Society for Computer Technology & Research's (SCTR's)

Pune Institute of Computer Technology (PICT), Pune

An Autonomous Institute affiliated to the Savitribai Phule Pune University (SPPU)
Approved by AICTE & Government of Maharashtra,
Accredited by NAAC (A+) & NBA [All eligible UG Programs]

Syllabus for

S.Y B. Tech Electronics and Computer Engineering (E&CE)

(2025-26 Course) *

With effect from (June 25)
National Education Policy (NEP) 2020 Compliant
*Approved by the Board of Studies (BoS) and Academic Council

Abbreviations used (Refer [1-3] for more details)

Sr. No.	Broad Category of the course	Sub- Category of course	Category Code
I.	Basic Science/ Engineering Science Course (BSC/ ESC)	Basic Science Course (BSC)	01
		Engineering Science Course (ESC)	02
II.	Program Courses (PC)	Program Core Course (PCC)	03
		Program Elective Course (PEC)	04
III.	Multidisciplinary Courses (MC)	Multidisciplinary Minor (MDM)	05
		Open Elective (OE) Other than particular program	06
IV.	Skill Courses (SC)	Vocational and Skill Enhancement Course (VSEC)	07
V.	Humanities Social Science and Management (HSSM)	Ability Enhancement Course (AEC-01, AEC-02)	08
		Entrepreneurship/Economics/ Management Courses (EEM)	09
		Indian Knowledge System (IKS)	10
		Value Education Course (VEC)	11
VI.	Experiential Learning Courses (ELC)	Research Methodology (RM)	12
		Community Engagement Project (CEP) / Field Project (FP)	13
		Project (PRJ)	14
		Internship/ On Job Training (IP/OJT)	15
VII.	Liberal Learning Courses (LLC)	Co-curricular Activities (CCA)	16

Detailed guidelines for General Instructions:

Link: General Instructions

Detailed guidelines for Evaluation and Assessment:

Link: Guidelines for Evaluation and Assessment

Detailed guidelines for examination:

Link: Guidelines for examination

Index

Contents

S.Y B. Tech Syllabus Structure
Semester – III

Semester -3			Teaching Scheme (Hours/Week)				Credit scheme				Examination/ Evaluation Scheme and Marks						
Category of Course	Course code	Name of the Course	L	P	T	Total	L	P	T	Total	Theory			Practical			Total
											ISE	CIE	ESE	CIE	ESE		
											[20]	[20]	[60]	TW	P	OR	
PCC	**5303101**	Analog and Digital Electronics (ADE)	3	-	-	**3**	3	-	-	**3**	20	20	60	-	-	-	**100**
PCC	**5303202**	Analog and Digital Electronics Lab (ADEL)	-	2	-	**2**	-	1	-	**1**	-	-	-	-	50	-	**50**
PCC	**5303103**	Operating System (OS)	2	-	1	**3**	2	-	1	**3**	20	20	60	25	-	-	**125**
PCC	**5303104**	Principles of Data Structure (PDS)	3	-	-	**3**	3	-	-	**3**	20	20	60	-	-	-	**100**
PCC	**5303205**	Principles of Data Structure Lab (PDSL)	-	2	-	**2**	-	1	-	**1**	-	-	-	25	50	-	**75**
MDM	**03051X1**	MDM-1	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
MDM	**03052X1**	MDM-1 #	-	2	-	**2**	-	1	-	**1**	-	-	-	-	-	25	**25**
EEM	**5309101**	Financial Literacy and Banking (FLB)	2	-	-	**2**	2	-	-	**2**	-	-	-	50	-	-	**50**
OE	**0306301**	OE-I: Foreign Language Studies (FLS)	-	-	2	**2**	-	-	2	**2**	-	-	-	50	-	-	50
VEC	**0311101**	Universal Human Values (UHV)	2	-	-	**2**	2	-	-	**2**	-	-	-	25	-	-	**25**
AEC	**0308202**	Professional Development and Career Readiness (PDCR)	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
CEP	**03132XX**	Community Engagement project (CEP) /Field project (FP) /CCA$	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
		Total	**14**	**10**	**3**	**27**	**14**	**5**	**3**	**22**	**80**	**80**	**240**	**225**	**100**	**25**	**750**

L: Lecture, P: Practical, T: Tutorial,
CIE: Continuous Internal Evaluation, ISE: In-Semester Examination, ESE: End-Semester Examination,
TW: Term work, OR: Oral, P: Practical examination

S.Y. B. Tech, Semester - IV

Semester-4			Teaching Scheme (Hours/Week)				Credit scheme				Examination/ Evaluation Scheme and Marks						
											Theory			Practical			
Category of Course	Course code	Name of the Course	L	P	T	Total	L	P	T	Total	ISE [20]	CIE [20]	ESE [60]	CIE TW	ESE P	ESE OR	Total
PCC	5403106	Analog and Digital Communication (ADC)	3	-	-	3	3	-	-	3	20	20	60	-	-	-	100
PCC	5403107	Microcontroller and Application (MA)	3	-	-	3	3	-	-	3	20	20	60	-	-	-	100
PCC	5403208	ECE Lab-I (ECEL-I)	-	2	-	2	-	1	-	1	-	-	-	-	50	-	50
PCC	5403109	Object Oriented Programming (OOP)	3	-	-	3	3	-	-	3	20	20	60	-	-	-	100
PCC	5403210	Object Oriented Programming Lab (OOPL)	-	2	-	2	-	1	-	1	-	-	-	25	25	-	50
VSEC	5407201	Project Based Learning (PBL)	-	2	-	2	-	1	-	1	-	-	-	50	-	-	50
EEM	5409102	Integrated System Project Management	2	-	-	2	2	-	-	2	-	-	-	50	-	-	50
MDM	04051X2	MDM-2	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
MDM	04052X2	MDM-2 #	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
OE	04063XX	Open Elective-II (OE-II) *	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50
AEC	0408203	Collaborative Skills, Digital Ethics, and Cyber Security (CDC)	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
VEC	0411102	Indian Constitution and Social Responsibility (ICSR)	1	-	-	1	1	-	-	1	-	-	-	25	-	-	25
CEP	04132XX	Community Engagement project/Field project /CCA	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
		Total	**14**	**12**	**2**	**28**	**14**	**6**	**2**	**22**	**80**	**80**	**290**	**225**	**75**	**0**	**750**

#: Tutorial or laboratory as applicable. Choose one course from the MDM baskets. MDM: X is basket number, **Refer annexure-I** for MDM details.

*: Open elective (OE) offered by online platform such as SWAYAM/NPTEL, **Refer Annexure-II** for details.

$: Student should choose any one course from Community Engagement project (CEP) /Field project (FP) /CCA prescribed in the syllabus at the start of semester.

X: Serial number of the courses under that particular category.

Second Year B-Tech
(S. Y B. Tech)
Semester-3

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5303101]: Analog and Digital Electronics (ADE)

Semester	Credits	Teaching Scheme	Examination Scheme
3	3	L: 3 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of Basic Analog and Digital Electronics Engineering.

Course Objectives: The objective of this course is to provide students with

- Boolean algebra, Karnaugh maps and its application to the design and characterization of digital
- Circuits.
- The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
- Semiconductor device MOSFET, its characteristics, parameters & applications
- Operational amplifier, concept, parameters & applications

Course Outcomes: After completing this course, students will be able to

CO1: Design and implement combinational logic circuits.
CO2: Design and implement Sequential logic circuits.
CO3: Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.
CO4: Explore and deploy basic configurations of Op-amp with negative feedback, with focus on relevant parameters.

COURSE CONTENTS

Module-I	Combinational logic Circuit	07 Hrs.

Boolean algebra, SOP, POS, up to 6 variable K map. Don't care condition, Code convertor, Adders and their use as subtractor, look ahead carry, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De-multiplexers and their use in combinational logic designs, Decoders, Demultiplexer trees.

Module-II	Sequential logic Circuit	06 Hrs.

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, hold and setup time and metastability. Excitation Table for flip flops. Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.

Module-III	MOSFET Circuits and application	06 Hrs.

Enhancement MOSFET: Construction, Characteristics, AC equivalent circuits, Parameters, Parasitic, Body effect, Sub-threshold conduction, W/L ratio. Common source amplifier & analysis, Load line, Source follower. MOSFET as switch, resistor/diode. Current sink & source, Current mirror. Four types of

feedback amplifiers, Effects of feedback, Voltage series & current series feedback amplifiers. Barkhouse criterion, Wein bridge & phase shift oscillator.		
Module-IV	**Operational Amplifier**	**07 Hrs.**
Block diagram, Differential amplifier analysis for dual i/p balanced o/p mode (using r parameters), Level shifter, Op amp parameters, Current mirror, Op-amp characteristics (AC & DC). Inverting amplifier, Non inverting amplifier [Study the effect on Ri, Ro, gain & bandwidth, Voltage follower, Summing amplifier, Differential amplifier, Comparator, Schmitt trigger, Square & triangular wave generator, Precision rectifiers. [More emphasis on applications]		
Text Books:		
T1. R.P. Jain, "Modern digital electronics", 3rd edition, 12th reprint Tata McGraw Hill Publication,2007.		
T2. Donald Neaman, "Electronic Circuits – Analysis and Design" Third edition, Mc Graw Hill		
T3. Ramakant Gaikwad, "Op amps & Linear Integrated Circuits", Pearson Education.		
Reference Books:		
R1. Anand Kumar, "Fundamentals of Digital Circuits" 1st edition, Prentice Hall of India, 2001		
R2. Millman Halkias, "Integrated Electronics".		
Relevant MOOCs Course (Course name and Weblink)		
1. NPTEL Course "Digital Circuits" by Prof. Santanu Chattopadhay (IIT Kharakpur) https://nptel.ac.in/courses/108/105/ 108105113/ 2. NPTEL Course "Digital Circuits & Systems" https://nptel.ac.in/courses/117/106/117106086/ 3. NPTEL Course "Digital Circuits" by Prof. Goutam Saha (IIT Kharakpur) https://nptel.ac.in/courses/108/105/108105132/ 4. NPTEL Course "Analog Electronic Circuits" by Prof. Pradip Kumar Mandal (IIT Kharakpur) https://nptel.ac.in/courses/108/105/108105158/ 5. NPTEL Course on "Analog Circuits" by Prof. Jayanta Mukherjee (IIT Bombay) https://nptel.ac.in/courses/108/101/108101094/		
Relevant Topics for Self-study:		
Study Various types of BJT, JFET, D-MOSFET with their construction, Working and Q-point calculations.		

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5303202]: Analog and Digital Electronics Lab (ADEL)

Semester	Credits	Teaching Scheme	Examination Scheme
3	1	P: 2 Hrs./ Week	ESE (PR): 50 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of Basic Electronics Engineering

Course Objectives: The objective of this course is to provide students with

- Boolean algebra, Karnaugh maps and its application to the design and characterization of digital
- Circuits.
- The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
- Semiconductor device MOSFET, its characteristics, parameters & applications
- Operational amplifier, concept, parameters & applications

Course Outcomes: After completing this course, students will be able to

1. **Implement** Single stage MOSFET CS Amplifier, Voltage regulator and measure different parameters like Rif, Rof, Avf bandwidth, load regulation, line regulations etc.
2. **Verify** different OP-Amp Parameters and compare with data Sheet.
3. **Design** combinational and sequential circuits using MSI devices
4. **Compare** TTL and CMOS technology in terms of voltage levels, power dissipation, noise margin.

COURSE CONTENTS

GROUP A (ANY 5)

Expt. No.	Problem Statement
1.	To design, build single stage CS amplifier & verify dc operating point.
2.	To build & test single stage CS amplifier, plot frequency response. Calculate Av, Ri, Ro & bandwidth.
3.	To measure following Op- amp parameters & compare with specifications given in data sheet. [Any two Practical Op-Amp can be used for comparison. eg. LM741, OP07, LF351, LF356] a) Input bias current b) Input offset current c) Input offset voltage d) Slew rate e) CMRR
4.	To design, build & test integrator using Op-amp for given frequency fa.
5.	To design, build & test Schmitt trigger using Op-Amp (LF356)
6.	Design & implement an adjustable voltage regulator using three terminal voltage regulator IC.
7.	Design, build & test Square and triangular waveform generator using Op-Amp (LF351/LF356).
8.	Design, build & test Schmitt trigger using Op-Amp (LF356, TL071).
GROUP B	
9.	Study of IC-74LS153 as a Multiplexer: (Refer Data-Sheet). a. Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table. b. Design & Implement the given 4 variable functions using IC74LS153. Verify its Truth-Table

10.	Study of IC-74LS138 as a Demultiplexer / Decoder: (Refer Data-Sheet) a. Design and Implement full adder and subtractor function using IC-74LS138. b. Design & Implement 3-bit code converter using IC-74LS138. (Gray to Binary/Binary to Gray)
11.	Study of IC-74LS83 as a BCD adder: (Refer Data-Sheet). a. Design and Implement 1 digit BCD adder usingIC-74LS83 b. Design and Implement 4-bit Binary Adder and subtractor using IC-74LS83.
12.	Study of IC-74LS85 as a magnitude comparator: (Refer Data-Sheet) a. Design and Implement 4-bit Comparator. b. Design and Implement 8-bit Comparator
13.	Study of Counter ICs (74LS90/74LS93): (Refer Data-Sheet) a. Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram. b. Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.
Text Books:	
T1.	R.P. Jain, "Modern digital electronics", 3rd edition, 12th reprint Tata McGraw Hill Publication,2007.
T2.	Donald Neaman, "Electronic Circuits – Analysis and Design" Third edition, Mc Graw Hill
T3.	Ramakant Gaikwad, "Op amps & Linear Integrated Circuits", Pearson Education.
Reference Books:	
R1.	Anand Kumar, "Fundamentals of Digital Circuits" 1st edition, Prentice Hall of India, 2001
R2.	Millman Halkias, "Integrated Electronics".

