

Marathwada Mitra Mandal's College of Engineering
Karvenagar, Pune- 52

An Autonomous Institute Affiliated to SPPU



Curriculum for
Second Year B. Tech Electronics and
Telecommunication Engineering

A.Y. 2026-27

Permanently Affiliated to SPPU | Accredited with A++ grade by NAAC
Recipient of Best College award by SPPU | Accredited by NBA
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Institute Vision

To be a globally renowned institution through excellence in engineering education for sustainable and holistic development

Institute Mission

Our Mission is to:

M1: Empower students with cutting-edge technologies and global competencies

M2: Foster culture of research and entrepreneurial mindset

M3: Imbibe social and professional values

M4: Provide an inclusive environment for lifelong learning

Department Vision

To cultivate globally competent Electronics and Telecommunication Engineers for developing sustainable solutions

Department Mission

Our Mission is to:

M1: To empower students with foundational and emerging technologies in Electronics and Telecommunication Engineering, fostering global competencies

M2: To foster a research and collaborative learning ecosystem that encourages entrepreneurship, holistic and sustainable development

M3: To inculcate ethical values, leadership, adaptability, and a lifelong learnability in a diverse, global engineering

Knowledge and Attitude Profile (WK)

- 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 modelling 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.

Program Outcomes (PO)

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

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

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

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

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

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

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

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

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

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

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

Program Educational Objectives (PEO)

PEO1: Graduates will excel in their professional careers by applying cutting-edge technologies in Electronics and Telecommunication Engineering.

PEO2: Graduates will be globally aware, adaptive, and capable of solving real-world problems through multidisciplinary and innovative thinking.

PEO3: Graduates will evolve into professionals with strong communication, teamwork, leadership, and ethical decision-making capabilities with societal and environmental awareness.

Program Specific Outcomes (PSOs)

Students will be able,

PSO1: Design and develop Embedded systems to provide solutions in the field of Electronics and Telecommunication Engineering.

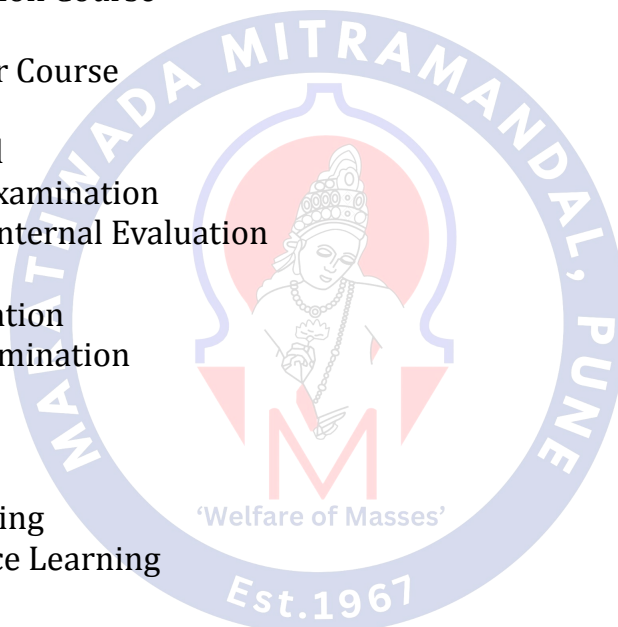
PSO2: Apply and analyze Communication Engineering fundamentals in the field of wireless communications and networking.

PSO3: Apply cutting-edge technology in multidisciplinary fields.



Abbreviations

BSC:	Basic Science Course
UG:	Undergraduate Programme
ESC:	Engineering Science Course
PCC:	Program Core Courses
PEC:	Program Elective Courses
MDM:	Multidisciplinary Minor Courses
OE:	Open Elective
VSC:	Vocational Skill Course
SEC:	Skill Enhancement Course
AEC:	Ability Enhancement Course
IKS:	Indian Knowledge System
VEC:	Value Education Course
FP:	Field Project
CC:	Co-Curricular Course
IT:	Internal Tool
ET:	External Tool
ETE:	End -Term Examination
CIE:	Continuous Internal Evaluation
TW:	Term work
OR:	Oral Examination
PR:	Practical Examination
L:	Lecture
P:	Practical
T:	Tutorial
OL:	Online Teaching
ODL:	Open Distance Learning



Curriculum Structure Sem-III & IV

Second Year B.Tech Electronics and Telecommunication Engineering Semester-III															
Course Code	Course Name	Course Type	Teaching Scheme (Hrs/week)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
ET24PCC201	Digital Electronics	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24PCC202	Data Structures & Algorithms	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24PCC203	Network Analysis	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24MDM204	*(Multidisciplinary Minor Theory)	MDM	2	-	-	40	60	-	-	-	100	2	-	-	2
ET24PCC205	Digital Electronics Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
ET24PCC206	Data Structures & Algorithms Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
ET24MDM207	*(Multidisciplinary Minor Lab)	MDM	-	2	-	-	-	25	-	-	25	-	1	-	1
ET24CEP208	Project Based Learning	CEP	-	4	-	-	-	50	-	-	50	-	2	-	2
ET24RMD209	Scientific Research & Publications	RMD	-	-	2	-	-	25	-	-	25	-	-	2	2
ET24VEC210	Universal Human Values	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24AEC202	Professional Communication and Personality Development	AEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			11	10	6	160	240	200	100	-	700	11	5	6	22

*Refer separate Booklet for MDM

L- Lecture	P- Practical	T- Tutorial	CIE-Continuous Internal Evaluation
ETE- End Term Examination	TW- Term work	PR- Practical	OR- Oral
L : 1 Hr.= 1 credit	P: 2 Hr. = 1 Credit	T: 1 Hr. = 1 Credit	

Second Year B.Tech Electronics and Telecommunication Engineering Semester-IV															
Course Code	Course Name	Course Type	Teaching Scheme (Hrs/week)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
ET24PCC251	Analog Electronics	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24PCC252	Microcontroller and Interfacing	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24PCC253	Signals and Systems	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24OEL254	*(Open Elective Theory)	OEL	3	-	-	40	60	-	-	-	100	3	-	-	3
ET24PCC255	Analog Electronics Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
ET24PCC256	Microcontroller and Interfacing Lab	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
ET24VSE257	Circuit & Systems Laboratory	VSE	-	4	-	-	-	50	-	-	50	-	2	-	2
ET24EEM258	Entrepreneurship Skills Development	EEM	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24PVEC201	Environment Sustainability	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			12	8	4	160	240	150	100	-	650	12	4	4	20

*Refer separate Booklet for OEL

L- Lecture	P- Practical	T- Tutorial	CIE-Continuous Internal Evaluation
ETE- End Term Examination	TW- Term work	PR- Practical	OR- Oral
L : 1 Hr.= 1 credit	P: 2 Hr. = 1 Credit	T: 1 Hr. = 1 Credit	

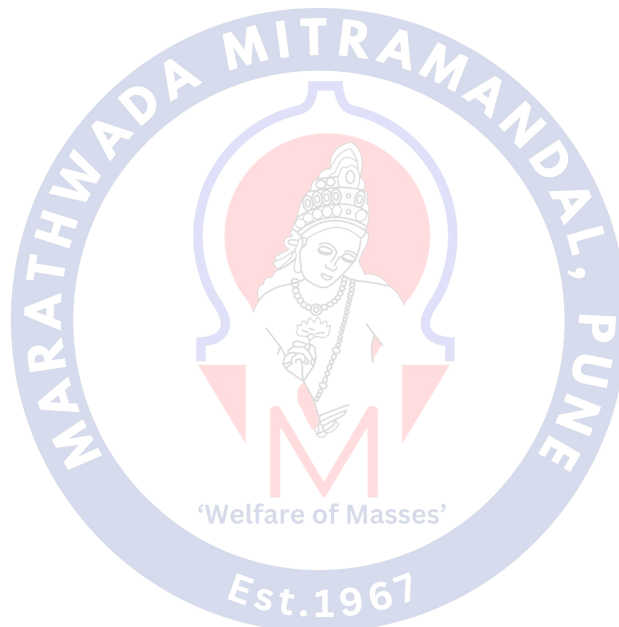
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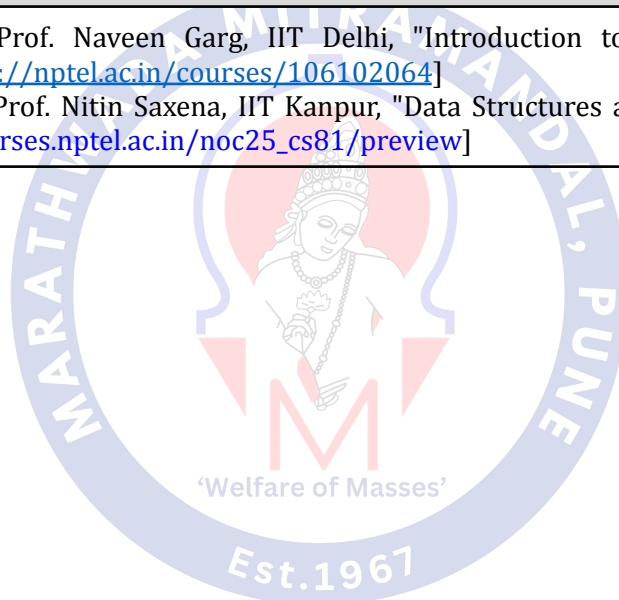
Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24PCC201										Course Name: Digital Electronics				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Basics of Electronics Technology														
Course Objectives: • Introduce techniques for the simplification of logic functions. • Make students familiar with the design and applications of combinational circuits. • Introduce sequential circuits, their functionality, design, and applications. • Make students aware of the design and implementation of state machines, and introduce HDL. • Make students familiar with logic families and Programmable Logic Devices.														
Course Outcomes: After learning the course, the students will be able to: CO1: Solve Boolean Functions using Minimization Techniques. CO2: Design Combinational Logic circuits. CO3: Design Sequential Logic circuits. CO4: Design Finite State Machines. CO5: Summarize characteristics of digital logic families and PLDs.														
Unit	Contents												Duration (Hrs.)	
1	Introduction to Logic Circuits Introduction to combinational logic, standard representations for logic functions, K-map representation of logic functions (SOP and POS forms), simplification of logic functions using K-map (up to 4 variables), don't-care conditions, Quine-McCluskey method.												8	
2	Combinational Logic Design Design Examples: Arithmetic circuits, Code converters, Multiplexers and their use in Combinational Logic Design, Demultiplexers/Decoders and their use in Combinational Logic Design, Adders and their use as Subtractor, BCD Arithmetic, ALU, Digital comparator, Parity generators/checkers.												8	
3	Sequential Logic Design 1-Bit memory cell, Clocked SR, JK, D, and T flip-flops. Excitation table for flip-flop, Clocked flip-flop design, Applications of flip-flops-registers, Shift registers, Counters, Synchronous counters, Asynchronous Counters.												8	
4	State Machines Basic design steps: State diagram, State table, State reduction, State assignment, Mealy and Moore machine representation, Implementation, Finite state machine implementation, Sequence detector. Introduction to HDL, representation of FSM in HDL.												8	
5	Digital Logic Families and PLDs Classification and characteristics of digital logic families: Speed/Propagation delay, power dissipation, figure of merit, fan-in, fan-out, current, voltage, noise immunity, operating temperatures and power supply requirements. CMOS logic: CMOS inverter, NAND gate. Introduction to PLDs, block diagram of FPGA and CPLD.												8	

