5. Write a Java program to demonstrate constructor overloading and method overloading. 6. Write Java programs to sort: i) List of integers ii) List of names		
Group C: OOP with JAVA : Any 4 to be Performed		
1. Create base class Employee and derived classes Manager and Developer with overridden salary methods. 2. Write a Java program to create and use a user-defined package. 3. Write a Java program to implement an interface (e.g., Vehicle with Car and Bike classes). 4. Write a program using try-catch for exception handling. Create a user-defined exception for voter age validation 5. Write a Java program to create multiple threads and demonstrate inter-thread communication. 6. Write a Java program to draw oval, rectangle, line, text using graphics class		

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7. Write a java program in which data is read from one file and should be written in another file line by line.

Group D: OOP with JAVA : (Mini Project)

1. A Mini project in Java: A group of 4 students can develop a small application in JAVA.

Text books:

1. **Herbert Schildt**, *Java: The Complete Reference*, 12th Edition, McGraw-Hill Education.

2. **E. Balagurusamy**, *Programming with Java – A Primer*, 7th Edition, McGraw-Hill Education.

Reference Books:

1. **Patrick Naughton and Herbert Schildt**, *Java 2: The Complete Reference*, McGraw-Hill Education.

2. **Paul Deitel and Harvey Deitel**, *Java: How to Program*, 12th Edition, Pearson.

Virtual Lab Source:

Object-Oriented Programming Virtual Lab (Virtual Labs): https://oop-amrt.vlabs.ac.in/?utm_source=source.com

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	3	-	-	-	-	-	-	1	2	3
CO2	3	3	3	2	3	-	-	-	-	-	-	1	3	3
CO3	3	3	3	3	3	-	-	2	2	2	2	2	2	3
Avg	3	2.67	2.67	2.5	3	-	-	2	2	2	2	1.33	2.33	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

This course serves as a prerequisite for / maps with the following future courses:

Data Structures and Algorithms, Advanced Java Programming, Software Engineering

Job Mapping:

Job opportunities that one can get after learning this course:

1. Java Developer
2. Software Developer / Software Engineer
3. Application Developer

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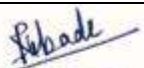
Program:	S. Y. B. Tech (E&TC Engineering)			Semester:	IV		
Course	Life Skills, Leadership and Professional Communication			Course Code:	R25-ET-VEC-221		
Teaching Scheme				Examination Scheme			
Lecture	Practical	Tutorial	Credit	CCE	ESE	TW	PR
02	-	-	02	50	-	-	-
Course Description: This course focuses on developing life skills, leadership qualities, ethical values, teamwork, and professional communication abilities among engineering students. The course helps students improve interpersonal skills, self-management, confidence, emotional intelligence, and workplace communication required for academic, professional, and personal success.							
Course Relevance: Engineers require not only technical knowledge but also effective communication, leadership, ethics, teamwork, and problem-solving abilities. This course helps students become responsible professionals with strong interpersonal and professional skills suitable for industry, entrepreneurship, and society.							
Prerequisite: 1. Basic communication ability in English 2. Willingness to participate in group discussions and activities							
Bridge Content: 1. Basics of communication skills 2. Introduction to personality development 3. Importance of ethics and leadership in professional life							
Course Objectives: 1. Develop effective communication and interpersonal skills. 2. Enhance leadership qualities and teamwork abilities. 3. Understand professional ethics and workplace behaviour. 4. Improve confidence, self-management, and decision-making skills. 5. Prepare students for professional and social responsibilities.							
Course Outcomes: After learning the course, students will be able to							
CO	Course Outcome					Bloom's Level	
CO1	Explain life skills, emotional intelligence, and self-management concepts					2	
CO2	Demonstrate effective verbal and non-verbal communication skills					3	
CO3	Apply leadership and teamwork skills in professional situations					3	
CO4	Analyze ethical and professional issues in engineering practice					4	
CO5	Analyze career opportunities and develop creativity, critical thinking, personality development, and lifelong learning skills for professional growth.					4	
Course Content							
Unit I	Life Skills and Self-Management					5 Hrs.	CO1