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5303103]: Operating System (OS)

Semester	Credits	Teaching Scheme	Examination Scheme
3	3	L: 3 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks
	1	TuT: 1 Hr/Week	CIE (TW) :25 Marks

Prerequisite: Students should have prior knowledge of

- **Fundamentals of Computer Science**: Basic understanding of hardware and software systems.
- **Programming Foundations**: Knowledge of at least one programming language.
- **Discrete Mathematics**: Familiarity with mathematical structures, logic, and basic algorithms.
- **Digital Logic Design**: Understanding binary systems, logic gates, and basic electronic principles

Course Objectives: The objective of this course is to provide students with

- **Understand** the fundamental architecture of computer systems—including CPU design, memory management, and I/O systems—and their interaction with operating systems.
- **Gain** insight into the internal working of operating systems and their management of processes, memory, and files in modern computing environments.
- **Learn** system-level programming and optimization techniques that bridge the gap between hardware and software, including efficient utilization of resources.
- **Analyze** various process and resource management techniques used in different operating systems and apply them in real-world system design and programming.

Course Outcomes: After completing this course, students will be able to:

CO1: Describe the architecture of computer systems—including CPU, memory hierarchy, and I/O systems—and understand their operational interactions.

CO2: Analyze and implement basic operating system functionalities, including process management, memory management, and file systems.

CO3: Write and debug system-level programs in an operating system environment (e.g., Unix/Linux), working with processes, memory, and I/O devices.

CO4: Evaluate and apply scheduling, synchronization, and resource management techniques in both theoretical and practical settings, including multi-core and distributed systems.

COURSE CONTENTS

Module-I	Fundamental Concepts	06 Hrs.

A] Basic Computer Organization and Architecture: On Neumann architecture vs. Harvard architecture, Components of a computer: CPU, memory, I/O devices, Buses and data transfer mechanisms, Instruction sets and addressing modes.

CPU Design and Function: Central Processing Unit (CPU): ALU, control unit, and registers, Fetch-Decode-Execute cycle, Pipelining and parallelism in modern processors, Superscalar architecture and its performance improvements.

B] Memory Hierarchy: Primary, secondary, and cache memory, Memory mapping techniques: Paging and segmentation, Virtual memory and its management technique. **Introduction to Operating Systems:** Types of operating systems: Batch, time-sharing, real-time, embedded, distributed,Key functions of an OS: Process management, memory management, file management, I/O system management.

Module-II	Operating Systems Services	07 Hrs.

Process Management: Process concept, process states, and control blocks (PCB), Process scheduling algorithms: FCFS, SJF, Round Robin, Priority Scheduling, Threading and multithreading concepts,Inter-process communication (IPC): Pipes, shared memory, message queues.
Memory Management: Contiguous and non-contiguous memory allocation, Paging and segmentation, Virtual memory management: page tables, page faults, and replacement algorithms (LRU, FIFO, Optimal), Fragmentation: Internal and external.

File Systems and Storage Management: File system concepts: Files, directories, and permissions, File allocation methods: Contiguous, linked, and indexed, Disk management and disk scheduling algorithms (FCFS, SSTF, SCAN), Virtual File System (VFS) and file system mounting.

Module-III	Concurrency & Security in Operating Systems	07 Hrs.

Process Synchronization and Concurrency: Critical section problem and race conditions, Synchronization mechanisms: Semaphores, mutexes, and monitors, Deadlock: Detection, prevention, and recovery,Resource allocation graphs (RAG) and Banker's algorithm.

Security and Protection in Operating Systems security models: Authentication, authorization, encryption, Protection mechanisms and access control lists (ACLs), Malware, viruses, and OS vulnerabilities, Secure OS design principles.

Module-IV	APIs and Case Studies	05 Hrs

System Calls and APIs: Introduction to system calls in Unix/Linux: Process control, file manipulation, memory management, Writing system-level programs in C: File I/O, memory allocation, and process control.

OS Implementation: Overview of UNIX/Linux architecture and components,Windows OS architecture: Process management, threading, and memory management. Case study: Analysis of Android OS for mobile computing.

Distributed Systems and RTOS: Concepts of distributed operating systems and message-passing,Resource management and synchronization in distributed systems,Real-Time Operating Systems (RTOS): Scheduling algorithms and their applications in embedded systems.

Text Books:

T1. **Computer Organization and Design: The Hardware/Software Interface"** by David A. Patterson and John L. Hennessy.

T2. **"Operating System Concepts"** by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne.

T3.	**"Operating Systems : Internals and Design Principles"** by Stallings, William, Prentice Hall, 2001.
Reference Books:	
R1.	**"Computer Systems: A Programmer's Perspective"** by Randal E. Bryant and David R. O'Hallaron.
R2.	"**Operating Systems: Design and Implementation**" by Andrew S. Tanenbaum and Herbert Bos.

LIST OF TUTORIALS

	TUTORIAL
1.	**Linux System Calls and Process Management** Master Linux system calls and process management by simulating process lifecycle operations and building a basic shell. **Implementing System Calls** Write programs using fork(), exec(), wait(), and exit() to demonstrate process creation, termination, and execution flow.
2.	**Process Lifecycle Simulation** Simulate process scheduling behavior (creation, termination, and priority adjustments) in a Linux environment. **Process Monitoring** Use tools like ps, top, and htop to analyze real-time process activity and resource usage.
3.	**Shell Development** Design a minimal shell that parses user commands, launches processes, and handles background/foreground execution
4.	**CPU Scheduling Algorithms** Implement and evaluate CPU scheduling algorithms for optimizing process execution. **Algorithm Implementation** • First-Come-First-Serve (FCFS) • Shortest Job First (SJF) • Round Robin (RR) Priority Scheduling
5.	**Performance Analysis** Calculate metrics like average waiting time, turnaround time, and CPU utilization for varying input cases. **Comparative Study** Generate a table comparing algorithm efficiency under different workloads (e.g., varying burst/arrival times)
6.	**Memory Management Techniques** Simulate paging and segmentation for efficient memory allocation and fault handling. **Paging** • Implement page table structures and simulate FIFO/LRU page replacement. • Trigger and resolve page faults dynamically.
7.	**Segmentation** Divide a process's address space into variable-sized segments and manage allocation/deallocation.

	Fault Handling Design test cases for both page and segment faults, including recovery mechanisms
8.	**IPC and Synchronization** Implement inter-process communication and synchronization to resolve concurrency issues. **IPC Mechanisms** Create programs using pipes, shared memory, and message queues for data exchange.
9.	**Synchronization** Use semaphores or mutexes to solve the producer-consumer problem, avoiding race conditions.
10.	**Deadlock Analysis** Simulate deadlock scenarios and apply prevention/detection strategies (e.g., resource allocation graphs)

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)
[5303104]: Principles of Data Structure (PDS)

Semester	Credits	Teaching Scheme	Examination Scheme
3	3	L: 3 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Basic principles of programming language, Fundamentals of programming language such as data types, variable declaration and initializations, tokens, statements, array, string, pointer etc.

Course Objectives: The objective of this course is to provide students with

- A fundamental understanding of the concepts of data structure.
- Analysis of performance based on time and space complexity, asymptotic notations, best, average and worst cases.
- Representation of linear data structure and their storage.
- A foundational understanding of stacks and queues, linked list
- The essential groundwork for implementation of trees and graph theories.

Course Outcomes: After completing this course, students will be able to

CO1: Analyze and compare the time complexity of various searching, sorting, and traversal algorithms to evaluate their efficiency.

CO2: Understand the concepts of linear data structures, their representations, and perform various operations to assess their behavior, efficiency, and algorithmic complexity.

CO3: Examine non-linear data structures, implement traversal techniques, and apply algorithms to perform essential operations effectively.

CO4: Apply dynamic programming and competitive programming techniques, such as bit manipulation, divide & conquer, and hashing, to solve complex computational problems.

COURSE CONTENTS

Module-I	Algorithms	06 Hrs.

Sorting algorithms: Bubble, Insertion, Selection, Merge, and Quick sorting techniques,

Searching algorithms: Linear, Binary searching, algorithmic notations, time, and space complexity. Asymptotic Notations: Big-O, Big-Ω, Big-Θ

Recursion and Backtracking: Factorial, Fibonacci

Case Study: Choosing the Right Sorting Algorithm for Large-Scale Data Processing in E-Commerce

Expected Outcome: Students will implement all five sorting algorithms, execute them on real-world datasets, and compare their efficiency in different scenarios using time complexity graphs

Module-II	Linear Data Structures	07 Hrs.

Arrays: Operations, Two-Pointer Technique, Sliding Window

Stack: Creation of stack using array and linked list. Various operation such as push, pop on stack. Applications of stack such as evaluation of expression.

Queue: Creation of queue using array and linked list. Various operations on queue such as insert, delete. Study of circular queue.

Linked List: Dynamic memory allocation, types of lists such as singly linked list (SLL), doubly linked list (DLL), circularly linked list (CLL). creation of linked list and operation list such as insert, delete, modify, reverse.		
Case Study Stack – Push/Pop Operations, Applications Scenario: A simple text editor needs an Undo feature. Every typed word is pushed onto a stack, and when Undo is pressed, the last word is popped. Outcome: Students will implement stack operations and understand real-world applications.		
Module-III	**Non-Linear Data Structures**	**06 Hrs.**
Tree: Terminologies of tree, types of trees, Binary Tree (BT), and Binary Search Tree (BST). Various operations on BST such as create, insert, delete, and traversing. Graph: Terminologies of graph, types of graphs, Adjacency matrix and list. Depth first search (DFS), Breadth first search (BFS). Minimal spanning tree algorithm (Prims').		
Case Study Stack Trees – Terminologies, Binary Tree (BT), BST Operations (Insert, Delete, Traverse) Scenario: A company maintains an organizational hierarchy where the CEO is at the top, and employees are stored as nodes in a tree. Outcome: Students will implement tree-based hierarchy management, similar to company structures		
Module-IV	**Competitive and Dynamic Programming**	**07 Hrs**
Competitive Programming: Bit Manipulation Techniques, Divide & Conquer, Two Pointer & Sliding Window Problems, Hashing Techniques (Chaining, Open Addressing) Dynamic Programming: Memoization vs Tabulation Classical Problems: Fibonacci, Knapsack, Longest Common Subsequence (LCS), Longest Increasing Subsequence (LIS)		
Case Study: Competitive Programming – Bit Manipulation Techniques **Scenario:** A security system needs to store access permissions for multiple users in a compressed format. Instead of using a boolean array, a bitwise approach is used to: 1. Set (Grant) and Clear (Revoke) specific permissions using bitwise AND, OR, and XOR. 2. Check if a user has specific permissions using bitwise operations. **Outcome:** Students will implement bitwise operations to efficiently store and process boolean data with minimal memory usage		
Text Books:		
T1. Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi 1995 ISBN 16782928		
T2. Data Structures and Algorithm Analysis in C++, M.A.Weiss.		
Reference Books:		
R1. The C++ Programming Language by Bjarne Stroustrup, 2013. Or, Programming: Principles and Practice Using C++ by Bjarne Stroustrup, 2014.		
R2. Cracking the Coding Interview by Gayle McDowell, 6th edition		
Relevant MOOCs Course (Course name and Weblink)		
NPTEL Course **"Programming & Data Structure"** https://nptel.ac.in/courses/106/105/106105085/ NPTEL Course **"Data Structure & Algorithms**" https://nptel.ac.in/courses/106/102/106102064/ NPTEL Course **"Programming in C++"** By Prof. Partha Pratim Das, IIT Kharagpur **Link:** https://onlinecourses.nptel.ac.in/noc21_cs02/preview		

Relevant Topics for Self-study:
Stack application for conversion of expression. Hashing techniques. Priority queue. Double linked list. AVL: Height balance tree, AVL rotations., Threaded Binary Tree. Shortest path algorithm (Dijkstra's).