Total Hours	40
Text Books	
1. R.P. Jain, "Modern Digital Electronics", TMH Publication, 3rd Edition, 2007. 2. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 3rd Edition, 2004. 3. Stephen D. Brown and Zvonko G Vranesic, "Fundamentals of Digital Logic with Verilog Design", Pearson Education, 2nd Edition, 2008.	
Reference Books	
1. Wakerly, "Digital Design Principles and Practices", Pearson Education, 3rd Edition, 2004. 2. Anand Kumar, "Fundamentals of Digital Circuits", PHI Publication, 1st Edition, 2001.	
Online References	
1. NPTEL Course: Prof. Goutam Saha, IIT Kharagpur, "Digital Electronics Circuits" [https://onlinecourses.nptel.ac.in/noc25_ee20/preview]	



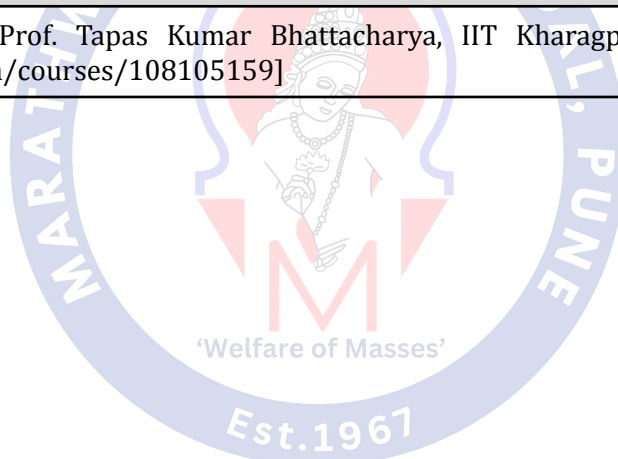
Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24PCC202										Course Name: Data Structures & Algorithms				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Fundamentals of Programming Language														
Course Objectives:														
• To understand various types of data structures and their applications. • To evaluate time and space complexity for sorting and searching algorithms. • To learn linear data structures like Stack and Queue using arrays for efficient data handling. • To analyze the nonlinear data structures for complex computational problems solving.														
Course Outcomes:														
After learning the course, the students will be able to:														
CO1: Understand different types of data structures.														
CO2: Implement sorting and searching algorithms and calculate their complexity.														
CO3: Implement Stack and Queue using arrays.														
CO4: Analyze the application of nonlinear data structures - Tree and Graph.														
Unit	Contents													Duration (Hrs.)
1	Types of Data Structures Need for different types of data structure and trade off, Arrays & Pointers: Arrays, Functions, Recursive Functions, Pointers, String Manipulations, Structures, Union, Enumeration, MACROS Definition. Types and Classifications of data structures: linear vs non-linear, static vs dynamic. Introduction to Linked Lists: Types: singly linked list, doubly linked list operations: insertion, deletion, traversal, Dynamic memory allocation with malloc and free.													8
2	Searching and Sorting Algorithms Algorithms Analysis of Iterative and Recursive algorithms, Space & Time complexity, Asymptotic notation - Big-O, Theta and Omega notations. Searching methods: Linear, Binary and Fibonacci Search. Sorting methods: Bubble, Insertion, Selection, Merge, and Quick Sort.													7
3	Stacks and Queues Stacks: Definition, Operations: push, pop, peek, Stack Applications: expression evaluation (infix to postfix conversion), recursion Implementing stack using arrays and linked lists. Queues: Definition, operations: enqueue, dequeue, front, rear Types: simple queue, circular queue, deque (double-ended queue), priority queue Applications: scheduling algorithms, handling requests in operating system.													8
4	Tree and Graph Introduction to Trees: Terminologies and Types of Tree. Binary tree traversals techniques. Graph Theory Basics: Definition and terminology of Graphs. Directed vs Undirected graphs. Graph representations. Graph Traversal Algorithms. Shortest Path Algorithms Dijkstra's algorithm, Bellman-Ford algorithm Minimum Spanning Tree algorithms: Kruskal's, Prim's algorithm.													8

5	Applications of Data Structures Case study 1: Create example for problem solving using algorithm thinking Case Study 2: Circular Buffer for Real-time sensor Data Handling using C Case Study 3: UART (Universal Asynchronous Receiver / Transmitter) communication using C.	7
Total Hours		38
Text Books		
1. E Balagurusamy, "Data Structures with C", Tata McGrawHill, 3 rd Edition, 2007. 2. Herbert Schildt, "The Complete Reference C", Tata McGrawHill, 4 th Edition, 2018.		
Reference Books		
1. Reema Thareja, "Data Structures Using C", Oxford, 2 nd Edition, 2014. 2. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education India, 2 nd Edition, 2002.		
Online References		
1. NPTEL Course: Prof. Naveen Garg, IIT Delhi, "Introduction to Data Structures and Algorithms" [https://nptel.ac.in/courses/106102064] 2. NPTEL Course: Prof. Nitin Saxena, IIT Kanpur, "Data Structures and Algorithms Design" [https://onlinecourses.nptel.ac.in/noc25_cs81/preview]		



Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24PCC203										Course Name: Network Analysis				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Basic Electrical Engineering, Basics of Electronics Technology														
Course Objectives: - To make the students familiarize with Basic Electric circuits and simplification techniques. - To make students acquainted with frequency selective circuits and resonance in electric circuits. - To create skills amongst students to design different types of filters and attenuators. - To increase mathematical ability of students for understanding and solving Laplace transform and Inverse Laplace Transform. - To make students aware about two port networks.														
Course Outcomes: After learning the course, the students will be able to: CO1: Analyze basic electrical circuits. CO2: Analyze frequency-selective networks. CO3: Design filters and attenuators. CO4: Solve Laplace transform and its inverse. CO5: Understand two-port networks.														
Unit	Contents										Duration (Hrs.)			
1	Basic Circuit Analysis and Simplification Techniques Network Analysis: Mesh, Node and Supernode analysis. Source transformation and source shifting. Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.										7			
2	Frequency Selective Networks Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity. Effect of R_g on BW & Selectivity. Magnification factor. Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth and selectivity. Comparison and applications of series and parallel resonant circuits. Twin T and Wein Bridge Networks as Notch Filters.										8			
3	Filters and Attenuators Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network: (i) Symmetrical Networks (T and Pi only). Z_0 and γ in terms of circuit components, open and short circuit parameters (ii) Asymmetrical Networks: Image Impedance and Iterative Impedance (L-Section only). Filters: Filter fundamentals, Constant K-LPF, HPF, BPF and BSF, m derived LPF and HPF, Concept of composite filters Attenuators.										8			
4	Laplace Transform and Its Applications in electrical networks Introduction to complex frequency, Definition of Laplace Transform for electrical circuits, Analysis of circuits using Basic Properties of Laplace Transform, Analysis of circuit response using Inverse Laplace Transform Techniques, Laplace Transform of Basic R, L and C components.										8			

5	Two Port Network Parameters and Functions Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.	8
Total Hours		39
Text Books		
1. D Roy Choudary, "Network and Systems", New Age International, 1 st edition, 2013. 2. John D. Ryder, "Network Lines and Fields", PHI, 2 nd edition, 2015. 3. C. P. Kuriakose, "Circuit Theory Continuous and Discrete Time System, Elements of Network Synthesis", PHI, 2005.		
Reference Books		
1. W.H. Hayt Kemmerly, "Engineering Circuit Analysis", Tata McGraw Hill Publications, 10 th Edition, 2024. 2. M.E. Van Valkenburg, "Network Analysis", Pearson, 3 rd Edition, 2019. 3. Boylestead, "Introductory Circuit Analysis", Charles & Merrill, 14 th edition, 2023.		
Online References		
1. NPTEL Course: Prof. Tapas Kumar Bhattacharya, IIT Kharagpur, "Network Analysis" [https://nptel.ac.in/courses/108105159]		