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Introduction to life skills Self-awareness and self-confidence Emotional intelligence Stress and time management Goal setting and positive attitude Decision-making and problem-solving skills			
Exemplars / Practical Applications and usage: Personal SWOT analysis Stress management techniques Goal planning activities			
Assignments: 1. Explain the importance of life skills in professional life. 2. Write a short note on emotional intelligence. 3. Describe methods for effective time management. 4. Explain decision-making and problem-solving skills.			
Unit II	Professional Communication Skills	6 Hrs.	CO2
Fundamentals of communication Verbal and non-verbal communication Listening and presentation skills Group discussion and interview skills Professional email and report writing Resume and LinkedIn profile basics			
Exemplars / Practical Applications and usage: Mock interviews Group discussion activities Presentation practice			
Assignments: 1. Explain the communication process with diagram. 2. Differentiate between verbal and non-verbal communication. 3. Write guidelines for effective presentations. 4. Prepare a sample professional resume.			
Unit III	Leadership and Team Building	5 Hrs.	CO3
Leadership qualities and styles Teamwork and collaboration Conflict management Motivation and responsibility Professional behaviour and workplace culture Role of leaders in organizations and society			
Exemplars / Practical Applications and usage: Ethical decision-making case studies			


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Social responsibility discussions Environmental awareness activities			
Assignments: 1. Explain different leadership styles. 2. Discuss the importance of teamwork in engineering projects. 3. Describe methods of conflict management. 4. Write a short note on workplace etiquette (protocol).			
Unit IV	Innovation, Career Skills and Personality Development	6 Hrs.	CO4
Creativity and innovation Critical thinking and analytical skills Adaptability and lifelong learning Personality development and confidence building Public speaking skills Career planning and professional growth			
Exemplars / Practical Applications and usage: Brainstorming activities Public speaking practice Career goal planning activities Personality assessment exercises			
Assignments: 1. Explain the importance of creativity and innovation in engineering. 2. Discuss the role of critical thinking in problem solving. 3. Write a short note on personality development. 4. Explain the importance of lifelong learning and adaptability.			
Suggested Activity			
1. Group discussion 2. Mock interview 3. Presentation activity 4. Leadership role play 5. Resume writing 6. Case study discussion 7. Stress management activity 8. Team-building exercise			
Textbooks:			
1. B. B. Singh, <i>Life Skills for Engineers</i>, S. Chand Publishing, New Delhi. 2. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press, 3rd Edition, 2024, ISBN: 9789354978555. 3. Textbook on Professional Ethics and Human Values, R. S. Naagarazan, New Age International Publishers, New Delhi, 2006.			
Reference Books:			

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1. The 7 Habits of Highly Effective People, Stephen R. Covey, Simon & Schuster Publications.
2. Emotional Intelligence, Daniel Goleman, Bantam Books.
3. Business Communication, Oxford University Press

MOOCs Links and additional reading material:

1. <https://swayam.gov.in>
2. <https://nptel.ac.in>
3. <https://www.coursera.org>
4. <https://www.linkedin.com/learning>

CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	2	1	1	1	-	2	1	-	-
CO2	-	-	-	-	-	2	1	1	1	-	2	1	-	-
CO3	-	-	-	-	-	2	1	1	1	-	2	1	-	-
CO4	-	-	-	-	-	2	1	1	1	-	2	1	-	-
Avg.	-	-	-	-	-	2	1	1	1	-	2	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern

BT Level	CCE					ESE				
	CO1	CO2	CO3	CO4	CO5	CO1	CO2	CO3	CO4	CO5
	8	8	8	8	8	12	12	12	12	12
L1	√	√	√	√	√	√	√	√	√	√
L2	√	√	√	√	√	√	√	√	√	√
L3	—	√	√	√	√	—	√	√	√	√
L4	-	—	-	√	√	-	—	-	√	√
L5	-	-	-	-	-	-	-	-	-	-
L6	-	-	-	-	-	-	-	-	-	-

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This course serves as a prerequisite for / maps with the following future courses:

1. Project Management
2. Entrepreneurship
3. Human Resource Management
4. Technical Communication
5. Organizational Behaviour
6. Career Development
7. Professional Development
8. Innovation Management

Job Mapping:

Job opportunities and career enhancement areas supported by this course:

1. Team Leader
2. Project Coordinator
3. HR and Communication Roles
4. Corporate Trainer
5. Entrepreneur / Startup Founder
6. Technical Support and Client Communication Roles
7. Public Relations and Management Roles


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