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5303205]: Principles of Data Structure Lab (PDSL)

Semester	Credits	Teaching Scheme	Examination Scheme
3	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks ESE (PR): 50 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of programming, syntax, keywords, tokens.

Course Objectives: The objective of this course is to provide students with

- A fundamental understanding of the concepts of data structure.
- Understanding of Sorting Algorithms.
- Analysis of performance on the basis of time and space complexity, asymptotic notations, best, average and worst cases.
- A foundational understanding of stacks and queues.
- The essential groundwork for implementation of trees and graph theories.

Course Outcomes: After completing this course, students will be able to

CO1: Implement and analyze the time complexity of various searching, sorting, and traversal algorithms through hands-on experiments to evaluate their efficiency in different scenarios.

CO2: Design and implement programs using linear data structures (arrays, linked lists, stacks, and queues) to perform insertion, deletion, and searching operations, and analyze their efficiency through experimental evaluation.

CO3: Develop and execute programs using non-linear data structures (trees and graphs) by applying traversal techniques and performing operations such as insertion, deletion, and searching to understand their practical applications.

CO4: Apply dynamic programming and competitive programming techniques, including bit manipulation, divide & conquer, sliding window, and hashing, to solve real-world computational problems efficiently through practical implementation.

COURSE CONTENTS

Expt. No.	Problem Statement
1.	Write C++ program to sort given data elements in ascending order using bubble sort, quick sort, and merge sort. Search any element in given data set using linear and binary search.
2.	Implement following data structures using Standard Template Library (STL) to manipulate data elements. 1. **Vector** (create, access (front, back, at), alter, loop through, insert, and delete). 2. **List** (create, access (front, back, at), alter, loop through, insert, and delete). 3. **Stack** (create, access, alter, loop through, insert, and delete). 4. **Queue** (create, access, alter, loop through, insert, and delete). 5. **Set** ((create, access, add, remove, loop through, unique, and sort).

	Map (create, access, alter, loop through, insert, and delete).
3.	Design and implement a function in C++ to evaluate an infix expression directly, without converting it to postfix. The function should correctly handle spaces, parentheses (), operator precedence, and associativity.
4.	Implement a C++ program for a ticket booking system where customers arrive at a counter and wait in a queue. The program should allow customers to join the queue (enqueue), process a customer when they buy a ticket (dequeue), and display the current queue status.
5.	Create a C++ program using a circular linked list to implement a simple music playlist. Each song should have a title and duration. The program should support adding a song, deleting a song, moving to the next song, and displaying the current playlist in a loop.
6.	Design and implement a C++ program to manage a student database using a Binary Search Tree (BST). Each node of the BST should store student details such as Roll Number, Name, and Marks. The BST should support the following operations: 1. **Insert a new student record** (based on Roll Number as the key). 2. **Delete a student record** by Roll Number. 3. **Search for a student** by Roll Number. 4. **Display the student records** using Inorder, Preorder, and Postorder traversal (both recursively and non-recursively). 5. **Find the student with the highest and lowest marks** using BST properties. **Find the total number of students (size of BST).**
7.	Design and implement a C++ program to model a simple social network using a graph. Each person is represented as a node, and a connection (friendship) between two people is represented as an edge. The program should allow the following operations: 1. **Add a new person to the network.** 2. **Create a friendship connection between two people.** 3. **Find all friends of a given person using Breadth-First Search (BFS).** 4. **Find if a connection exists between two people using Depth-First Search (DFS).** **Display the entire social network (Graph Representation: Adjacency List or Matrix).**
8.	Design a C++ program to solve the following real-world applications using DP: 1. **DNA Sequence Matching** – Use LCS to find similarities between two DNA sequences. **Stock Market Analysis** – Use LIS to determine the longest period of increasing stock prices.
Text Books:	
T1.	E. Horowitz, S. Sahni, S.Anderson-freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, ISBN 978-81-7371-605-8
T2.	B. Kernighan, D. Ritchie, “The C Programming Language”, Prentice Hall of India, Second Edition, ISBN 81-203-0596-5
Reference Books:	
R1.	Ellis Horowitz, S. Sahni, D. Mehta “Fundamentals of Data Structures in C++”, Galgotia Book Source, New Delhi 1995 ISBN 16782928
R2.	Jean-Paul Tremblay, Paul. G. Sorensan, “An introduction to data structures with Applications”, Tata Mc-Graw Hill International Editions, 2nd edition 1984, ISBN-0-07 462471-7

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Electronics and Computer Engineering (E&CE) [03051X1]: Multidisciplinary Minor (MDM-1)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
3	**2**	**L: 2 Hrs./ Week**	**ISE: 20 Marks** **CIE: 20 Marks** **ESE: 60 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Electronics and Computer Engineering (E&CE) [03052X1]: Multidisciplinary Minor Lab (MDM-1)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
3	**1**	**P: 2 Hrs./ Week**	**ESE (P): 25 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)
[5309101]: Financial Literacy and Banking (FLB)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	L: 2 Hrs./ Week	CIE(TW): 50 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of Finance

Course Objectives: The objective of this course is to provide students with

- This course helps the student to learn financial planning & control, practical aspects of Account. Focuses on financial management skills to practical situations.

CO1: Implement financial knowledge in real life related to personal context and business context.
CO2: Gain a comprehensive understanding of the structure and evolution of the Indian banking system.
CO3: Understand various intelligent sources for investment by analyzing capital, insurance and risks Involved in processing.
CO4: Explain balance sheet.

COURSE CONTENTS

Module-I	Foundations of Finance	06 Hrs.

Need for Financial Planning, Financial Goals, Financial Management:
Concept, Finance Function. Banking in India: Concepts of Banking, Types of Bank Accounts and Deposits.
Banking Activities: Deposits and Types of Deposits-Saving Bank Accounts, Fixed Deposit Accounts, Recurring Deposit Account, Special Term Deposit Schemes, Loans and Types of loan advanced by Banks and Other secondary functions of Bank. Banking structure in India and Role of Reserve Bank of India.

Module-II	Investment Management-I	06 Hrs.

Investment Goals: Basic Investment Objectives, Time Frame, Assessing Risk Profile, Diversification and Asset Allocation.

Module-III	Investment Management-II	06 Hrs.

Investment and Saving alternatives for a Common Investor: Insurance, Stocks, Bonds, etc. Stock Markets: Primary and Secondary Markets. Criteria for Stock Selection.

Module-IV	Financial Planning and Mutual Funds	06 Hrs.

Financial Planning: Concept and Objectives. Mutual Funds: Concept and History of Mutual Funds in India. Types of Mutual Funds.
Protection Related products: Insurance Policies, Life Insurance, Term Life Insurance, Endowment Policies, Pension Policies, ULIP, Health Insurance and its Plans, Understanding of Ponzi Schemes

Text Books:

T1. Financial Management – I.M. Pandey (Vikas Publishing House, New Delhi)
T2. Financial Management—MY Khan & PK Jain (Tata McGraw Hill)
T3. Financial management—Sheeba Kapil (Pearson)

Reference Books:

R1. Indian financial System, by T. R. Jain and R. L. Sharma, VK Global Publisher
R2. Money and Banking by T. R. Jain and R. K. Kaundal, VK Global Publisher
Relevant MOOCs Course (Course name and Weblink)
NPTEL Course “Foundations of Accounting & Finance” by By Prof. Arun Kumar Gopalaswamy IIT Madras https://onlinecourses.nptel.ac.in/noc25_ec02/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0306301]: OE-I Foreign Language Studies (FLS)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	Tut.: 2Hrs./ Week	CIE (TW): 50 Marks

Refer Annexure-II

Select one course listed in Annexure and

Second Year
B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0311101]: Universal Human Values (UHV)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	L: 2 Hrs. / Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- UHV-I: Universal Human Values-Introduction (SIP)

Course Objectives: The objective of this course is to provide students with

- An appreciation for the essential complementarity between 'values' and 'skills' as a foundation for sustained happiness and prosperity — the core aspirations of every human being.
- A holistic perspective on life and profession, grounded in a correct understanding of human reality and the rest of existence. This perspective supports the development of universal human values and encourages value-based living in a natural and integrated manner.
- Insights into the practical implications of a holistic understanding — fostering ethical human conduct, trustful and fulfilling relationships, and mutually enriching interactions with nature. This serves as an essential orientation in value education for young and curious minds.

Course Outcomes: After completion of this course, students will be able to

CO1: Distinguish between values and skills; differentiate happiness from the accumulation of physical facilities; compare the Self and the Body, and **evaluate** the role of intention and competence in human behavior.

CO2: **Analyze** the importance of harmonious relationships based on trust and respect, and **apply** these principles in personal and professional life.

CO3: **Examine** the role of human beings in establishing harmony with society and nature; **develop** strategies for ethical living and professional conduct.

COURSE CONTENT

Module-I	Basic aspiration of Human being & Harmony in Human being	12 Hrs.

Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to fulfill the Basic Human Aspirations. 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, Program to ensure self-regulation and Health.

Module-II	Harmony in the Family, society & Nature / Existence	12 Hrs.

Harmony in the Family – the Basic Unit of Human Interaction, Values in Human–to–Human Relationship, Nine universal values in relationships viz. Trust, Respect, Affection, Care, Guidance, Reverence, Glory, Gratitude, Love. Understanding Harmony in Society, Vision for the Universal Human Order, Human Order Five Dimension. Understanding Harmony in the Nature, self–regulation & mutual fulfillment among the Four orders of Nature, Realizing Existence as co-existence at all levels holistic perception of harmony in existence.

Textbooks:

T1. Gaur, R. R., Sangal, R., and Bagaria, G. P. *Human Values and Professional Ethics* 3rd revised ed., PHI, Excel Books Pvt. Ltd., New Delhi, 2010.

Reference Books:

R1. Nagaraj, A. *Jeevan Vidya: Ek Parichaya*. Jeevan Vidya Prakashan, Amarkantak, 1999.

R2. Tripathi, A. N. *Human Values*. New Age International Publishers, New Delhi, 2004.

R3. Krishnamurthy, J. *The Story of My Experiments with Truth* – by Mohandas Karamchand Gandhi on Education.

R4. Dharampal. *Rediscovering India*. Hind Swaraj or *Indian Home Rule* – by Mohandas K. Gandhi.

R5. Gandhi, M. K. *Hind Swaraj or Indian Home Rule*.

Websites and Online Resources:

W1. Universal Human Values

- Link: Universal Human Values - YouTube
- The focus of Universal Human Values is to guide learners in discovering what they find truly valuable in all aspects of life—individual, family, society, and nature/existence—while strengthening their resolve to uphold and live by these values.

W2. English eSIP Module 1 Universal Human Values I (UHV I) Session 1& 2

- Link: https://www.youtube.com/live/OgdNx0X923I?feature=shared
- This video module introduces Universal Human Values (UHV), explores life without clarity of basic aspirations, and highlights the importance of right understanding, relationships, and physical facilities.

Relevant MOOCs Course (Course name and Weblink)

1. NPTEL Course: Visions of Happiness and Perfect Society, by Prof. A. K. Sharma, Humanities and Social Sciences, IIT Kanpur.

Link: NPTEL :: Humanities and Social Sciences - Exploring Human Values: Visions of Happiness and Perfect Society.
Relevant Topics for Self-study:
Making the Right Choices: Staying True to Your Values Despite Outside Pressure How Kindness and Understanding Help Build Strong Relationships

List of tutorials:

Sr. No.	Problem Statement	Hrs.	CO
1.	Analyze inherent relationships and harmony through self-exploration, and evaluate the shift toward universal human consciousness and a holistic world vision.	2	CO1, CO3
2.	Reflect on personal experiences to identify patterns in human consciousness, and assess the influence of natural acceptance on decision-making.	2	CO1
3.	Differentiate between the needs of the Self and the Body; evaluate the sources of imagination within the Self; relate mental well-being to physical health.	2	CO1
4.	Analyze the role of trust and respect in human interactions, and evaluate their impact on personal and societal relationships.	2	CO2
5.	Reflect on personal family experiences to identify value systems and evaluate their contribution to societal harmony.	2	CO2, CO3
6.	Document and discuss real-life examples of universal human values like trust, respect, and gratitude in human relationships.	2	CO2
7.	Analyze the interconnectedness of self, family, and society, and assess how personal well-being contributes to societal harmony.	2	CO2, CO3
8.	Investigate natural ecosystems for balance and self-regulation, and propose ways humans can align their behavior with ecological harmony.	2	CO3

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0308202]: Professional Development and Career Readiness (PDCR)

Semester	Credits	Teaching Scheme	Examination Scheme
3	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Soft Skills (SS)

Course Objectives: The objective of this course is to provide students with

- The skills to prepare a good resume, as well as prepare for interviews and group discussions.
- The ability to explore desired career opportunities in the employment market while considering their personal strengths, weaknesses, opportunities, and threats (SWOT).
- The necessary career skills to partake in and fully pursue a successful career path.