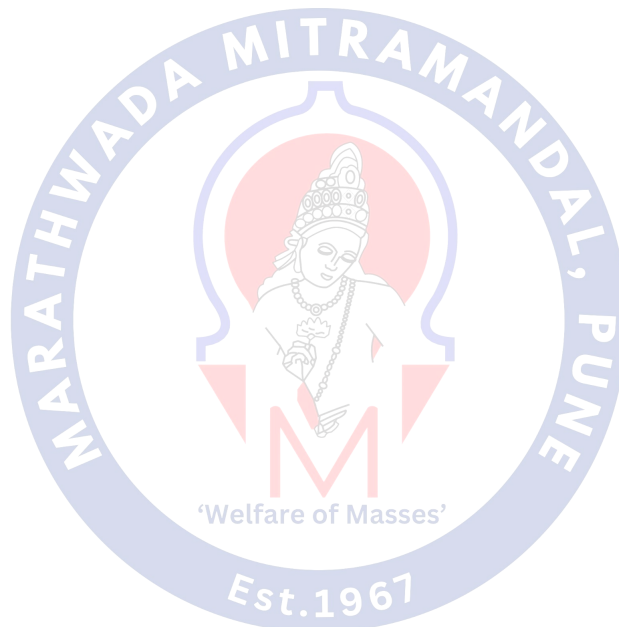


Second Year B.Tech Electronics and Telecommunication Engineering															
Semester-III															
Course Code: ET24PCC205										Course Name: Digital Electronics Lab					
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL	
-	2	-	-	-	-	-	-	-	50	50	-	1	-	1	
Prerequisite: Basics of Electronics Technology															
Course Objectives: ● To design and implement of Combinational Circuits. ● To design and implement of Sequential Circuits. ● To write HDL code for Finite State Machines. ● To design and develop digital logic system.															
Course Outcomes: After learning the course, the students will be able to: CO1: Implement Combinational Circuits. CO2: Implement Sequential Circuits. CO3: Construct HDL Code for FSMs. CO4: Develop Digital Systems.															
List of Experiments															
Sr. No.	Name of the Experiment										Duration (Hrs.)				
1	Design and Implement Half Adder and Full Adder.										2				
2	Design of Combinational Logic Circuits using Multiplexer IC74LS153.										2				
3	Design of Combinational Logic Circuits using Decoder IC74LS138.										4				
4	Design and Implement 1 digit BCD adder using IC74LS83.										4				
5	Design and Implement MOD-N and MOD-NN using IC74LS90.										2				
6	Design and Implement MOD-N and MOD-NN using IC74LS93.										2				
7	Design and Implement Pulse train generator using IC74LS95.										2				
8	Write HDL code and simulate a Combinational logic circuit.										2				
9	Write HDL code and simulate for FSM.										2				
10	Hardware /HDL-based Project.										4				
											Total Hours				26

Text Books
1. R.P. Jain, "Modern Digital Electronics", TMH Publication, 3 rd Edition, 2007. 2. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 3 rd Edition, 2004. 3. Stephen D. Brown and Zvonko G Vranesic, "Fundamentals of Digital Logic with Verilog Design", Pearson Education, 2 nd Edition, 2008.
Reference Books
1. Wakerly, "Digital Design Principles and Practices", Pearson Education, 3 rd Edition, 2004. 2. Anand Kumar, "Fundamentals of Digital Circuits", PHI Publication, 1 st Edition, 2001.
Online References
1. NPTEL Course: Prof. Goutam Saha, IIT Kharagpur, "Digital Electronics Circuits" [https://onlinecourses.nptel.ac.in/noc25_ee20/preview]

Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24PCC206					Course Name: Data Structures & Algorithms Lab									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	-	50	50	-	1	-	1
Prerequisite: Fundamentals of Programming Language														
Course Objectives: - To implement algorithms for string manipulation, searching, and sorting. - To use arrays of structures for effective data organization and retrieval. - To implement linear data structures like stacks and queues using arrays. - To apply nonlinear data structures such as trees and graphs for efficient problem-solving. - To Integrate data structures in practical applications like expression evaluation and UART communication.														
Course Outcomes: After learning the course, the students will be able to: CO1: Solve data handling problems using basic string functions, binary searching, and sorting algorithms. CO2: Apply arrays of structures for effective database management. CO3: Implement stack and queue using arrays for organizing data. CO4: Illustrate MST using Prim’s algorithm for the traversal of binary search trees. CO5: Apply data structures in real-time applications.														
List of Experiments														
Sr. No.		Name of the Experiment									Duration (Hrs.)			
1		Perform following String operations: a. substring b. palindrome c. compare d. copy e. reverse.									2			
2		Perform recursive binary search using C.									2			
3		Perform Bubble sort, Selection sort, Insertion, Quick and Merge sort.									2			
4		Implement Database Management using arrays of structures with operations Create, Display, Modify, Search and Sort.									2			
5		Implement Stack and Queue using arrays in C.									2			
6		Implement Stack using Linked List.									4			
7		Evaluation of Postfix expression (input will be postfix expression).									2			
8		Implement Binary search tree with operations create, search, and recursive traversal.									2			
9		Represent graphs and generate minimum spanning trees using Prim’s algorithm.									2			
10		Implement UART communication using Data Structures in C.									4			
		Total Hours									26			

Text Books
1. E Balagurusamy, "Data Structures with C", Tata McGrawHill, 3rd Edition, 2007. 2. Herbert Schildt, "The Complete Reference C", Tata McGrawHill, 4th Edition, 2018.
Reference Books
1. Reema Thareja, "Data Structures Using C", Oxford, 2nd Edition, 2014. 2. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education India, 2nd Edition, 2002.
Online References
1. NPTEL Course: Prof. Naveen Garg, IIT Delhi, "Introduction to Data Structures and Algorithms" [https://nptel.ac.in/courses/106102064] 2. NPTEL Course: Prof. Nitin Saxena, IIT Kanpur, "Data Structures and Algorithms Design" [https://onlinecourses.nptel.ac.in/noc25_cs81/preview]



Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24CEP208											Course Name: Project Based Learning			
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	4	-	-	-	-	-	50	-	-	50	-	2	-	2
Prerequisite: Basics of Electronics Technology, Engineering Exploration Labs, Fundamentals of Programming Language														
Course Objectives: • Enable students to analyze and recognize real-world problems relevant to their domain. • Implement innovative, sustainable, and ethically responsible solutions that address societal needs, thereby making a positive impact on the community. • Apply acquired knowledge, skills in practical or simulated scenarios. • Design solutions for practical, real-world problems using the concept of object-oriented programming. • Implement file handling operations in C++ for reading from and writing to files, enabling persistent data storage and retrieval.														
Course Outcomes: After learning the course, the students will be able to: CO1: Identify the real-world problem using various sources. CO2: Contribute to society through an appropriate solution. CO3: Demonstrate the learning. CO4: Apply the principles of object-oriented programming for real world problems. CO5: Describe and use of file handling in C++.														
Project Based Learning Framework (Group A)														
Group Structure: Working in supervisor/mentor-monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem. The project shall consist of a group of 4 to 5 students from each division.														
Selection of Project/Problem: The problem-based project-oriented model for learning is recommended. The model begins with identifying the problem, often growing out of a question, or “wondering”. This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame. A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students’ wandering within different disciplines and professional environments. A chosen problem must be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases. By example, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry. There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity. • A few hands-on activities that may or may not be multidisciplinary.														

- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize, and present their learning.
- Activities may include- Solving a real-life problem, investigation /Study and writing reports of in-depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness. Progress of PBL is monitored regularly on a weekly basis. Weekly review of the work is necessary. During the process of monitoring and continuous assessment and evaluation, the individual and team performance is to be measured. Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes. The group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

- Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
- Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
- Documentation and presentation

Evaluation Guidelines:

It is recommended that all activities are to be recorded and regular assessment of work to be done and Continuous Internal Evaluation record is to be maintained by all mentors/department. Recommended parameters for assessment, evaluation and weightage are as follows,

- Idea Inception (5%)
- Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (50%) (Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) (25%)
- Demonstration (Presentation, User Interface, Usability etc) (10%)
- Contest Participation/ publication (5%)
- Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (5%)

Report writing:

A project report with following contents shall be prepared:

- Title
- Abstract
- Introduction
 - Project overview
 - Problem Statement
- Literature Survey
- Objective

• System Block Diagram & Description • Hardware and Software Tools required • Design and Implementation • Results • Advantages & Limitations • Applications • Conclusion and Future Scope • References • Data sheets
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Sr. No.	Name of the Activity to be Performed	Duration (Hrs.)
1	Form groups, Identify problem statements, Set objectives, and Finalize the PBL title.	4
2	Submission of Literature Survey, Problem statement and abstract based on idea of project, design using an appropriate EDA tool, Simulation.	4
3	Introduction, Aim, Objectives, and System Block diagram.	4
4	Detailing of hardware and software, Simulation using suitable tool, system Implementation Details.	4
5	Hardware and software design, testing of final product, Preparation and Correction of the Draft Copy of Report.	4
6	Demonstration & Group Presentations. Documentation- Project Report, Paper publication/Poster if any and Submission.	6

Total Hours (A)	26
Object Oriented Programming Lab (Group B)	

Sr. No.	Name of the Activity to be Performed	Duration (Hrs.)
1	Write a C++ program to print pascal's triangles.	2
2	Find out the sum of even numbers between 1 to 50 using loops.	2
3	Write a program in C++ to sort the numbers in an array using separate functions for read, display, sort and swap. The objective of this assignment is to learn the concepts of input, output, functions, call by reference in C++.	2
4	Write a program in C++ to perform arithmetic operations on complex numbers. Design the class for complex number representation and the operations to be performed. The objective of this assignment is to learn the concepts of classes and objects.	2
5	Write a C++ program that illustrates the concept of Function overloading.	2
6	Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide. Use operator overloading for these operations. The objective of this assignment is to learn the concepts of Operator overloading.	2
7	Write a program in C++ to implement string class using Constructors, Destructors for Accept and Display operation.	2
8	Write a program in C++ to Read and Display the Information of Employees using Multiple Inheritance. Use Basic and Department Information as the base classes of the Employee class.	2
9	Write a C++ program that illustrates run time polymorphism using virtual functions.	2
10	Write a C++ program which uses Try and Catch for exception handling.	2

11	Write a C++ program to implement class and function Templates.	2
12	Write a C++ program which demonstrates use of Namespace in the program.	2
13	Write a C++ program which copies the contents of one file to another file.	2
Total Hours (B)		26
Total Hours (A+B)		52
Text Books		
1. E Balagurusamy, "Programming with C++", Tata McGraw Hill, 3rd Edition, 2017. 2. Herbert Schildt, "The Complete Reference C++", 4th Edition, 2021.		
Reference Books		
1. John Larmer, John R. Mergendoller, and Suzie Boss, "Setting the Standard for Project Based Learning", ASCD, 2015. 2. John Larmer and Suzie Boss, "Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences", ASCD, 2018 3. Erin M. Murphy and Ross Cooper, "Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry". M. Krašna, "Project based learning (PBL) in the teachers' education," 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, 2016, pp. 852-856, doi: 10.1109/MIPRO.2016.7522258. 4. J. Macias- Guarasa, J.M. Montero, R. San-Segundo, A. Araujo and O. Nieto-Taladriz, "A project-based learning approach to design electronic systems curricula", IEEE transactions on Education, vol.49, no. 3, pp. 389-397, Aug. 2006, doi: 10.1109/TE.2006.879784. 5. Robert Lafore, "Object Oriented Programming in C++", Sams Publishing, 4th Edition, 2002. 6. Matt Weisfeld, "The Object-Oriented Thought Process", Pearson Education, 2008.		
Online References		
1. NPTEL Course: Prof. N.V.Chalapathi Rao, IISc Bangalore, "Electronics equipment integration and Prototype building" [https://onlinecourses.nptel.ac.in/noc22_ee25/preview] 2. NPTEL Course: Prof. Parth Das, "Programming in Modern C++" [https://nptel.ac.in/courses/106105151]		

Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24RMD209					Course Name: Scientific Research & Publications									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	25	-	-	25	-	-	2	2
Prerequisite: –														
Course Objectives: - To introduce undergraduate students to the fundamentals of research and its importance in engineering innovation. - To develop awareness about research publications, patents, IPR, and research ethics. - To inculcate ethical research practices and scientific writing skills.														
Course Outcomes: After learning the course, the students will be able to: CO1: Apply the fundamental concepts of research in engineering to real-world engineering problems and demonstrate their significance. CO2: Apply basic research methodology and technical writing skills. CO3: Explain the process of research publications and intellectual property rights. CO4: Practice ethical standards in research activities.														
Contents														
1	Introduction and Importance of Research Research definition and meaning, Classification of research: basic, applied, experimental, analytical, and interdisciplinary research, Research in engineering and technology, Importance of research in innovation, sustainability, and societal development, Research problem identification and formulation													
2	Research Methodology and Technical Writing Introduction of Research methodology, steps involved in conducting research, Research design and methods of data collection, Basics of Data analysis and interpretation, Structure of a technical/research paper, Literature survey: purpose, sources, and review process, Use of digital research databases, Abstract writing, keywords, and conclusion writing, Referencing styles and citation tools													
3	Research Publications, Patents, and IPR Research publications: journals, conferences, review papers, and book chapters, Indexing and quality metrics, impact factor, h-index, citation count, Predatory journals and conferences. Intellectual Property Rights (IPR): Introduction, Types of IPR: patents, copyrights, trademarks, industrial designs, Patent process: prior art search, patent filing procedure, overview of patent drafting, Role of patents in engineering and entrepreneurship													
4	Research Ethics and Professional Conduct Research ethics and responsible conduct of research, Plagiarism: types, consequences, and prevention, plagiarism detection tools, acceptable similarity index, falsification, and duplication, authorship ethics and conflict of interest, ethical issues in sponsored and collaborative research, Overview of institutional ethics committees and ethical guidelines													

List of Tutorials		
Sr. No	Name of the tutorial	Duration (Hrs)
1	Identification and formulation of a research problem statement derived from relevant societal challenges, followed by a critical discussion on sustainable and feasible solutions.	4
2	Systematic literature review related to the identified research problem to understand the current state of knowledge, research gaps, and scope for innovation.	2
3	Development of a structured research methodology, including preparation of a detailed flowchart outlining the proposed research approach and experimental/analytical steps.	4
4	Hands-on activity on patent search and analysis, along with an introduction to the patent drafting process aligned with the proposed research methodology.	4
5	Activity on plagiarism detection tools and an in-depth discussion on research ethics, academic integrity, and responsible conduct of research.	4
6	Guided activity on writing a review paper based on the selected research topic, focusing on structure, critical analysis, and scholarly presentation.	4
7	Oral presentation and documentation of the research work, demonstrating the application of the proposed methodology, findings from literature, ethical compliance, and innovation potential.	4
Total Hrs		26
Text Books		
1. Kothari C.R., "Research Methodology: Methods and Techniques", New age International Publications- 2024. 2. Dipankar Deb, Rajeeb Dey, Valentina E. Balas, "Engineering Research Methodology: A Practical Insight for Researchers", Springer Nature Singapore - 2019		
Reference Books		
1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Pvt. Ltd - 2024		
Online References		
1. NPTEL Course: By Prof. Edamana Prasad, Prof. Prathap Haridoss, IIT Madras, "Research Methodology" (https://onlinecourses.nptel.ac.in/noc23_ge36/preview) 2. NPTEL Course: By Prof. Prathap Haridoss, IIT Madras, "Introduction to Research" (https://onlinecourses.nptel.ac.in/noc21_ge03/preview)		

Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-III														
Course Code: ET24VEC210										Course Name: Universal Human Values				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisite:														
1. Readiness for Self-Exploration														
The course is not about memorizing facts but about a process of dialogue between what you are and what is naturally acceptable to you. You should be prepared to:														
• Verify proposals: Treat course content as "proposals" to be tested against your own Natural Acceptance rather than dogmas to be accepted blindly. • Validate experientially: Be willing to test these values in your daily living to see if they actually lead to harmony and happiness.														
2. Openness to Holistic Thinking														
The syllabus moves from the individual to the family, society, and finally nature. You need an initial willingness to:														
• Look beyond individual success toward mutual fulfillment. • Acknowledge the interconnectedness between yourself and the "four orders" of nature (physical, bio, animal, and human).														
Course Objectives:														
• Development of a holistic perspective based on self- exploration about themselves (human-beings), family, society and nature/existence. • Understanding of the harmony in the human-beings,family, society and nature/existence. • Strengthening of self-reflection. • Development of commitment and courage to act.														
Course Outcomes:														
After the completion of course, the students can:														
CO1:Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.														
CO2: Explore the human being as the coexistence of self and body to see their real needs basic aspirations clearly.														
CO3:Explain relationship between one self and the other self as the essential part of relationship and harmony in the family														
CO4: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence														
Contents														
Introduction to Value Education and Harmony in the Human Being														
i. Understanding Value Education														
ii. Self-exploration as the Process for Value Education														
1 iii. Continuous Happiness and Prosperity- the Basic Human Aspirations and their Fulfilment														
iv. Right Understanding, Relationship and Physical Facility														
v. Happiness and Prosperity- Current Scenario														
vi. Method to Fulfil the Basic Human Aspirations														

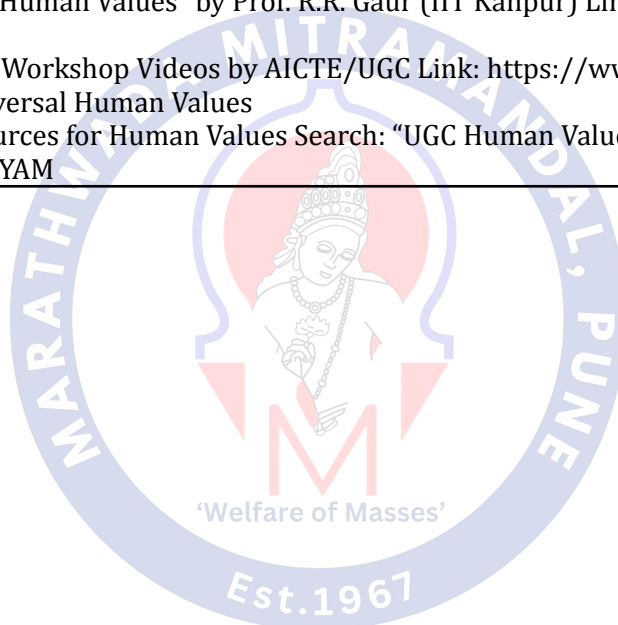
2	Harmony in the Human Being : i. Understanding Human being as the Co-existence of the Self and the Body ii. Distinguishing between the Needs of the Self and the Body iii. The Body as an Instrument of the Self iv. Understanding Harmony in the Self v. Harmony of the Self with the Body vi. Programme to Ensure self-regulation and Health	
3	Harmony in the Family, Society and Nature : i.Harmony in the Family- the Basic Unit of Human Interaction "Trust"- the Foundational Value in Relationship ii. 'Respect'- as the Right Evaluation iii. Values in Human-to-Human Relationship iv. Understanding Harmony in the Society v. Vision for the Universal Human Order vi. Understanding Harmony in Nature – Interconnectedness and Mutual Fulfillment	
4	Professional Ethics and Application of Values: i..Competence in Professional Ethics: Ability to Utilize Values in Decision-Making ii. Ethical Human Conduct – The Foundation of Universal Human Order iii. Integration of Human Values with Technical Education	
List of Tutorials		
Sr. No	List of Tutorial (Select any 08 activities out of 10 contributing to 26 hours)	Duration (Hrs)
1	Structured Self-Exploration Reflection Report	4
2	Case Study analysis on Contemporary Life Issues	4
3	Value Identification from Everyday Scenarios	4
4	Reflective Journal – Harmony in Self	2
5	Group Discussion - Topics e.g The Goal of Education (Siksha-Sanskar),Health and Responsibility (Swasthya-Sanyam),Production and Nature,The Cycle of Nature,Identifying the Root Cause,Defining Conduct	2
6	Role Play: Human Relationships	2
7	Debate: Material Growth versus Human Well-Being	2
8	Scenario Evaluation: Right Understanding in Personal Decisions	4
9	Engineering Ethics	2
10	Peer Interaction on Social Responsibility	2
Total Hrs		26
Text Books		
1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1		
2. The Teacher’s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G		
3. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.		
4. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press		
5. AICTE Model Curriculum for Universal Human Values .		