Course Outcomes: After completing this course, students will be able to

CO1: Prepare the resume on an appropriate template without any grammatical and syntax errors, and Present and Discuss with students.

CO2: Participate in a simulated interview and evaluate own performance for betterment.

CO3: Demonstrate effective communication skills through Group Discussion, self-management attributes.

CO4: Define personal and career goals (short-term and long-term) using introspective skills and Perform SWOT assessment.

CO5: Identify career opportunities in consideration of potential and aspirations.

COURSE CONTENTS

Expt. No.	Task to carry out	Hrs.	CO
1.	**Resume Skills** • Introduction of resume and its importance • Difference between a CV, resume and biodata • Essential components of a good resume. • Common errors while preparing a resume	4	CO1
2.	Prepare a good resume considering all essential components and present the resume	2	CO 1
3.	**Interview Skills: Preparation and Presentation** • Meaning and types of interviews (F2F, telephonic, video, etc.) • Dress code, background research, dos and don'ts. • Situation, task, action, and response (STAR concept) for facing an interview. • Interview procedure (opening, listening skills, and closure). • Important questions generally asked at a job interview (open- and close-ended questions)	2	CO 2
4.	**Interview Skills: Common Errors** • Discuss the common errors that candidates generally make at an interview • Demonstrate an ideal interview	2	CO 3
5.	**Group Discussion Skills**	2	CO 3

	• Meaning and Methods of Group Discussion • Procedure of Group Discussion • Group Discussion — Simulation Group Discussion — Common Errors		
6.	**Strengths, Weaknesses, Opportunities and Threats Analysis (SWOT):** • To carryout introspection and become aware of one's Strengths, Weakness, • Opportunities and Threats. • Document SWOT analysis in a matrix format.	2	CO 3
7.	**Exploring Career Opportunities** • Knowledge about the world of work, requirements of jobs, including self-employment. • Sources of career information. • Preparing for a career based on potential and availability of opportunities.	2	CO 4

Text Books:

T1.	Bhattacharya, I. *An Approach to Communication Skills*. Dhanpat Rai.
T2.	Chauhan, R. G. S., and Sharma, S. *Soft Skills: An Integrated Approach to Maximize Personality*. Wiley, First Edition, 2016.

Reference Books:

R1.	Sweeney, S. *English for Business Communication*. Cambridge University Press.
R2.	Kumar, S., and Lata, P. *Communication Skills*. Oxford University Press.
R3.	Kalam, A. P. J. *Ignited Minds: Unleashing the Power Within India*. Penguin Books India, New Delhi, 2003.

Relevant Topics for Self-study:

- Foundation Skills in IT (FSIT) — Refer to the websites like https://www.sscnasscom. com/ssc-projects/capacity-building-and-development/training/fsit/ and
- Global Business Foundation Skills (GBFS) – Refer websites like https://www. sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0313201]: Community Engagement Project (CEP)

Semester	Credits	Teaching Scheme	Examination Scheme
3	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of social and ethical responsibilities.
- Teamwork and communication skills acquired in prior coursework or group activities.
- Familiarity with problem-solving methodologies and project planning.

Course Objectives: The objective of this course is to provide students with

- Opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
- An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
- The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
- The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

Course Outcomes: After completing this course, students will be able to

CO1: Identify and Analyze community needs and challenges by engaging with stakeholders and evaluating real-world problems. *(Remembering & analyzing)*

CO2: Design and Implement practical, creative, and context-specific solutions using engineering principles to address community issues. *(Creating & applying)*

CO3: Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations. *(Evaluating & Understanding)*

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

B. Project Scope:

The CEP should focus on addressing a specific community or societal issue. Projects may fall under the following themes:

1. **Education and Awareness:**
   - Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
2. **Technology for Social Good:**
   - Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
3. **Environmental Sustainability:**

- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.

4. **Health and Wellness:**

- Promote health through awareness programs on hygiene, nutrition, and exercise.

5. **Skill Development:**

- Teach basic computer or technical skills to students, staff, or the community.

C. Step-by-Step Execution Plan:

1. Planning Phase:

- **Team Formation:**

Form teams of 3-4 students with a balance of skills and interests.

- **Project Selection:**

Choose a project theme and define a clear objective that aligns with community needs.

- **Proposal Submission:**
  - Submit a one-page project proposal outlining:
  - Title of the project.
  - Objective and expected outcome.
  - Plan of execution (timeline and activities).
  - Required resources (if any).
  - Get approval from the designated faculty mentor.

2. Execution Phase:

- **Phase 1 Activities**
  - Conduct initial outreach and engage with the community or target participants.
  - Implement planned activities with close teamwork and documentation.
- **Phase Activities**
  - Continue engagement and collect feedback from the participants.
  - Begin summarizing the outcomes of the project.
- **Best Practices:**
  - Maintain a positive attitude and open communication with the community.
  - Respect cultural norms and values of the participants.
  - Adapt your plan based on real-time needs or challenges.

3. Reporting Phase:

- **Documentation:**
  - Create a detailed report containing
  - Title, objective, and scope of the project.
  - Activities conducted and timeline.
  - Outcomes and community feedback.
  - Photos/videos of the activities (if permitted).
  - Challenges faced and how they were addressed.
- **Presentation:**
  - Each team will present their project to a panel of faculty members or peers, showcasing their efforts and outcomes.
  - Duration of presentation: 5-7 minutes per team.

D. Evaluation Criteria:

Projects will be evaluated based on:

1. **Relevance:** How well the project aligns with community needs.
2. **Impact:** The tangible and intangible benefits delivered to the community.
3. **Innovation:** Creativity in the approach or solution provided.
4. **Teamwork:** Collaboration and effective delegation within the group.
5. **Documentation & Presentation:** Clarity, depth, and overall delivery of the report and presentation.

E. Guidelines for Conduct:

1. **Behavior:** Students should display professionalism, punctuality, and respect.
2. **Safety:** Follow all safety protocols during on-campus or fieldwork activities.
3. **Feedback:** Collect feedback from participants to measure the success and identify areas for improvement.

F. Support and Supervision:

1. Faculty mentors will be assigned to each group to guide them throughout the project.
2. A resource or helpdesk will be available for logistical or technical support.

Reference Books:

R1. Dostilio, L. D., et al. *The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education*. Stylus Publishing, 2017. A practical guide for community engagement projects, including tools and strategies for effective implementation and assessment.

R2. Waterman, A. *Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects*. Routledge, 1997. Insights into service-learning methodology, planning, and assessment techniques for impactful projects.

R3. Beckman, M., and Long, J. F. *Community-Based Research: Teaching for Community Impact*. Stylus Publishing, 2016. Approaches for conducting research and engagement projects collaboratively with communities.

R4. IDEO.org. *Design Thinking for Social Innovation*. IDEO Press, 2015. Explains how to apply design thinking to solve social problems, ideal for projects focusing on community engagement.

R5. Sherrod, L. R., Torney-Purta, J., and Flanagan, C. A. (Eds.). *Handbook of Research on Civic Engagement in Youth*. Wiley, 2010. A detailed guide on youth involvement in civic and community projects, with case studies and strategies for engagement.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. UNESCO: Education for Sustainable Development

- Website: https://www.unesco.org
- Focus: Resources and case studies related to sustainability and community engagement.

W2. EPICS (Engineering Projects in Community Service)

- Website: https://engineering.purdue.edu/EPICS
- Focus: Offers methodologies and tools for engineering students to work on real-world projects benefiting communities.

W3. Ashoka: Innovators for the Public

- Website: https://www.ashoka.org

- Focus: Information on social entrepreneurship and community innovation projects.

W4. Design for Change

- Website: https://www.dfcworld.com
- Focus: Templates, toolkits, and project ideas for implementing impactful community-based projects.

For Evaluation and Impact Assessment:

W5. Community Tool Box (University of Kansas)

- Website: https://ctb.ku.edu
- Focus: Comprehensive resources for community engagement, project evaluation, and measuring outcomes.

W6. UN SDG (Sustainable Development Goals) Knowledge Platform

- Website: https://sdgs.un.org/
- Focus: Guidance on aligning community engagement projects with UN Sustainable Development Goals (SDGs).

W7. Campus Compact

- **Website: https://www.compact.org/**
- **Focus: Resources on civic and community engagement for students and educators, with a focus on project assessment.**

W8. BetterEvaluation

- Website: https://www.betterevaluation.org
- Focus: Tools and frameworks to evaluate the impact of community projects effectively.

W9. lan-Do-Check-Act Cycle (PDCA) – Deming Institute

- Website: https://deming.org/explore/pdsa
- Focus: Step-by-step guides for planning, implementing, and refining community projects.

Relevant MOOCs Course (Course name and Weblink)

1. NPTEL course: Ecology and Society, by Prof. Ngamjahao Kipgen, IIT Guwahati
   This course delves into the dynamic relationships between human cultures and their ecological environments, focusing on human-environment interactions and sustainable development.
   Link: https://onlinecourses.nptel.ac.in/noc20_hs77/preview.
2. NPTEL course: Basics of Health Promotion and Education Intervention, by Dr. Arista Lahiri, Dr. Sweety Suman Jha (IIT Kharagpur), Dr. Madhumita Dobe, Dr. Chandrashekhar Taklikar (AIIH&PH, Kolkata)
   This course provides a comprehensive understanding of health promotion and education interventions, covering planning, implementation, and evaluation strategies.
   Link: https://onlinecourses.nptel.ac.in/noc22_ge18/preview
3. NPTEL course: A Hybrid Course on Water Quality – An Approach to People's Water Data, by IIT Madras
   This hybrid course emphasizes practical fieldwork, including water sample collection and analysis, engaging with communities to assess water quality.
   Link: https://elearn.nptel.ac.in/shop/iit-workshops/completed/a-hybrid-course-on-water-quality-an-approach-to-peoples-water-data/?v=c86ee0d9d7ed

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0313202]: Field Project (FP)

Semester	Credits	Teaching Scheme	Examination Scheme
3	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- Hands-on, real-world experience in applying engineering concepts through practical problem-solving and teamwork.
- The ability to analyze real-world field situations by identifying key challenges and requirements.
- The skills to apply engineering knowledge, tools, and techniques to develop effective solutions.
- The capability to critically evaluate their fieldwork outcomes in terms of impact, feasibility, and sustainability.

Course Outcomes: After completing this course, students will be able to

CO1: Assess field conditions and identify problems through observation and interaction with stakeholders.
CO2: Develop and **execute** a practical, field-based solution or prototype aligned with the identified needs.
CO3: Reflect on and evaluate the project outcomes in terms of their technical, social, and ethical impact.

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

B. Field Project Execution Guidelines

1. **Team Formation and Topic Selection:**
   - Students form groups of 3-4.
   - Select a project aligned with an engineering problem or theme, such as:
     - Environmental monitoring and solutions.
     - Designing small-scale engineering systems.
     - Infrastructure or community development.
     - Renewable energy solutions.
2. **Proposal Submission:**
   - Prepare a proposal that includes:
     - Project title and objectives.
     - Problem statement and proposed solution.
     - Field location and timeline.
     - Required resources.
   - Obtain faculty mentor approval.
3. **Fieldwork:**
   - Conduct site visits, data collection, and stakeholder interactions.
   - Design or develop the solution based on field observations.

- Ensure proper documentation of all activities.

4. **Reporting and Presentation:**
   - Prepare a detailed report with:
     - Objectives, methodology, and field observations.
     - Design, implementation, and results.
     - Challenges faced and lessons learned.
   - Present the report and findings to faculty and peers.

Reference Books:

R1. Walesh, S. G. *Engineering Your Future: The Professional Practice of Engineering*. Cengage Learning, 2012. Real-world applications of engineering principles, teamwork, and ethical practices.

R2. Phillips, R., and Johns, J. *Fieldwork for Human Geography*. Sage Publications, 2012. Field research methodologies, data collection techniques, and stakeholder engagement.

R3. Oberlender, G. D. *Project Management for Engineering and Construction*. McGraw-Hill Education, 2014. Planning and managing projects with practical tools for engineers.

R4. Williams, D. E. *Sustainable Design: Ecology, Architecture, and Planning*. Wiley, 2007. Field-based solutions emphasizing sustainability and environmental impact.

R5. Martin, M. W., and Schinzinger, R. *Introduction to Engineering Ethics*. McGraw-Hill, 2005. Ethical considerations in fieldwork and engineering projects.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. Engineering Projects in Community Service (EPICS)
- Website: https://engineering.purdue.edu/EPICS
- Focus: Resources for field-based projects benefiting communities.

W2. Community Tool Box
- Website: https://ctb.ku.edu
- Focus: Guidelines for project planning, stakeholder engagement, and evaluation.

W3. National Geographic Education – Fieldwork Resources
- Website: https://education.nationalgeographic.org/
- Focus: Tips for conducting fieldwork, documenting findings, and analyzing data.

W4. BetterEvaluation
- Website: https://www.betterevaluation.org
- Focus: Frameworks and tools for project evaluation and impact assessment.

W5. Design for Change (DFC)
- Website: https://www.dfcworld.com
- Focus: Step-by-step guidance for impactful, design-based field projects.

W6. PDCA (Plan-Do-Check-Act) Methodology
- Website: https://deming.org/explore/pdsa
- Focus: Tools for iterative project planning and improvement during field execution.

Relevant MOOCs Course (Course name and Weblink)

1. Project Management, by Prof. Ramesh Anbanandam, IIT Roorkee,
   Link: https://onlinecourses.nptel.ac.in/noc24_mg01/preview.
2. Project Planning & Control, by Prof. Koshy Varghese, IIT Madras,
   Link: https://onlinecourses.nptel.ac.in/noc19_ce30/preview.
3. Project Management: Planning, Execution, Evaluation and Control, by Prof. Sanjib Chowdhury, IIT Kharagpur.
4. Link: https://onlinecourses.nptel.ac.in/noc24_mg78/preview.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0313203]: Co-Curricular Activity (CCA)

Semester	Credits	Teaching Scheme	Examination Scheme
3	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- An opportunity to acquire skills and competencies beyond the core curriculum.
- A foundation for holistic personality development.
- Preparation for future academic, professional, and personal growth.

Course Outcomes: After completing this course, students will be able to

CO1: Demonstrate the ability to lead and participate in teams.

CO2: Develop several important life skills such as leadership, organization, confidence time management, and socialization.

CO3: Improve self-confidence and decision-making abilities.

CO4: Experience the importance of community involvement.

COURSE GUIDELINES

As part of the implementation of autonomy with effective from Academic Year 2025-26 for the UG Co-curricular activities are included as credit courses in the curriculum. Accordingly, the number of credits is incorporated in curriculum structure.

BACKGROUND

SCTR's Pune Institute of Computer Technology believes in wholistic development of student catering to the requirements of engineering attributes (program outcomes) prescribed by Washington Accord and NBA through the implementation of Outcome Based Education. There is a limited scope of attaining all the program outcomes through classroom and laboratory teaching learning process. To expand the scope of learning to acquire all the attributes, PICT proposes to institutionalize and formalize the ongoing extra and co-curricular activities which are being carried out by students by awarding due credits and a certificate at the time of their graduation in addition to the University degree certificate. The purpose of Co and extracurricular activities is primarily the acquisition of skills and competencies in areas that are not directly part of the curriculum.

SCOPE

Co-curricular activity (CCA) is an activity, performed by students, that falls outside the realm of the regular academics of college or university education. Such activities are generally social, philanthropic, and often involve others of the same age. However, as part of autonomy and NEP 2020 guidelines some of the credits are included in the curriculum as mandatory for CCA. CCA includes but are not limited to Community Service Organizations (NCC, NSS), Cultural / Ethnic Organizations, Engineering Academic Honor Societies, Engineering Clubs/ Organizations, Orientation Programs, Health Related Organizations, Professional Engineering Societies – Student Chapters, Research(Voluntary Basis), Sports, educational

activities that include, seminars, workshops, project competitions, hackathons, debate competitions, and mathematics, robotics, and engineering teams and contests.

A student can earn one/two credits per year.

The activity hours accumulated throughout the year shall be calculated by the Co-Curricular Activity Committee (CCAC) to fix the number of credits to be granted to students at the end of the year. (Note: 30 hours =1credit)

MODE OF IMPLEMENTATION

1. A committee called Co-Curricular Activity Committee (CCAC) consisting of Dean Student Affairs and all the functional in charges of various activities shall facilitate the activities.
2. Identification and inclusion of Co-Curricular Activities to be considered for Credit System.
3. Mapping each activity to the program outcomes, design the assessment methodology.
4. Define the scope, methodology, number of hours required of each activity
5. Announcement of activity calendar
6. Registration and enrollment of interested students.
7. Allocation of faculty mentors to interested students based on the activity and expertise/interest.
8. Carry out the activities, submission of weekly report in the form of logbook.
9. Submission of detailed report in prescribed format mentioning all the activities carried out along with certificates, mementoes, photographs etc.
10. End-semester assessment and certificate of appropriate credits with the grade Outstanding, Excellent, Very Good, Good, Satisfactory etc.
11. Award of consolidated certificate at the time of graduation.

LIST OF VARIOUS CO-CURRICULAR ACTIVITIES

1. ADDICTION- Annual Social Gathering
2. Alumni Association
3. Art Circle
4. Astro Club
5. Automobile Club
6. AWS Cloud Club
7. Career Guidance Cell
8. Code Chef
9. CSI
10. Cyber Security Club
11. Debate Society DEBSOC
12. Defense Aspirant Club
13. Entrepreneurship Development Cell
14. Ethicraft Club
15. Finance club (PFISOC)
16. FOSS Club
17. Game Development Club (Game Utopia)
18. IEEE (PISB)
19. IEEE APS
20. Impetus & Concepts (INC)
21. Model United Nations (MUN)
22. National Service Scheme (NSS)
23. PICTOREAL
24. ROBOCON
25. Smart India Hackathon (SIH)
26. Social media Cell
27. Sports
28. Startup and Innovation Cell
29. Student Welfare & Discipline
30. TechFiesta (PICT International Hackathon)
31. ACM (PASC)
32. TEDx PICT
33. Training and Placement
34. Universal Human Values (UHV)

Second Year B. Tech (S.Y B. Tech)

Semester-4

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5403106]: Analog and Digital Communication (ADC)

Semester	Credits	Teaching Scheme	Examination Scheme
4	3	L: 3 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Basics of Fourier analysis, Signals and Systems

Course Objectives: The objective of this course is to provide students with

- A fundamental understanding of communication systems essential for analyzing modern analog and digital communication technologies.
- Knowledge of various analog modulation schemes (AM, FM), the need for sampling and quantization in PCM, and different waveform coding techniques such as DM and ADM.
- An understanding of various line coding schemes and their appropriate applications.
- Insights into different digital modulation schemes and spread spectrum techniques.

Course Outcomes: After completing this course, students will be able to

CO1: Define AM and FM techniques, analyze them in time and frequency domains, and explain their generation and detection methods. Compare power requirements, bandwidth, and hardware complexity.

CO2: Explain the sampling process and theorem for low-pass signals. Sketch the frequency spectrum for ideal, natural, and flat-top sampling. Draw and describe PCM, DM, and ADM modulators and demodulators.

CO3: Compare Polar, Unipolar, and Manchester line codes based on PSD, transparency, and error detection. Draw the transmitter and receiver block diagrams for BASK, BPSK, BFSK, QPSK, and MPSK, highlighting each block's function.

CO4: Draw the transmitter and receiver block diagrams for QASK, MSK, OFDM, DSSS, and FHSS. Analyze and compare bandpass modulation techniques based on BER, hardware complexity, and applications.

COURSE CONTENTS

Module-I	Analog transmission & reception	09 Hrs.

Amplitude modulation (DSB-FC), Double sideband Suppressed carrier (DSB-SC) modulation Spectrum and Bandwidth of AM, DSB-SC, Calculation of Modulation Index for AM wave, Power and power efficiency, Block diagram of AM receiver. Frequency Modulation (FM), Modulation Index, Spectrum of FM (single tone): Feature of Bessel Coefficient, Power of FM signal, Bandwidth of FM signal, FM Modulator, FM generation by Armstrong's Indirect method, FM demodulator.

Module-II	Pulse Modulation	09 Hrs.

Sampling theorem for low pass signal in time domain and Fourier domain and Nyquist criteria, Types of sampling- natural and flat top. Pulse amplitude modulation & concept of TDM: Channel bandwidth for PAM, Quantization of Signals, Quantization error, Companding: A-law & μ-law. Generation &

Reconstruction of Pulse code modulation (PCM), Differential Pulse code modulation, Delta Modulation, Adaptive Delta Modulation.

Module-III	**Digital Modulation I**	**09 Hrs.**

Line codes: Properties and spectrum, Baseband Signal Receiver, Digital Modulation: Generation, Reception, Signal Space Representation and Probability of Error Calculation for Binary Phase Shift Keying (BPSK), Binary Frequency Shift Keying (BFSK), Quadrature Phase Shift Keying (QPSK), M-ary Phase Shift Keying (MPSK).

Module-IV	**Digital Modulation II**	**09 Hrs.**

Generation, Reception, Signal Space Representation and Probability of Error Calculation for Quadrature Amplitude Shift Keying (QASK), Minimum Shift Keying (MSK), Orthogonal Frequency Division Multiplexing (OFDM), Comparison of digital modulation systems. Basics od Spread spectrum, Block diagram of Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread spectrum (FHSS).

Text Books:

T1. B.P. Lathi, Zhi Ding, *Modern Analog and Digital Communication Systems*, 4th Edition, Oxford University Press, **2010**.

T2. Taub, Schilling, Saha, *Principles of Communication Systems*, 4th Edition, McGraw-Hill Education, **2013**.

Reference Books:

R1. Bernard Sklar, Prabitra Kumar Ray, Digital Communications: Fundamentals and Applications, 2nd Edition, Pearson Education, 2009.

R2. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons, 2001.

R3. A.B. Carlson, P.B. Crilly, J.C. Rutledge, Communication Systems, 5th Edition, Tata McGraw-Hill, 2010.

Relevant MOOCs Course (Course name and Weblink)

1. NPTEL Course: Principles of Communication Systems-I, by Prof. Aditya K. Jagannatham, IIT Kanpur, Link: https://nptel.ac.in/courses/108/104/108104091
2. NPTEL Course: Principles of Communication, by Prof. V. Venkat Rao, IIT Madras. Link: https://nptel.ac.in/courses/117/106/117106090/

Relevant Topics for Self-study:

AM receivers, Optimum Receiver, Mary-FSK

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5403107]: Microcontroller and Application (MA)

Semester	Credits	Teaching Scheme	Examination Scheme
4	3	L: 3 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of Digital and Electronic Engineering

Course Objectives: The objective of this course is to provide students with

- Fundamentals of microcontrollers, develop microcontroller programming skills, Interface different peripherals and performance analysis of different microcontrollers.

Course Outcomes: After completing this course, students will be able to

CO1: Differentiate various architectures of microcontrollers.

CO2: Impart microcontroller programming and design skills.

CO3: Understand problem identification formulation and selection of appropriate microcontroller as per the applications.

CO4: Interface and use different peripherals with microcontrollers

COURSE CONTENTS

Module-I	Fundamentals of Microcontrollers	07 Hrs.

Introduction: Overview of microcontrollers, features and selection factors, Microcontrollers vs. Microprocessors. Differences, advantages, and applications. RISC vs. CISC architecture (ESP32 as an example of RISC). Von-Neumann vs. Harvard architecture. Microcontroller Components CPU, Registers, Clock, ALU, I/O Ports, Timers, Interrupts. Stack, Stack Pointer, and Program Execution. Memory organization and Peripheral interfacing. Overview of development environments (Arduino IDE, Platform IO, ESP-IDF). Compilation toolchain: Compiler, Linker, Debugger, Loader. Concept of ISP (In-System Programming) and OTA (Over-the-Air Updates)

Module-II	ESP32 Architecture & Basic Programming	06 Hrs.

ESP32 Overview: Features of ESP32 (Dual-core, Wi-Fi, Bluetooth, Low power modes). ESP32 vs. other microcontrollers (Arduino, STM32, Raspberry Pi Pico). ESP32 Development Setup Installing Arduino IDE, ESP-IDF, Platform IO.

Understanding ESP32 Bootloader and Flashing firmware. GPIO handling: Digital Input/Output, Pull-up/Pull-down resistors. Programming Basics & Peripherals ESP32 Pinout and Functional Blocks. Addressing Modes & Instruction Set.

Timers, Interrupts, and Watchdog Timer (WDT). Pulse Width Modulation (PWM) and Frequency Control.ESP32 Power Management & Optimization Deep Sleep, Light Sleep, ULP Co-Processor. Power-saving techniques for IoT applications.

Module-III	ESP32 Communication & Peripheral Interfacing	06 Hrs.