Journals and Articles

1. Dr. SARVESHWARI SHEKHAWAT (May-2025). Universal Human Values and Professional Ethics: A Path to Sustainable Development. INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT, 10(5), 276-287.
<https://ijnrd.org/papers/IJNRDD001043.pdf>
2. Rani, S., Beenu, Jindal, H., Gautam, N., & Kumar, S. (2022). Importance of Universal Human Values for Life: A Study. Asian Journal of Science and Applied Technology, 11(1), 36-48.
<https://doi.org/10.51983/ajsat-2022.11.1.3204>

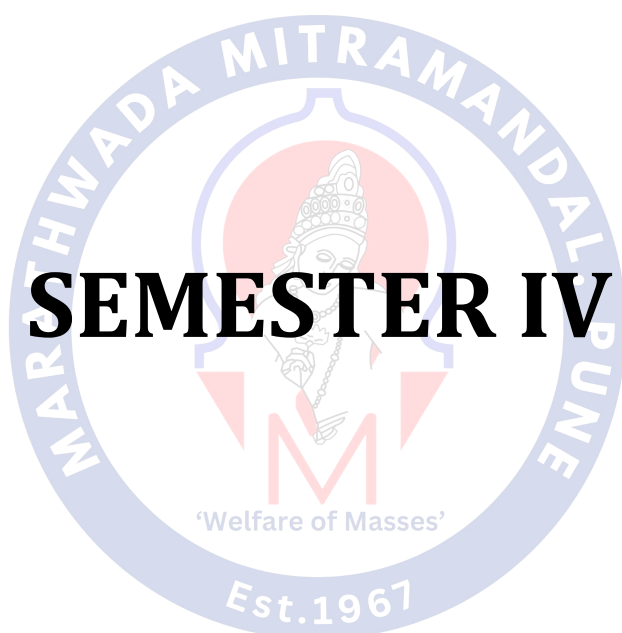
Online References

1. Exploring Human Values: Visions of Happiness and Perfect Society
2. <https://nptel.ac.in/courses/109104068>
3. Moral Thinking: An Introduction to Values and Ethics
(https://onlinecourses.nptel.ac.in/noc24_hs169/preview)
4. NPTEL Course: "Human Values and Ethics" by Prof. V. S. Ravi Link: NPTEL - Human Values and Ethics
5. NPTEL Course: "Human Values" by Prof. R.R. Gaur (IIT Kanpur) Link: NPTEL - Human Values
6. Value Education Workshop Videos by AICTE/UGC Link: <https://www.aiCTE-india.org> > Education > Universal Human Values
7. UGC Video Resources for Human Values Search: "UGC Human Values Video Lectures" on YouTube or SWAYAM



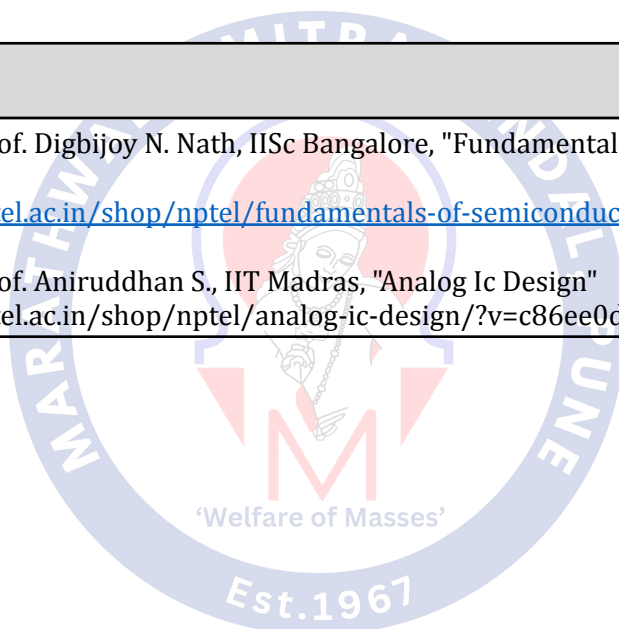
Second Year B.Tech Engineering														
Semester-III														
Course Code: SH24AEC202										Course Name: Professional Communication & Personality Development				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisite: Basic understanding of LSRW skills, grammar, and vocabulary of the English Language														
Course Objectives: • To develop students’ rhetorical and persuasive abilities for effective oral communication and audience engagement. • To familiarize students with key business and managerial terminologies essential for effective communication and decision-making. • To strengthen analytical and critical thinking skills for constructing logical arguments and making informed decisions. • To cultivate professional and technical writing competence, ensuring clarity, accuracy, and etiquette in communication.														
Course Outcomes: After learning the course, the students will be able to: CO1: Demonstrate effective rhetoric, persuasive skills, audience engagement, and adaptability in communication. CO2: Apply visual aids, body language, voice modulation, and confidently manage audience questions and maintain engagement throughout. CO3: Analyze information and construct logical arguments to solve problems and make informed Decisions. CO4: Exhibit professional and technical writing skills and avoid common pitfalls, ensuring clear, polite, and informative communication.														
Contents														
1	Public Speaking Using Persuasive language and understanding the context in public speaking Controlling nervousness, building confidence, stage presence, poise, and impact Employing voice modulation, pace, volume & pitch.													
2	Presentation Skills Structuring a presentation & using visual aids Understanding audience connection strategies & feedback Handling Q&A sessions with confidence.													
3	Critical Thinking Working on Case Studies and Situational Analysis Structuring the argument and handling rebuttal Analyzing logical fallacies and cognitive biases.													
4	Technical Writing Structuring emails for different purposes (requests, complaints, updates and follow-ups) Avoiding common mistakes and making the right use of CC, BCC, and reply-all options Blog/article/ newsletter/survey report format and examples.													
5	Group Discussion Implementing coherence and cohesion in structuring the argument Integrating non-verbal communication in the conversation Managing disagreement and aggression in the discussion.													

List of Tutorials		
Sr. No.	Name of the Tutorials	Duration (Hrs.)
1	Ice-breaking Session	2
2	Storytelling	4
3	Idea Presentation	4
4	Advertisement Creation	4
5	Case Study Analysis	2
6	Debate	2
7	Email Writing (Professional & Personal)	2
8	Blog Writing	2
9	Survey Reports	2
10	Group Discussion	2
Total Hours		26
Text Books		
1. Stephen E. Lucas, <i>The Art of Public Speaking</i>, McGraw Hill Publication, ISBN-10: 1260914275 ISBN-13: 9781260914276. 2. Jaishri Jethwaney and Sanjay Bhargava, <i>Corporate Communication: Principles and Practices</i>. 3. Dr. Ranjit Singh, <i>Critical Thinking and Problem Solving</i>. 4. Rajendra Pal and J. S. Korlahalli, <i>Essentials of Business Communication</i>, Sultan Chand & Sons, 2011. ISBN: 8180547299, 9788180547294.		
Reference Books		
1. Shiv Khera, <i>You Can Win</i>, Bloomsbury India, ISBN-10: 9382951717 · ISBN-13: 9789832951711. 2. Carmine Gallo, <i>Talk Like TED</i>, Macmillan Business. 3. Garr Reynolds, <i>Presentation Zen: Simple Ideas on Presentation Design and Delivery</i>, New Riders. 4. Peter Facione and Carol Ann Gittens, <i>Think Critically</i>. 5. Lewis Vaughn, <i>The Power of Critical Thinking</i>, Oxford University Press. 6. Emily Post and Peter Post, <i>The Etiquette Advantage in Business: Personal Skills for Professional Success</i>.		
Online References		
1. NPTEL Course: <i>Technical English for Engineers</i> – https://onlinecourses.nptel.ac.in/noc20_hs56/preview 2. SWAYAM Course: <i>English for Research Paper Writing</i> – https://onlinecourses.swayam2.ac.in/ntr24_ed15/previe 3. SWAYAM Course: <i>Personality Development and Communication Skills</i> – https://onlinecourses.swayam2.ac.in/cec22_cm03/preview		



Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24PCC251										Course Name: Analog Electronics				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Engineering Mathematics - I and II, Engineering Physics, Basics of Electronics Technology, Engineering Exploration Labs														
Course Objectives: - Comprehend the structure, operation, and characteristics of BJT, JFET, and MOSFET for analyzing and designing basic electronic circuits. - Analyze the behavior and performance of circuits using Bipolar Junction Transistors (BJTs) and Metal Oxide Semiconductor Field Effect Transistor (MOSFET). - Understand and analyze the role of feedback in electronic circuits and the principles governing various oscillator types. - Identify and compare different classes of power amplifiers based on their operation, efficiency, and applications.														
Course Outcomes: After learning the course, the students will be able to: CO1: Comprehend a Bipolar Junction Transistor (BJT), Junction Field Effect Transistor (JFET) and Metal Oxide Semiconductor Field Effect Transistor (MOSFET). CO2: Analyze Bipolar Junction Transistor and Junction Field Effect based circuits. CO3: Analyze Metal Oxide Semiconductor Field Effect based circuits. CO4: Analyze the operation of feedback circuits and explain the working principles of different types of oscillators. CO5: Compare classes of power amplifiers.														
Unit	Contents										Duration (Hrs.)			
1	BJT Circuits Diode Analysis: DC analysis, AC equivalent circuits. BJT: BJT Common Emitter characteristics- Operating point of BJT; DC Biasing: voltage divider bias. Two port device and hybrid model; Analysis of CE amplifier using h-parameters.										8			
2	JFET Circuits Introduction, types, construction of JFET, characteristics, Schockley's equation, JFET biasing and DC analysis, JFET as amplifier, CS amplifier analysis.										7			
3	MOSFET Circuits Two-Terminal MOS Structure, Enhancement - Mode MOSFET, Ideal MOSFET Current-Voltage Characteristics, MOSFET Structures and circuit symbols, non-ideal voltage current characteristics viz. Finite output resistance, body effect, subthreshold conduction, breakdown effects and temperature effects; MOSFET DC circuit Analysis, Common source circuit, Load Line & Modes of operation, MOSFET as amplifier, Common Source amplifier analysis.										8			
4	Feedback Amplifiers and Oscillators Introduction to Feedback, Feedback topologies; Voltage series and Current series feedback amplifiers and their analysis, Oscillator Operation, Barkhausen criterion, Phase-Shift Oscillator, Wien Bridge Oscillator, Hartley and Colpitts oscillators.										8			

5	Power Amplifiers Classes of Power Amplifiers (Class A, B, AB, C, D). Analysis of Class-A power amplifiers, Class-B & Class AB Push-Pull and complementary-symmetry stages.	8
Total Hours		39
Text Books		
1. Donald Neaman, "Electronic Circuits - Analysis and Design", Mc Graw Hill, 3 rd Edition, 2005. 2. Millman, Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems", TMH, 2 nd Edition, 2008. 3. R. L. Boylestad, L. Nashlesky, "Electronic Devices and Circuits Theory", 9 th Edition, PrenticeHall of India, 2008.		
Reference Books		
1. David A. Bell, "Electronic Devices and Circuits", Oxford press, 5 th Edition, 2008. 2. Anil K. Maini and Varsha Agarwal "Electronic Devices and Circuits", Wiley India, 2 nd Edition, 2019.		
Online References		
1. NPTEL Course: Prof. Digbijoy N. Nath, IISc Bangalore, "Fundamentals of Semiconductor Devices" [https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-semiconductor-devices/?v=c86ee0d9d7edvvv] 2. NPTEL Course: Prof. Aniruddhan S., IIT Madras, "Analog Ic Design" [https://elearn.nptel.ac.in/shop/nptel/analog-ic-design/?v=c86ee0d9d7ed]		

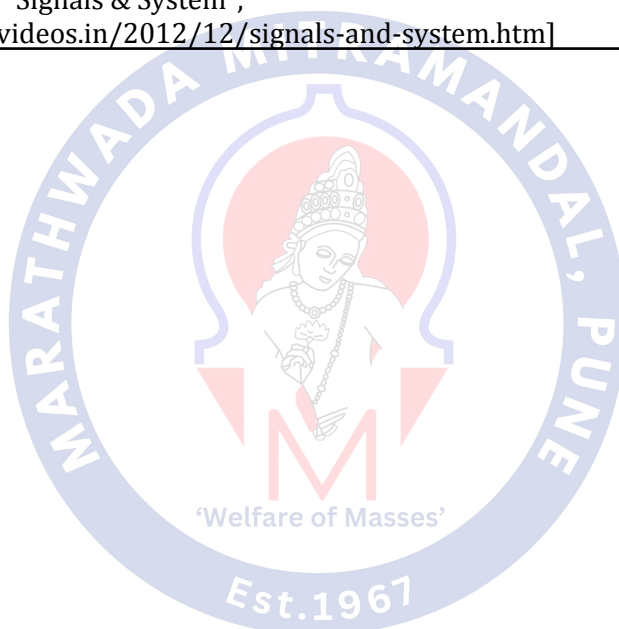


Second Year B.Tech. Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24PCC252										Course Name: Microcontroller and Interfacing				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Basic Electronics, Digital Electronics, C Programming Language														
Course Objectives: - To introduce CPU organization and memory types used in embedded systems. - To explain the architecture and features of the 8051 microcontroller. - To develop programming skills for 8051 using timers and interrupts in C. - To enable interfacing of I/O devices through port programming. - To illustrate serial communication using UART with 8051.														
Course Outcomes: After learning the course, the students will be able to: CO1: Interpret blocks of CPU organization and memory types used in computer systems. CO2: Explore the architecture, features, and programming of the 8051 microcontroller. CO3: Apply timer and interrupt concepts to write programs in C language for 8051 microcontroller. CO4: Apply port programming to interface IO devices to 8051 microcontroller. CO5: Apply serial communication concepts for UART interfacing.														
Unit	Contents										Duration (Hrs.)			
1	Computer Organization & Memory Functions of CPU, Memory, I/O, and system buses. Von Neumann and Harvard architectures. Instruction cycle and processor components like ALU, registers and control units, Internal and external memory types (SRAM, DRAM, ROM), memory hierarchy, and the organization of semiconductor memory, Cache Memory and cache coherence (MESI protocol). Programmed I/O, Interrupt-driven I/O, and DMA.										8			
2	Introduction to Microcontroller & Programming Introduction to the microcontrollers and classification. 8051 microcontroller features and block diagram, functions of 8051 pins, memory organization of 8051, Program Status Word of 8051, overview of special function registers. Overview of 8051 instruction set. Arithmetic and logical instructions, Boolean and Program Branching instructions, Data transfer instructions, Addressing modes of 8051 and programs in assembly language. Overview of Data types, Operators, Arrays, Pointers and Structures in C.										8			
3	Timer and Interrupts Programming Timers and counters in 8051, Timer modes, Timer and counter programming in C. Interrupt structure of 8051 and SFR associated with interrupts. Programming of interrupts in C.										8			
4	Input and Output Interfacing Port structure, IO Interfacing Requirements, Interfacing of LEDs, Keys, 7-segment display, LCD, DAC 0808, ADC 0809, Stepper motor, Relay, Buzzer, Opto-isolators.										8			

5	Serial Communication Basics of Serial Communication Protocol, UART, Data transmission and reception using Serial port. 8051 serial communication programming in C, Design of Data acquisition System (DAS).	8
Total Hours		40
Text Books		
1. C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", McGraw Hill, 5th edition, 2011. 2. Mahumad Ali Mazadi, Janice Gillispie Mazadi, Rolin D McKinlay, "The 8051 Microcontroller & Embedded Systems (Using Assembly and C)", PHI, Pearsons Publishers, 2nd Edition, 2023. 3. Ajay Deshmukh, "Microcontrollers Theory and Applications", TATA McGraw Hill, 4th Edition, 2023.		
Reference Books		
1. William Stallings, "Computer Organization and Architecture: Designing for performance", Prentice Education India, 7th Edition, 2016. 2. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Cengage Learning, 3rd Edition, 2007. 3. Han-Way Huang, "Embedded System Design with C8051", Cengage Learning, 1st edition, 2008.		
Online References		
1. NPTEL Course: Prof. Santanu Chattopadhyay, IIT Kharagpur, "Microprocessors and Microcontrollers - Course" [https://onlinecourses.nptel.ac.in/noc25_ee49/preview]		

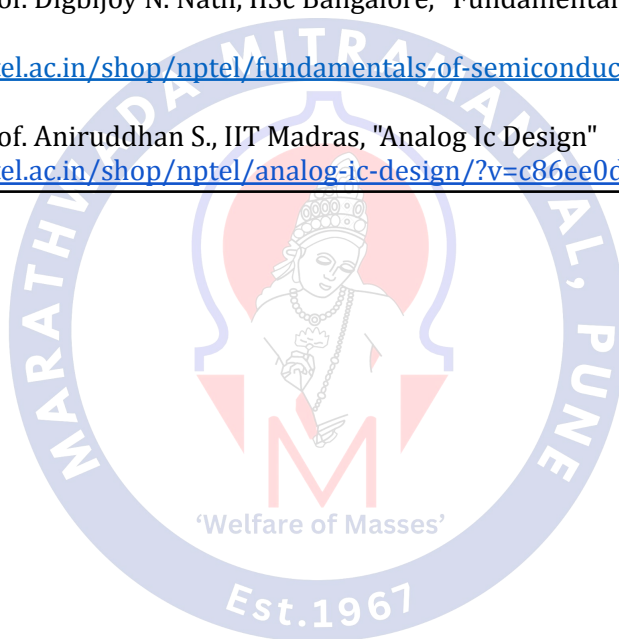
Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24PCC253										Course Name: Signals and Systems				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
3		-	-	-	40	60	-	-		100	3		-	3
Prerequisites: Engineering Mathematics - I and II														
Course Objectives: • To explain the basics of signals and systems. • To discuss convolution techniques for linear time-invariant (LTI) system analysis. • To explain the Fourier series basics to represent continuous-time signals. • To show the representation of aperiodic signals using Fourier Transform technique. • To discuss the basics of Laplace Transform technique.														
Course Outcomes: After learning the course, the students will be able to: CO1: Compare the types of signals and systems and perform operations on it. CO2: Apply convolution for linear time-invariant (LTI) system analysis. CO3: Apply the Fourier series representation to continuous-time signals. CO4: Apply the Fourier Transform to obtain the representation of aperiodic signals. CO5: Extend the concept of Laplace transform for signals and systems.														
Unit	Contents										Duration (Hrs.)			
1	Introduction to Signals & Systems Review of function, signal interpretation as a function, Introduction to signals, standard test input signals, Operations on signals, Classification of signals; Systems: Introduction, Classification of Systems.										8			
2	LTI System analysis Properties of LTI systems, Definition of impulse response, representation of discrete-time signals in terms of impulse, convolution, Convolution sum, and its computation, Convolution integral, computation of convolution integral.										8			
3	Fourier Series Review of a Fourier Series- Complex numbers, real and complex sinusoids, properties; Concept of frequency domain- need analysis, Amplitude and phase response; Fourier series (FS) representation of periodic Continuous Time (CT) signals, orthogonality, Applications of Fourier series, Gibbs phenomenon.										8			
4	Fourier Transform Dirichlet conditions, Fourier Transform (FT) representation of aperiodic CT signals, evaluation of magnitude and phase response, Interplay between time and frequency domain using sinc and rectangular signals, Concept of Sampling theorem, anti-aliasing filter, Signal reconstruction; Discrete Time Fourier Transform (DTFT), Comparison with CTFT, Properties of DTFT.										8			
5	Laplace Transform Limitation of Fourier Transform-Complex domain and stability concern, Need of Laplace transform (LT), Definition and mathematical representation in comparison with FT, Region of Convergence, Laplace transform of standard periodic and aperiodic signals, properties, Inverse Laplace transform based on partial fraction expansion.										8			
Total Hours										40				

Text Books
1. Simon Haykins and Barry Van Veen, "Signals and Systems", Wiley India, 2nd Edition, 2002. 2. M.J. Roberts "Signal and Systems", Tata McGraw Hill, 2007. 3. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Pearson Education, India, 2nd Edition, 2013.
Reference Books
1. Charles Phillips, "Signals, Systems and Transforms", Pearson Education, 5th Edition, 2013. 2. A. Nagoor Kanni, "Signals and Systems", McGraw Hill, 2nd Edition, 2022.
Online References
1. NPTEL Course: Prof. Aditya Jagannatham, IIT Kanpur, "Principles of Signals & System" [https://nptel.ac.in/courses/108/104/108104100/] 2. NPTEL Course: "Signals & System", [https://archive.nptel.ac.in/courses/108/106/108106163/] 3. Lecture Series on: "Signals & System", [http://www.nptelvideos.in/2012/12/signals-and-system.htm]



Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24PCC255										Course Name: Analog Electronics Lab				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	-	50	50	-	1	-	1
Prerequisite: Engineering Mathematics - I and II, Basics of Electronics Technology, Engineering Exploration Labs, Analog Electronics														
Course Objectives: - To experimentally determine the input and output characteristics of a BJT in common emitter configurations, and evaluate its behavior under various operating conditions. - To experimentally determine the transfer and output characteristics of an n-channel JFET in various configurations, and interpret its behavior for different gate-source and drain-source voltage conditions. - To simulate and analyze the operation of a Wien Bridge or RC phase shift oscillator using FET/MOSFET. - To determine performance of complementary-symmetry power amplifiers and observe the effects of crossover distortion.														
Course Outcomes: After learning the course, the students will be able to: CO1: Determine and analyze the input and output characteristics of a Bipolar Junction Transistor (BJT) in specific configurations through experimental methods. CO2: Determine and analyze the transfer and output characteristics of an n-channel Junction Field Effect Transistor (JFET) through experimental observation. CO3: Simulate and analyze the operation of a Wien Bridge or RC phase shift oscillator circuit using FET/MOSFET and interpret waveform characteristics. CO4: Experimentally verify the performance of complementary-symmetry power amplifiers, observing the effects of crossover distortion.														
List of Experiments														
Sr. No.	Name of the Experiment										Duration (Hrs.)			
1	Plot Input and Output Characteristics of BJT.										2			
2	Design and simulate a Single stage BJT amplifier, for given specifications (DC & AC Analysis).										4			
3	Build and test above (experiment 2) amplifier and measure A_v , R_i , R_o and BW.										2			
4	Plot transfer and output characteristics of a n-channel Junction Field Effect Transistor (JFET).										2			
5	Implement single stage CS amplifier with bypass capacitor. Determine A_v , R_i , R_o and BW.										4			
6	Implement current series feedback amplifiers and find R_{if} , R_{of} , G_{mf} and Bandwidth.										4			
7	Simulate Voltage Series Feedback Amplifier (Compare performance of voltage series circuit under with and without feedback conditions).										4			
8	Simulate Wien Bridge /RC phase shift oscillator using FET/MOSFET.										2			

9	DC analysis of complementary-symmetry power amplifier: Observe and eliminate crossover distortion.	2
	Total Hours	26
Text Books		
1. Donald Neaman, "Electronic Circuits - Analysis and Design", Mc Graw Hill, 3 rd Edition, 2005. 2. Millman, Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems", TMH. 3. R. L. Boylestad, L. Nashlesky, "Electronic Devices and Circuits Theory", 9 th Edition, Prentice Hall of India, 2008.		
Reference Books		
1. David A. Bell, "Electronic Devices and Circuits", 5 th Edition, Oxford press, 2008. 2. Anil K. Maini and Varsha Agarwal "Electronic Devices and Circuits", Wiley India, 2012.		
Online References		
1. NPTEL Course: Prof. Digbijoy N. Nath, IISc Bangalore, "Fundamentals of Semiconductor Devices" [https://elearn.nptel.ac.in/shop/nptel/fundamentals-of-semiconductor-devices/?v=c86ee0d9d7edvvv] 2. NPTEL Course: Prof. Aniruddhan S., IIT Madras, "Analog Ic Design" [https://elearn.nptel.ac.in/shop/nptel/analog-ic-design/?v=c86ee0d9d7ed]		



Second Year B.Tech. Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24PCC256					Course Name: Microcontroller and Interfacing Lab									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	Total
-	2	-	-	-	-	-	-	-	50	50	-	1	-	1
Prerequisite: Basic Electronics, Digital Electronics, C Programming Language.														
Course Objectives: - To understand the programming architecture and instruction set of the 8051 microcontroller. - To explore assembly and C language programming to solve real-time embedded problems. - To simulate and validate 8051 programs using tools like Proteus and Keil IDE. - To interface electronic devices such as LED, switches, LCD, DAC, and sensors with 8051. - To design and implement embedded solutions for data acquisition and communication using UART protocols.														
Course Outcomes: After learning the course, the students will be able to: CO1: Demonstrate arithmetic operations on 8-bit data using Assembly Language programming. CO2: Interface peripheral devices with the 8051-microcontroller using embedded C programming. CO3: Implement serial communication between PCs using UART protocol and 8051 microcontroller. CO4: Design a Data Acquisition System using 8051 to collect and process sensor data.														
List of Experiments														
Sr. No.		Name of the Experiment									Duration (Hrs.)			
1		To study the programming techniques of the 8051 microcontroller and apply them to solve basic Electronics Engineering problems using simulation tools like Proteus.									2			
2		Assembly Language programming and simulation using Proteus tool for the arithmetic operations on 8-bit numbers.									2			
3		Interface LED and switch with 8051 microcontroller hardware board using C Language programming.									4			
4		Interface 16x2 LCD with 8051 microcontroller hardware board using C Language programming.									4			
5		Interface 8-bit DAC 0808 with 8051 microcontroller to generate waveform using C Language programming using Keil simulation and hardware boards.									4			
6		Programming the 8051 for PC-to-PC serial communication using UART.									4			
7		Design and Implementation of a Data Acquisition System using 8051 microcontroller in the Proteus tool.									4			
8		Design and develop a program to measure the physical parameters (Temperature/Pressure) using Proteus tool.									4			
		Total Hours									28			

Text Books
1. C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", McGraw Hill, 5th edition, 2011. 2. Mahumad Ali Mazadi, Janice Gillispie Mazadi, Rolin D McKinlay, "The 8051 Microcontroller & Embedded Systems (Using Assembly and C)", PHI, Pearsons Publishers, 2nd Edition, 2023. 3. Ajay Deshmukh, "Microcontrollers Theory and Applications", TATA McGraw Hill, 4th Edition, 2023.
Reference Books
1. William Stallings, "Computer Organization and Architecture: Designing for performance", Prentice Education India, 7th Edition, 2016. 2. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Cengage Learning, 3rd Edition, 2007. 3. Han-Way Huang, "Embedded System Design with C8051", Cengage Learning, 1st edition, 2008.
Online References
1. NPTEL Course: Prof. Santanu Chattopadhyay, IIT Kharagpur, "Microprocessors and Microcontrollers - Course" [https://onlinecourses.nptel.ac.in/noc25_ee49/preview]



Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24VSE257					Course Name: Circuit & Systems Laboratory									
Teaching Scheme (Hrs/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	4	-	-	-	-	-	50	-	-	50	-	2	-	2
Prerequisites: Engineering Mathematics - I and II, Basics of Electronics Technology														
Course Objectives:														
• To describe the fundamental architecture and performance parameters of operational amplifiers. • To apply analytical methods to design and evaluate both linear and nonlinear applications of Op-Amps. • To discuss the standard test input signals using appropriate time-domain expressions. • To demonstrate the process of convolution between two signals through analysis and visualization. • To utilize transform techniques to solve problems in practical signal processing scenarios.														
Course Outcomes:														
After learning the course, the students will be able to:														
CO1: Examine performance parameters of the Op-Amp.														
CO2: Analyze linear and Non-Linear applications of Op-Amp.														
CO3: Demonstrate standard test input signals using time domain representation.														
CO4: Visualize convolution operation for given two signals.														
CO5: Apply transform techniques to real-time signal processing inputs.														
List of Practicals														
Sr. No.	Name of the Experiment Integrated Circuits (Group A)										Duration (Hours)			
1	Measure following Op-amp parameters & compare with specifications given in the data sheet [Any two Op-Amps can be used for comparison. e.g. 741C, OP07, LF351, LF356, TI071, TI072] a) Input bias current b) Input offset current c) Input offset voltage d) Slew rate e) CMRR										4			
2	Design, build & test integrator using Op-amp.										4			
3	Design, build and test Schmitt trigger and plot transfer characteristics.										2			
4	Build & test Square and triangular waveform generator using Op-Amp (LF351/LF356).										4			
5	Build and test precision half & full wave rectifier.										4			
6	Build and test 2-bit DAC (R-2R ladder) or 2-bit ADC (flash type ADC).										2			
7	Build & test Instrumentation amplifier using three Op-amps for typical application.										2			
8	Build & test PLL circuit.										4			
Total Hours (A)													26	

Sr. No.	Name of the Experiment Signals & Systems (Group B)	Duration (Hrs.)
1	Introduction to MATLAB (OnRamp free certification course).	2
2	Write a program to generate and plot the standard test input signals.	4
3	Write a program to find the convolution sum of two discrete-time signals $x(n)$ and $h(n)$. Write a program to find the convolution integral of two continuous-time signals $x(t)$ and $h(t)$. Also verify the commutative property of convolution integral.	4
4	Write a program to find Fourier series coefficients using exponential or trigonometric FS method for any one periodic signal. Observe the effect of Gibb's phenomenon.	2
5	Write a program to find Fourier transform of the following signals: (i) $x(t) = A$ (ii) $x(t) = u(t)$ (iii) $x(t) = A \cdot e^{(-at)} \cdot u(t)$ (iv) $x(t) = A \cdot \cos(wt)$	4
6	Write a program to find Laplace transforms of the following standard causal signals: (i) $x(t) = t$ (ii) $x(t) = e^{(-at)}$ (iii) $x(t) = t \cdot e^{(-at)}$ (iv) $x(t) = \cos(wt)$	4
7	Case study based on (i) Medical Image Processing or (ii) Communication Systems.	6
Total Hours (B)		26
Total Hours (A+B)		52
Text Books		
1. Donald Neaman, "Electronic Circuits - Analysis and Design", Mc Graw Hill, 3 rd Edition, 2012. 2. Ramakant Gaikwad, "Op Amps & Linear Integrated Circuits", Pearson Education, 2007. 3. Simon Haykins and Barry Van Veen, "Signals and Systems", Wiley India, 2 nd Edition, 2002. 4. M.J. Roberts "Signal and Systems", Tata McGraw Hill, 2007. 5. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Pearson Education, India, 2 nd Edition, 2013.		
Reference Books		
1. Salivahan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, 2012. 2. Charles Phillips, "Signals, Systems and Transforms", Pearson Education, 5 th Edition, 2013. 3. A. Nagoor Kanni, "Signals and Systems", McGraw Hill, 2 nd Edition, 2022.		
Online References		
1. NPTEL Course: Prof. Aditya Jagannatham, IIT Kanpur, "Principles of Signals & System" [https://nptel.ac.in/courses/108/104/108104100/] 2. NPTEL Course: "Signals & System", [https://archive.nptel.ac.in/courses/108/106/108106163/] 3. Lecture Series on: "Signals & System", [http://www.nptelvideos.in/2012/12/signals-and-system.htm]		

Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: ET24EEM258										Course Name: Entrepreneurship Skills Development				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisites: Communication Skills														
Course Objectives: • To introduce the fundamentals of entrepreneurship and its role in economic growth, innovation, and societal development. • To explore personal traits and psychological factors that influence entrepreneurial success and failure. • To develop the ability to identify business opportunities across sectors, focusing on emerging trends and needs. • To build competence in creating business plans with market analysis, financials, and operational strategies. • To introduce strategic tools that improve business plan effectiveness and support informed decisions.														
Course Outcomes: After learning the course, the students will be able to: CO1: Define entrepreneurship and explain its significance in economic and societal development. CO2: Understand the personal factors that contribute to both entrepreneurial success and failure, including personality traits, motivations, and decision-making styles. CO3: Implement effective e-waste management strategies through regulatory compliance, EPR and waste minimization. Identify potential business opportunities across various sectors, including technology, healthcare, education, and social enterprises. CO4: Prepare a comprehensive and realistic business plan for a new venture, demonstrating the ability to integrate market research, financial projections, and operational plans. CO5: Apply business strategies for success of a business plan.														
Contents														
1	Foundation of Entrepreneurship Concept and need of entrepreneurship; Characteristics and types of entrepreneurships; Charm of becoming an entrepreneur; Entrepreneurial decision process, entrepreneurship as a career, entrepreneurship as a style of management, changing role of entrepreneur, Entrepreneurial traits, factors affecting entrepreneurs.													
2	Theories of Entrepreneurship Influences on Entrepreneurship development; External influences on Entrepreneurship development: Socio-cultural, political economical, personal entrepreneurial failure and success; Reasons and remedies, successful entrepreneurs, challenges and achievements of successful entrepreneurs.													
3	Opportunities identification and selection Need for Opportunities identification and selection; Environmental dynamics and changes; Business Opportunities in various sectors, identification of business opportunities, Opportunity selection.													
4	Business Planning Process The Business plan as entrepreneurial tool, Elements of business planning, objectives, Market analysis, Development of product/Ideas, Marketing, Finance, Organization, and Management, Ownership, Critical risk contingencies of the proposal, Scheduling and Milestones.													

5	Skill Development Design Thinking, Idea Generation, Creating a business plan, Preparing a Pitching presentation, Building business strategy, Patent Filing.	
Sr. No.	Name of the Tutorial	Duration (Hrs.)
1	Identify, study and explore life of entrepreneurs who have achieved significant success in a) Industry (Unicorn) b) Family Business c) Rural Development.	2
2	Study three start-ups. The first startup should be a failed one, second should be the one which has just started and third one should be one that has achieved a grand success. Compare those on the basis of personal traits, internal and external factors.	4
3	Undertake a market research and SWOT analysis of any business sector (of your choice) and find out the business opportunity(ies).	2
4	Select the business opportunity from the previous tutorial on the basis of passion and skills, market demand analysis, Financial Viability, Target Audience Identification, Competitive Analysis, Regulatory Environment and Risk Assessment.	4
5	Explain in detail elements of the business plan.	2
6	Prepare a business plan for the business opportunity selected in tutorial number 4.	2
7	Prepare a deck of slides for pitching your business idea.	2
8	Present your business opportunity as per tutorial number 7.	2
9	Study different types of IPRs and its importance in business.	2
10	Explore the different funding agencies.	2
11	Write in detail the types of ownerships and the procedure to register a start-up.	2
Total Hours		26
Text Books		
1. Vasant Desai, "Entrepreneurial Development", Vasant Desai, Himalaya Publishing House		
Reference Books		
1. Badhai, B, "Entrepreneurship for Engineers", Dhanpat Rai & Co. Ltd. 2. IDEO.org. "The Field Guide to Human-Centered Design". IDEO, 2015, https://www.designkit.org/resources/1 . 3. Kalyan C. Kankanala, A.K. Narasani, V. Radhakrishnan, "Indian Patent Law and Practice", Oxford Press, 1 st edition, 2012. 4. Eric Ries, "The Lean Startup", Penguin Books Limited, 1 st edition, 2011.		
Online References		
1. Swayam Course: Prof. C. Bhaktvatsala Rao, IIT Madras, "Entrepreneurship" [https://onlinecourses.nptel.ac.in/noc21_mg70/preview] 2. Swayam Course: Prof. A. Mahalingam, Prof. B. Ramadurai IIT Madras, "Design Thinking-A Primer" [https://onlinecourses.nptel.ac.in/noc22_mg32/preview] 3. Swayam Course: Prof. Feroz Ali, IIT Madras, "Patent Law for Scientists and Engineers" [https://onlinecourses.nptel.ac.in/noc20_hs55/preview] 4. NPTEL Course: Prof. Rajat Agarwal, Prof. Vinay Sharma, IIT Roorkee, "Innovation, Business Models and Entrepreneurship" [https://nptel.ac.in/courses/110107094]		

Second Year B.Tech Electronics and Telecommunication Engineering														
Semester-IV														
Course Code: SH24PVEC201					Course Name: Environment Sustainability (VEC)									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisites: A basic understanding of environmental science, geography, or social studies														
Course Objectives: - Understand the foundational concepts of sustainability, including its social, environmental, and economic dimensions, and the global need for sustainable development. - Gain insights into the 17 United Nations Sustainable Development Goals (SDGs) and the role of technology, international cooperation, and policy in achieving them. - Identify and explain different types of pollution (air, water, solid waste), their sources and impacts, and sustainable approaches to waste management including the 3Rs (Reduce, Reuse, Recycle) and zero-waste concepts. - Evaluate global and local environmental challenges, including climate change, global warming, ozone depletion, and resource degradation.														
Course Outcomes: After the completion of course, the students can: CO1: Describe the fundamental ideas of environmental sustainability. CO2: Examine sustainability's social, economic, and environmental facets. CO3: Analyze how human actions affect Environmental systems. CO4: Propose strategies for sustainable development in various sectors.														
Unit	Content													
1	Introduction to Environmental Sustainability: Global environmental issues, Foundations of Environmental Sustainability. Sustainability: Challenges, potential; role of technology, policies.													
2	Environmental Pollution and Waste Management: Air Pollution: Sources and Effects of Air Pollution. Water Pollution: Sources of Water Pollution, Sustainable Wastewater Treatment. Solid Waste zero Waste Concepts (3R Concept).													
3	Climate Change and Energy: Understanding Climate Change, Science and impacts of climate change Climate modeling and adaptation, Sustainable Energy Solutions, Renewable energy technology, Efficient energy system and conservation													
4	Sustainable Development Practices: Sustainability in Cities, infrastructure and cities that are sustainable, green buildings and smart cities.													
Sr. No	List of Tutorial (Select any 08 activities out of 10 contributing to 26 hours)													Hours
1	Examine the river pollution in Pune.													4
2	Prepare a climate change strategy for your town, city, or building.													4

3	Initiate a campaign to bring emphasis to a sustainability concern.	4
4	Examine the Current Environmental Issue	2
5	Examine a successful sustainability attempt from the real world	2
6	Home energy audit: Have students make a list of all the appliances and light bulbs in their house. How much energy does their house use if all the lights are on for 4 hours per day? If their appliances are on for 2 hours per day? How much energy could they save if they switched to energy-efficient appliances or lightbulbs?	2
7	Use recycled material in art projects: recycled materials can make beautiful art projects such as jewelry, planters, and birdhouses. Incorporating materials that would otherwise be thrown away into art projects can show your students how to find new uses for these items.	2
8	Life cycle: One way to show students what happens when you put something in the trash versus recycling or reusing the object is to do a life cycle analysis. This is a flowchart that shows the environmental impacts of an object, from extracting the raw materials to decomposition and everything in between. When something is put in the trash instead of being reused or recycled, the life cycle assessment will show a bigger environmental impact. When something is reused or recycled, the environmental impact is less because raw materials don't need to be extracted to create something new.	4
9	Go on a field trip: Visit your local landfill, recycling center, or a nearby composting facility where the students can see firsthand what is happening to waste and learn about the lifecycle of waste and its effect on the environment.	2
10	Compare carbon footprints of different materials used in construction or manufacturing in India.	2
Total Hours for 08 Activities		26
Text Books		
1. Sharma, "P.D. Ecology and Environment", Rastogi Publications, 2020. 2. Kaushik, C.P., Kaushik, Anubha, "Perspectives in Environmental Studies New Age", International Publishers, 2021. 3. Agarwal, S.K. "Environmental Management", APH Publishing Corporation, 2005.		
Journals and Articles		
1. Kalam, A.P.J. Abdul, Srijan Pal Singh, "Target 3 Billion Innovative Solutions Towards Sustainable Development", Penguin Books, 2011. 2. Kolbert, Elizabeth, "The Sixth Extinction: An Unnatural History", Henry Holt and Co., 2014.		
Online References		
1. NPTEL Course : Prof. Trupti Mishra, IIT Bombay "Business and Sustainable Development" [https://nptel.ac.in/courses/110101153] 2. NPTEL Course : By Prof. Brajesh Kumar Dubey, IIT Kharagpur "Sustainable Engineering Concepts And Life Cycle Analysis" [https://onlinecourses.nptel.ac.in/noc23_ce90/preview]		