Serial Communication Protocols: UART, SPI, I²C (Theory and ESP32 Implementation). I²C-based sensor interfacing (Accelerometers, Gyroscope, OLED display). SPI-based Flash Memory interfacing. ADC & DAC: Analog and Digital Signal Processing ADC for Sensor Interfacing (Temperature, LDR, Gas sensors). DAC and Analog Signal Generation.

Wireless Communication (Wi-Fi & Bluetooth) Wi-Fi basics, ESP32 as Access Point and Station Mode. MQTT and HTTP communication. Bluetooth Low Energy (BLE) and ESP-NOW communication. Interfacing with Actuators & Motors.		
Module-IV	**Foundation of STM32**	**06 Hrs.**
Introduction to STM32 and ARM, ARM Architecture, STMicroelectronics and the STM32 platform, STM32 key features, STM32 MCU family, STM32 Development Board, ARM Cortex M-4 Memory Maps Cortex Overview, CMSIS, Low Power Operation, Safety Features, The Flash Module.		
Text Books:		
T1. ESP32 Formats and Communication: Application of Communication Protocols with ESP32 Microcontroller, Neil Cameron, Apress.		
T2. Programming ESP32, Simon Monk		
Reference Books:		
R1. STM32 ARM Programming, Muhammad Ali Mazidi		
R2. Beginning STM32, William Grey, Apress		
Relevant MOOCs Course (Course name and Weblink)		
NPTEL :: Electronics & Communication Engineering - Microcontrollers and Applications Microprocessors And Microcontrollers - Course		

Second Year B-TECH (SY B-Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)
[5403208]: ECE Lab-I (ECEL-I)

Semester	Credits	Teaching Scheme	Examination Scheme
3	**1**	**PR: 2 Hrs./ Week**	**ESE (PR): 50 Marks**

Prerequisite: Students should have prior knowledge of Basics of Analog and Digital Circuits**.**

Course Outcomes:

•A fundamental understanding of communication systems, essential for analyzing modern analog and digital communication technologies.

•Knowledge of various analog modulation schemes (AM, FM), the importance of sampling and quantization in PCM, and different waveform coding techniques such as DM and ADM.

•Impart microcontroller programming and design skills

•Interface and use different peripherals with microcontrollers

List of Laboratory Experiments

Group A (Analog and Digital Communication) (Any 6)

Experiment No 1	Draw a block diagram of AM transmitter and receiver. Generate AM (DSB-FC) signal, calculate modulation index by graphical method and Power of AM Waveform for different modulating signal. Observe and sketch the AM waveforms and their spectrums for different modulation index.
Experiment No 2	Draw block diagram of the frequency modulator & demodulator, calculate modulation index & bandwidth of FM. Observe and sketch the FM waveform and spectrum.
Experiment No 3	Perform the experiment to verify Sampling Theorem and to generate PAM Techniques, (Flat top & Natural sampling), observe reconstruction of original signal, and aliasing Effect in frequency domain.
Experiment No 4	Perform the experiment to generate PCM, sketch the waveforms for PCM, Determine the signaling rate and bandwidth of PCM.
Experiment No 5	Perform the experiment to study Line codes (NRZ, RZ, AMI, Manchester), sketch the waveforms for Line codes, determine the bandwidths of various Line codes.
Experiment No 6	Generate the input bit sequence, sketch the waveform and Verify the Baseband receiver performance in presence of Noise using suitable hardware setup/kit.
Experiment No 7	Draw a block diagram of BFSK transmitter and receiver. Sketch the input bit sequence, carrier signal, ASK1, ASK2, BFSK waveforms and spectral diagrams. Calculate Bandwidth of FSK practically using suitable hardware setup/kit.
Experiment No 8	Draw a block diagram of DSSS transmitter and receiver. Perform the experiment to Generate and sketch the waveforms for PN CODE and DSSS using hardware setup/kit.

Group B (Microcontroller and Application) (Any 6)

Experiment No 9	LED Blinking – The “Hello World” of Microcontrollers

	Skills: Basic GPIO control. Connect an LED to ESP32 and make it blink every second. Modify the blink rate by changing the delay in the code.
Experiment No 10	Push Button Control – Turning LED ON/OFF Skills: Digital input handling Connect a push button and LED. Pressing the button toggles the LED state (ON → OFF → ON).
Experiment No 11	Serial Monitor & Debugging – Print Messages Skills: Serial communication, debugging basics. Print "Hello, ESP32!" on the Serial Monitor. Modify the code to print button press status in real-time.
Experiment No 12	Potentiometer & Analog Input (ADC) – Read & Display Values Skills: Basic analog input handling. Read voltage values from a potentiometer. Display the values on the Serial Monitor.
Experiment No 13	Buzzer Beep – Sound Alerts Skills: Digital output control. Connect a buzzer and make it beep every 2 seconds. Modify the beep pattern for a short or long alert.
Experiment No 14	PWM – LED Brightness Control Skills: Pulse Width Modulation (PWM). Use PWM to adjust LED brightness gradually. Modify the brightness using a potentiometer**.**
Experiment No 15	Temperature Sensor (DHT11) – Read & Display Temperature Skills: Basic sensor interfacing. Connect a DHT11 sensor to ESP32. Read and display temperature & humidity on the Serial Monitor.
Experiment No 16	Timer Interrupt – Blinking LED Without Delay. Skills: Event-driven programming. Blink an LED using hardware timers instead of delay (). Adjust the timing interval and observe the behavior.
Relevant MOOCs Course (Course name and Weblink)	
https://onlinecourses.nptel.ac.in/noc25_ee68/preview (principal of communication system) https://onlinecourses.nptel.ac.in/noc25_ee69/preview (digital communication system) NPTEL: Electronics & Communication Engineering - Microcontrollers and Applications Microprocessors And Microcontrollers - Course	

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5403109]: Object Oriented Programming (OOP)

Semester	Credits	Teaching Scheme	Examination Scheme
3	3	L: 3 Hrs./ Week	ISE: 20 Marks CIE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Fundamentals of programming language C, C++.
- Basic understanding of OOP features

Course Objectives: The objective of this course is to provide students with

- To lay the foundation for fundamentals of Java language.
- To define class and object in object-oriented programming and to implement various concepts such as constructors, destructors, operator overloading, friend functions using JAVA language.
- To state principles of OOP in JAVA such as encapsulation, data hiding, inheritance, polymorphism, interface, and packages,
- To describe the concept of collection framework and exception handling in JAVA.

Course Outcomes: After completing this course, students will be able to

CO1: Explain various features of JAVA and JAVA programming structure. **Elaborate** fundamental concepts of JAVA including tokens, data types, variables & typecasting of variables, statements, and expressions, classes, objects, methods, access specifier, keywords, constructor.

CO2: Define abstract method and classes, string classes and wrapper classes. **Implement** method and constructor overloading, inheritance using classes and code reusability using packages.

CO3: Implement multiple inheritance using interface and code reusability using packages.

CO4: Demonstrate exception handling in Java using try, catch, and finally blocks to ensure robust and error-free program execution. **Explain** the concepts and usage of the Collection Framework for efficient data storage, retrieval, and manipulation using various collection classes and interfaces.

COURSE CONTENTS

Module-I	Introduction to JAVA Programming	07 Hrs.

Fundamentals: - Java features, JDK, JRE, JVM, overview of Java language, simple Java program, Java program structure. Installing and configuring Java. Java tokens, Java statements, constants, concepts of variables, data types, operators. Arrays, statements and expressions, mathematical functions. Access specifiers, class and object, functions, constructor and its type, final, static, and this keywords, garbage collection, and finalize method.

Module-II	Implementation of OOP Concepts	07 Hrs.

Method and Classes: - Classes and Objects, OOP principles, Encapsulation, Abstraction, Inheritance and Polymorphism, Static variables and methods, reference variables and methods. Polymorphism: - Introduction, types of polymorphism, function and constructor overloading. Object as superclass: Object class methods, importance and implementation of toString() , equals(), hashCode() methods, Immutability of objects Wrapper classes:- Byte, Double, Float, Integer, Long, Short, Autoboxing and unboxing

Fundamental Classes: String, StringBuilder, Objects, Arrays, Math Inheritance: - Types of inheritance, method overriding, dynamic method dispatch.		
Module-III	**Interface and Packages**	**07 Hrs.**
Multiple Inheritance: - Interface, abstract method implementation, default and static method in interface, functional interface. Common interfaces: Comparable, Comparator, Iterable, Iterator, Runnable Packages: - Definition, types of packages, creation of package, accessing of package element		
Module-IV	**Exception Handling and Collection Framework**	**07 Hrs.**
Exception Handling: Exception hierarchy, Errors, Checked and un-checked exceptions. Exception propagation, try-catch-finallyblock, throws clause and throw keyword, multiple catch statements. Creating user defined checked and unchecked exceptions. Java Collection Framework: Introduction to JAVA Collection Framework and their use Commonly used collections with implementations: List (ArrayList, LinkedList), Set (HashSet, LinkedHashSet, TreeSet), Map (HashMap, LinkedHashMap, TreeMap), Concept of hashing.		
Text Books:		
T1. E Balagurusamy, "Programming with JAVA", Tata McGraw Hill, 6th Edition.		
T2. Herbert Schildt, "Java: The complete reference", Tata McGraw Hill, 7th Edition.		
Reference Books:		
R1. T. Budd, "Understanding OOP with Java", Pearson Education, 2nd Updated Edition.		
R2. Y. Daniel Liang (2010), "Introduction to Java programming", Pearson Education, India, 7th Edition.		
Relevant MOOCs Course (Course name and Weblink)		
JAVA Programming http://nptel.ac.in/courses/106103115/36 NPTEL Course "Programming in Java" https://nptel.ac.in/courses/106/105/106105191/ Object Oriented Programming with JAVA http://www.nptelvideos.com/video.php?id=1472		
Relevant Topics for Self-study:		
1) Special Traversing Technique: - for each loop 2) Modified Switch case 3) Introduction to generics, Generic classes, Generic methods 4) JAVA 8 Features 5)Annotations		

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5403210]: Object Oriented Programming Lab (OOPL)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	P: 2 Hrs./ Week	ESE (P): 25 Marks CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of
- Fundamentals of programming and logic building skills.

Course Objectives: The objective of this course is to provide students with
- To understand how to write down the JAVA programming and execution of JAVA program with the help of JDK, JRE, and JVM
- To implement the concept of OOP features in JAVA
- To understand how to execute exception handling and collection framework using JAVA

Course Outcomes: After completing this course, students will be able to
CO1: Apply fundamental constructs of JAVA programming to perform the mathematical operations.
CO2: Create a string in different styles and **implement** multiple operations on string using JAVA programming.
CO3: Employ the concept of inheritance and interface using JAVA programming.
CO4: **Demonstrate** concept of exception handling, and collection framework operations using JAVA programming.

COURSE CONTENTS

Expt. No.	Problem Statement	Hrs.	CO
1.	Implement a calculator with simple arithmetic operations such as add, subtract, multiply, divide, factorial etc. using switch case and other JAVA concepts like class, object, method and constructor	4	CO1
2.	Write a Java Program to create and sort arrays of Integers and Strings (Ascending/Descending)	2	CO1
3.	Write a JAVA program that performs the following operations on a given string: • Count the number of vowels and consonants. • Replace all spaces with a specific character (e.g., _). • Convert the string to uppercase and lowercase using String. Reverse the string using StringBuffer or StringBuilder.	2	CO2
4.	Demonstrate the concept of inheritance for an e-commerce system for product management ➢ Create a base class Product with attributes productID, name, and price. ➢ Create subclasses Electronics, Clothing, and Groceries. • Electronics should include an attribute warrantyPeriod. • Clothing should include an attribute size. • Groceries should include an attribute expiryDate. Implement an applyDiscount() method in the base class and override it in each subclass to apply category-specific discounts.	2	CO3

5.	Build multiple inheritance by implementing interface features for following online payment system . ➢ Create an interface CardPayment with methods processCardPayment() and refundCardPayment(). ➢ Create another interface UPIPayment with methods processUPIPayment() and refundUPIPayment(). ➢ Create a class PaymentGateway that implements both interfaces to support multiple payment methods. Demonstrate the working of the payment gateway by calling methods from both interfaces.	**2**	CO3
6.	Implement exception handling for a user login system with username and password validation. ➢ Throw a custom exception InvalidCredentialsException if the username or password is incorrect. ➢ Handle NullPointerException if either the username or password is null. Catch and log any other generic exceptions for debugging purposes.	**2**	CO4
7.	Build a product inventory system for a store using ArrayList. ➢ Each product should have a name, ID, and price. ➢ Implement features to add new products, update prices, and remove products. Sort products by price or name using a custom comparator.	**2**	CO4
8.	Develop a program to manage employee records using HashMap. ➢ Use the employee ID as the key and the employee name as the value. ➢ Perform operations like adding, updating, deleting, and searching employees. Display all employees in alphabetical order of their names.	**2**	CO4

Text Books:	
T1.	Herbert Schildt, "Java The Complete Reference", TMH, 7th edition.
T2.	E Balagurusamy, "Programming with JAVA", Tata McGraw Hill, 6th edition.
Reference Books:	
R1.	T. Budd, "Understanding OOP with Java", Pearson Education, 2nd updated edition.
R2.	Y.Daniel Liang, "Introduction to Java Programming", Pearson, 7th edition
Relevant MOOCs Course	
JAVA Programming http://nptel.ac.in/courses/106103115/36 Object Oriented Programming with JAVA http://www.nptelvideos.com/video.php?id=1472	
Relevant Topic for Self-study:	
Study of database using JDBC and insert values and delete values into it.	

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Electronics and Computer Engineering (E&CE) [04051X2]: Multidisciplinary Minor (MDM-2)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**2**	**L: 2 Hrs./ Week**	**ISE: 20 Marks** **CIE: 20 Marks** **ESE: 60 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Electronics and Computer Engineering (E&CE) [04051X2]: Multidisciplinary Minor Lab (MDM-2)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**1**	**P: 2 Hrs./ Week**	**ESE (P): 25 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Electronics and Computer Engineering (E&CE) [04063XX]: Open Elective-II (OE-II)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**2**	**Tut.: 2 Hrs./ Week**	**ESE: 50 Marks**
Refer Annexure-II			

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&TCE)

[5407201]: Project Based Learning (PBL)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basics of electronics components, circuits, electrical and electronics circuit analysis.
- C/ C++/ object-oriented programming and other programming knowledge.

Course Objectives: The objective of this course is to provide students with

- The ability to solve real-world problems individually or in groups using available resources.
- Skills to develop applications by applying electronics and communication engineering concepts, integrating prior knowledge when necessary.
- Hands-on experience in all stages of electrical and electronic system development, including specification, design, implementation, and testing.

Course Outcomes: After studying this course students will be able to

CO1: Formulate and **present** a project idea based on interest, literature survey, recent trends and real-life problems**. Plan** project work in team.

CO2: Implement electronic hardware by learning PCB artwork design, soldering techniques, testing, and troubleshooting etc. **Identify** appropriate solution and implement it using electronic hardware/software principles. **Demonstrate** the use of modern tools for simulation and implementation of the system.

CO3: Prepare a technical report based on the mini project work. **Comprehend** and **write** a project report and **draw** conclusions at a technical level.

COURSE GUIDELINES

A. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch.
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task allocation for each week should be maintained in LOG book by each group.
- Hardware projects should be encouraged (80%) and some software projects may be allowed (20%).

B. Problem statement selections:

- Each course teacher will provide a list of problems statement in particular course studying in current year. These statements will be displayed prior to the commencement of semester.
- Students are instructed to choose one out of the provided statements. The statement will approve by course teachers on first come first serve basis.

OR

- A group of students will find THREE problem statements in any domain. Course teachers will approve one out of that depending on resources availability, and need of time. You may use following list to search appropriate project title.

- Professional society (IEEE, IET, ACM etc.) Journal, Conference/transaction papers.
- Electronics project or design magazine (E4U, ED, ESD etc.)
- Component manufactures web sites (on semi, national semiconductors)
- Data sheets/ application notes/ data manuals by electronics component manufacturers.
- Design tutorials by electronics manufacturer.
- Appendix, exercise section of reference books listed in the syllabus.
- Recent trends in electronics.
- Manufacturer challenges/ competition.
- Carry out survey to solve problem by electronic means.
- Robotics/ Robocon and other professional society requirements.
- Extension to the old projects.
- Social, live, sponsored, consultancy projects, inter-disciplinary may be encouraged.

C. Evaluation Method:

- The project Seminar-I (Introductory seminar) and Seminar-II (Completion seminar) are compulsory.
- Course teacher will prepare rubrics for the assessment and share the same with students at the commencement of semester.
- Week wise assessment is considered under the head continuous internal evaluation (CIE).

D. Week wise Assessment schedule:

Week Scheduled	Task to be performed
Week-1	a. Formation of Group and b. Literature Survey, Finalizing the Specifications
Week-2	a. Finalization of project titles b. Seminar-I (Project Idea) Presentation
Week-3	a. Selection of Components/devices/ algorithms, Paper Design b. Block schematic and Circuit diagram/ flow charts
Week-4	a. Simulation of Different modules/ functions b. Component Purchasing, Breadboard testing/ PCB layout design. c. Algorithm, Flow Chart testing
Week-5	Programming, Assembling, Soldering and testing.
Week-6	a. Integrating modules in HW/SW b. Designing enclosures
Week-7	a. Testing and Troubleshooting of HW/SW b. Seminar –II (Project Work) Presentation
Week-8	a. Testing and Troubleshooting of HW/SW b. Seminar –II (Project Work) Presentation
Week-9	a. Project Demonstration b. Project report preparation
Week-10	a. Project Exhibition b. Final report submission

Note: Students are instructed to adhere to the schedule strictly to smooth conduction of course.

Reference Books:

R1. Larmer, J., Mergendoller, J. R., & Boss, S., *Setting the Standard for Project Based Learning*, ASCD, 2015.

R2.	Larmer, J., & Boss, S., *Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences*, ASCD, 2018.
R3.	Murphy, E. M., & Cooper, R., *Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry*, Times 10 Publications, 2017.
R4.	Krašna, M., *Project Based Learning (PBL) in the Teachers' Education*, 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), IEEE, pp. 852–856, 2016.
R5.	Macias-Guarasa, J., Montero, J. M., San-Segundo, R., Araujo, A., & Nieto-Taladriz, O., *A Project-Based Learning Approach to Design Electronic Systems Curricula*, IEEE Transactions on Education, Vol. 49, No. 3, pp. 389–397, 2006.
Relevant MOOCs Course (Course name and Weblink)	
SWYAM: Problem Based learning, by Dr. Indrajit Saha, National Institute of Technical Teachers Training and Research, Kolkata Link: https://onlinecourses.swayam2.ac.in/ntr20_ed12/preview.	

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[5409102]: Integrated System Project Management (ISPM)

Semester	Credits	Teaching Scheme	Examination Scheme
4	2	L: 2 Hrs./ Week	CIE (TW): 50 Marks

Prerequisite: Students should have prior knowledge of

- Principles of Management Course

Course Objectives: The objective of this course is to provide students with

- Fundamental concepts of project management and financial planning.
- An understanding of management evolution, principles, and strategic planning.
- Key aspects of forecasting, project estimation, and risk assessment.
- Enhanced decision-making abilities and organizational effectiveness.

Course Outcomes: After completing this course, students will be able to

CO1: Describe fundamental management principles and project management concepts, and **analyze** their applications in real-world scenarios.

CO2: Explain financial planning, risk assessment, and decision-making processes, and **evaluate** their effectiveness in project execution.

CO3: Apply basic management and project planning techniques to solve engineering and business-related problems, and **create** structured project plans for practical implementation.

COURSE CONTENTS

Module-I	Management and Project Fundamentals	5 Hrs.

- **Management Principles**: Definition, Nature, Scope, Characteristics, Functions, Roles, and Skills of an Effective Manager.
- **Evolution of Management**: Classical Theory, Scientific Management, Bureaucracy, Behavioral Science Approach, Systems Approach.
- **Project Management**: Introduction to Project Management, Project Life Cycle, Organization Strategy, and Project Selection.
- **Organizational Structure**: Project Management Organization Structure, Work Breakdown Structure (WBS).

Module-II	Planning, Forecasting, and Risk Management	5 Hrs.

- **Planning**: Types of Plans, Planning Process, Strategic Management, Environmental Appraisal, Industry Analysis.
- **Forecasting**: Components of Business Forecasting, Benefits, Techniques, and Limitations.
- **Project Estimation**: Time & Cost Estimation, Network Analysis using PERT/CPM, Resource Levelling, Scheduling.
- **Project Risk Management**: Risk Identification, Quantification, Mitigation, and Capital Project Risk Assessment.

Module-III	Financial and Objective Management	5 Hrs.

- **Decision-Making**: Decision-making Process, Group Decision-making, Problem-solving.
- **Management by Objectives (MBO)**: Concepts, Characteristics, Goal Setting, Action Plan.

- **Financial Management**: Profit Maximization, Wealth Maximization, Investment, Financing, and Dividend Decisions.
- **Investment Decisions**: Cost of Capital, Payback Period, Net Present Value, Internal Rate of Return, Profitability Index.

Module-IV	**Communication and Project Appraisal**	**5 Hrs.**

- **Communication**: Importance, Process, Barriers, Tone, Language, Role of Perception and Culture in Communication.
- **Project Appraisal**: Market, Technical, and Financial Feasibility.
- **Project Financing**: Capital Structure, Sources of Finance, Term Loans, Debentures, Public Issues.

Text Books:

T1:	Robbins, S. P., & Decenzo, D. A., *Fundamentals of Management*, 9th Edition, Pearson Education, 2016.
T2:	Koontz, H., O'Donnell, & Weihrich, H., *Essentials of Management*, 9th Edition, Tata McGraw Hill, 2012.
T3:	Chandra, P., *Projects: Planning, Analysis, Selection, Implementation & Review*, Tata McGraw Hill Publishing Co, 2014.
T4:	Gray, C. F., Larson, E. W., & Joshi, R., *Project Management – The Managerial Process*, 8th Edition, McGraw Hill Education, 2020.
T5:	Gido, J., & Clements, J. P., *Successful Project Management*, 6th Edition, Cengage Learning, 2014.
T6:	Chandra, P., *Financial Management*, Tata McGraw Hill Publishers, 2014.

Reference Books:

R1:	Nicholas, J. M., *Project Management for Business and Technology – Principles and Practice*, Prentice-Hall of India Ltd.
R2:	Pinto, J. K., *Project Management – Achieving Competitive Advantage*, 5th Edition, Pearson Publishing Ltd.
R3:	Khan, M. Y., & Jain, P. K., *Financial Management*, Tata McGraw Hill Publishers.
R4:	Daft, R. L., *Principles of Management*, Cengage Learning, 2009.
R5:	Tripathy, P. C., & Reddy, P. N., *Principles of Management*, Tata McGraw Hill, 1999.
R6:	Kreitner, R., & Mohapatra, M., *Management*, Biztantra, 2008.
R7:	*Management Fundamentals: Concepts, Applications, & Skill Development*, 6th Edition, Sage Publications, 2014.

Relevant MOOCs Course (Course name and Weblink)

1. Project Management: Planning, Execution, Evaluation and Control, By Prof. Sanjib Chowdhury, IIT Kharagpur
   Link: https://onlinecourses.nptel.ac.in/noc23_mg124/preview.
2. Introduction to Project Management: Principles & Practices, By Dr. Nimisha Singh, Quality Council of India
   Link: https://onlinecourses.swayam2.ac.in/imb25_mg80/preview.

Relevant Topics for Self-study:

Arbitration, Conflict Resolution and Project Management Tools

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0408203]: Collaborative Skills, Digital Ethics, and Cyber Security (CDC)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Course on Soft Skills (SS)

Course Objectives: The objective of this course is to provide students with

- Recognize the importance of team skills and develop strategies to acquire them.
- Effectively design, develop, and adapt to various situations both individually and as part of a team.

Course Outcomes: After completing this course, students will be able to

CO1: Empathize with and trust colleagues for improving interpersonal relations.

CO2: Demonstrate effective communication by respecting diversity and embracing good listening skills.

CO3: Distinguish the guiding principles for communication in a diverse, smaller, internal world.

CO4: Practice interpersonal skills for better social and professional relations with seniors, juniors, peers, and stakeholders.

COURSE CONTENTS

Expt. No.	Task to carry out	Hrs.	CO
1.	**Trust and Collaboration** Explain the Importance of Trust in Creating a Collaborative Team Agree to Disagree and Disagree to Agree – Spirit of Teamwork Understanding Fear of Being Judged and Strategies to Overcome Fear.	4	1
2.	**Listening as a Team Skill** Advantages of Effective Listening Listening as a Team Member and Team Leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no pre-think, use empathy, listen to tone and voice modulation, recapitulate points.).	2	2
3.	**Brainstorming** Brainstorming as a Technique to Promote Idea Generation a. Brainstorming: Meaning and the Process b. Procedure for Conducting Brainstorming c. Importance of Using Brainstorming Technique d. Types of Brainstorming	2	3
4.	Learning and Showcasing the Principles of Documentation of Team Session Outcomes.	2	3
5.	**Social and Cultural Etiquette** Need for Etiquette (impression, image, earn respect, appreciation) • Aspects of Social and Cultural/Corporate Etiquette in Promoting Teamwork • Importance of Time, Place, Propriety and Adaptability to Diverse Cultures	2	4

6.	**Digital Ethics** Digital Ethics i. Digital Literacy Skills, ii. Digital Etiquette, iii. Digital Life Skills	2	4
7.	**Cyber Security** The Art of Protecting Secrets a. Understanding Encryption and Decryption and Its Different Types b. Art of Data Masking c. Firewall and Its Proper Use in Cyber Protection	2	4

Text Books:

T1. Ratliff, J., *Leadership Through Trust & Collaboration: Practical Tools for Today's Results-Driven Leader*, Morgan James Publishing, 2020.

T2. Dauda, J., *Cybersecurity and Digital Ethics: Principles of Cybersecurity (Cybersecurity Practices, Technologies, and Processes), 2023*.

Reference Books:

R1. Kelly, T., & Kelly, D., *Creative Confidence: Unleashing the Creative Potential Within Us All*, Harper Collins Publishers India, New Delhi, 2014.

R2. Sweeney, S., *English for Business Communication*, Cambridge University Press, 2003.

R3. Kumar, S., & Lata, P., *Communication Skills*, Oxford University Press, 2015.

Students can avail additional resources to enhance soft skills further

1. SWAYAM Course: Leadership, by Prof. Kalyan Chakravarti and Prof. Tuheena Mukherjee, IIT Kharagpur Link: https://onlinecourses.nptel.ac.in/noc19_mg34/preview.
2. SWYAM course: Towards an Ethical Digital Society: From Theory to Practice, by Prof. Bidisha Chaudhuri, IIIT Bangalore
   Link: https://nptel.ac.in/course s/109106184
3. Global Business Foundation Skills (GBFS) – Refer websites like https://www. sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0411102]: Indian Constitution and Social Responsibility (ICSR)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	L: 1 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic Knowledge of Civics and Governance.
- Ethical Reasoning and Social Awareness, Communication and Critical Thinking Skills.

Course Objectives: The objective of this course is to provide students with

- An understanding of the principles of social responsibility, ethical citizenship, and the Indian Constitution.
- The ability to analyze the role of individuals and institutions in fostering responsible citizenship, democracy, and social change.
- Skills to evaluate ethical dilemmas and legal frameworks for making informed civic decisions.
- Opportunities to design initiatives that promote social responsibility and active community participation.

Course Outcomes: After completing this course, students will be able to

CO1: Explain fundamental concepts of social responsibility, civic engagement, and constitutional law.

CO2: Apply ethical and legal principles to address community and global issues.

CO3: Analyze the relationship between fundamental rights, duties, and governance in India.

CO4: Develop community-driven projects that contribute to sustainable development and civic well-being.

COURSE CONTENTS

Module-I	Introduction to Indian Constitution	4 Hrs.

- Historical Background and Evolution of the Indian Constitution
- Preamble and its significance
- Fundamental Rights and Duties
- Directive Principles of State Policy

Activities:

- **Debate:** Relevance of Fundamental Rights in Contemporary India
- **Case Study:** Landmark Supreme Court Judgments

Module-II	Government Structure & Electoral System	4 Hrs.

- Separation of Powers: Legislature, Executive, and Judiciary
- Parliamentary vs. Presidential System
- Supreme Court and High Court
- Federalism: Centre-State Relations
- Election Commission and Electoral Reforms (Antidefection law)

Activities:

- **Mock Parliament Session**

- **Discussion:** Impact of Electoral Reforms on Indian Democracy. Role of executives.

Module-III	Social Responsibility & Citizenship	4 Hrs.

- Definitions of Social Responsibility and Citizenship
- Ethics and Moral Duties in Society
- Individual vs. Collective Responsibility
- Case Studies: Impactful Citizens and Social Movements

Activities:

- **Group Discussion:** What does responsible citizenship mean to you?
- **Reflection Assignment:** Personal Social Responsibility

Module-IV	Civic Engagement & Sustainable Development	4 Hrs.

- Forms of Civic Engagement (Volunteering, Advocacy, Social Activism)
- Role of NGOs, Government, and Private Sectors
- Sustainable Development Goals (SDGs)
- Corporate Social Responsibility (CSR)

Activities:

- **Role-Playing Exercise:** Simulating a Town Hall Meeting
- **Local Community Service Initiative**

Reference Books:

R1:	Sen, Amartya. *The Idea of Justice*, Discusses fairness and ethics in society, 2009.
R2:	D.D. Basu, *Introduction to the Constitution of India*, LexisNexis, Latest Edition.
R3:	Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press.
R4:	Rawls, John. *A Theory of Justice*– Covers principles of justice and democracy, 1971.
R5:	United Nations Sustainable Development Goals (SDGs) – Official UN resources on social responsibility.
R6:	Sachs, Jeffrey. *The Age of Sustainable Development*– Insights into global responsibility, 2015.

Relevant Online Courses (Course name and Weblink)

1. **Harvard University (edX): "Justice" by Michael Sandel** – Ethics & civic responsibility.
2. **Coursera (University of London): "Global Diplomacy – The United Nations in the World"** – Understanding international citizenship.
3. **Future Learn: "Social Responsibility and Sustainable Development"** – Corporate & personal social responsibility.
4. **Khan Academy: "Civics & Government"** – Basic concepts of democracy and civic engagement.

Relevant Topics for Self-study:

1. NPTEL course: Corporate Social Responsibility, by Prof. Aradhna Malik, IIT Kharagpur
   This course introduces participants to the field of Corporate Social Responsibility (CSR), covering its history, planning, implementation, evaluation, and future directions.
   Link: Corporate Social Responsibility
2. NPTEL course: Community Engagement and Social Responsibility, by Prof. Akshay Kumar Satsangi, Dayalbagh Educational Institute, Agra
   This course emphasizes the importance of community development through self-help groups, health and well-being, literacy, employment, and the role of social networking in bridging government schemes and the people of India.
   Link: Community Engagement and Social Responsibility.

3. NPTEL course: Constitutional Government & Democracy in India, by Prof. Amitabha Ray, St. Xavier's College (Autonomous), Kolkata
   This course acquaints students with the constitutional design of state structures and institutions, and their actual working overtime. It traces the embodiment of conflicting impulses within the constitution and encourages a study of state institutions in their mutual interaction and with the larger extra-constitutional environment.
   Link: SWAYAM: Constitutional Government & Democracy in India
4. NPTEL course: Constitution Law and Public Administration in India, By Prof. Sairam Bhat, National Law School of India University
   This course explores the intricacies of constitutional law and public administration in India, providing insights into the legal frameworks and administrative structures that govern the country.
   Link: NPTEL: Constitution Law and Public Administration in India

Any special topics of interest:
Constitutional Bodies, Competitive examinations: UPSC, MPSC, IES.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[04 13201]: Community Engagement Project (CEP)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of social and ethical responsibilities.
- Teamwork and communication skills acquired in prior coursework or group activities.
- Familiarity with problem-solving methodologies and project planning.

Course Objectives: The objective of this course is to provide students with

- Opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
- An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
- The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
- The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

Course Outcomes: After completing this course, students will be able to

CO1: Identify and Analyze community needs and challenges by engaging with stakeholders and evaluating real-world problems. *(Remembering & analyzing)*

CO2: Design and Implement practical, creative, and context-specific solutions using engineering principles to address community issues. *(Creating & applying)*

CO3: Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations. *(Evaluating & Understanding)*

COURSE GUIDELINES

G. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

H. Project Scope:

The CEP should focus on addressing a specific community or societal issue. Projects may fall under the following themes:

6. **Education and Awareness:**
   - Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
7. **Technology for Social Good:**
   - Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
8. **Environmental Sustainability:**

- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.

9. **Health and Wellness:**

- Promote health through awareness programs on hygiene, nutrition, and exercise.

10. **Skill Development:**

- Teach basic computer or technical skills to students, staff, or the community.

I. Step-by-Step Execution Plan:

1. Planning Phase:

- **Team Formation:**

Form teams of 3-4 students with a balance of skills and interests.

- **Project Selection:**

Choose a project theme and define a clear objective that aligns with community needs.

- **Proposal Submission:**
  - Submit a one-page project proposal outlining:
  - Title of the project.
  - Objective and expected outcome.
  - Plan of execution (timeline and activities).
  - Required resources (if any).
  - Get approval from the designated faculty mentor.

2. Execution Phase:

- **Phase 1 Activities**
  - Conduct initial outreach and engage with the community or target participants.
  - Implement planned activities with close teamwork and documentation.
- **Phase Activities**
  - Continue engagement and collect feedback from the participants.
  - Begin summarizing the outcomes of the project.
- **Best Practices:**
  - Maintain a positive attitude and open communication with the community.
  - Respect cultural norms and values of the participants.
  - Adapt your plan based on real-time needs or challenges.

3. Reporting Phase:

- **Documentation:**
  - Create a detailed report containing
  - Title, objective, and scope of the project.
  - Activities conducted and timeline.
  - Outcomes and community feedback.
  - Photos/videos of the activities (if permitted).
  - Challenges faced and how they were addressed.
- **Presentation:**
  - Each team will present their project to a panel of faculty members or peers, showcasing their efforts and outcomes.
  - Duration of presentation: 5-7 minutes per team.

J. Evaluation Criteria:

Projects will be evaluated based on:

6. **Relevance:** How well the project aligns with community needs.
7. **Impact:** The tangible and intangible benefits delivered to the community.
8. **Innovation:** Creativity in the approach or solution provided.
9. **Teamwork:** Collaboration and effective delegation within the group.
10. **Documentation & Presentation:** Clarity, depth, and overall delivery of the report and presentation.

K. Guidelines for Conduct:

4. **Behavior:** Students should display professionalism, punctuality, and respect.
5. **Safety:** Follow all safety protocols during on-campus or fieldwork activities.
6. **Feedback:** Collect feedback from participants to measure the success and identify areas for improvement.

L. Support and Supervision:

3. Faculty mentors will be assigned to each group to guide them throughout the project.
4. A resource or helpdesk will be available for logistical or technical support.

Reference Books:

R1. Dostilio, L. D., et al. *The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education*. Stylus Publishing, 2017. A practical guide for community engagement projects, including tools and strategies for effective implementation and assessment.

R2. Waterman, A. *Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects*. Routledge, 1997. Insights into service-learning methodology, planning, and assessment techniques for impactful projects.

R3. Beckman, M., and Long, J. F. *Community-Based Research: Teaching for Community Impact*. Stylus Publishing, 2016. Approaches for conducting research and engagement projects collaboratively with communities.

R4. IDEO.org. *Design Thinking for Social Innovation*. IDEO Press, 2015. Explains how to apply design thinking to solve social problems, ideal for projects focusing on community engagement.

R5. Sherrod, L. R., Torney-Purta, J., and Flanagan, C. A. (Eds.). *Handbook of Research on Civic Engagement in Youth*. Wiley, 2010. A detailed guide on youth involvement in civic and community projects, with case studies and strategies for engagement.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. UNESCO: Education for Sustainable Development

- Website: https://www.unesco.org
- Focus: Resources and case studies related to sustainability and community engagement.

W2. EPICS (Engineering Projects in Community Service)

- Website: https://engineering.purdue.edu/EPICS
- Focus: Offers methodologies and tools for engineering students to work on real-world projects benefiting communities.

W3. Ashoka: Innovators for the Public

- Website: https://www.ashoka.org

- Focus: Information on social entrepreneurship and community innovation projects.

W4. Design for Change

- Website: https://www.dfcworld.com
- Focus: Templates, toolkits, and project ideas for implementing impactful community-based projects.

For Evaluation and Impact Assessment:

W5. Community Tool Box (University of Kansas)

- Website: https://ctb.ku.edu
- Focus: Comprehensive resources for community engagement, project evaluation, and measuring outcomes.

W6. UN SDG (Sustainable Development Goals) Knowledge Platform

- Website: https://sdgs.un.org/
- Focus: Guidance on aligning community engagement projects with UN Sustainable Development Goals (SDGs).

W7. Campus Compact

- **Website: https://www.compact.org/**
- **Focus: Resources on civic and community engagement for students and educators, with a focus on project assessment.**

W8. BetterEvaluation

- Website: https://www.betterevaluation.org
- Focus: Tools and frameworks to evaluate the impact of community projects effectively.

W9. lan-Do-Check-Act Cycle (PDCA) – Deming Institute

- Website: https://deming.org/explore/pdsa
- Focus: Step-by-step guides for planning, implementing, and refining community projects.

Relevant MOOCs Course (Course name and Weblink)

4. NPTEL course: Ecology and Society, by Prof. Ngamjahao Kipgen, IIT Guwahati
   This course delves into the dynamic relationships between human cultures and their ecological environments, focusing on human-environment interactions and sustainable development.
   Link: https://onlinecourses.nptel.ac.in/noc20_hs77/preview.
5. NPTEL course: Basics of Health Promotion and Education Intervention, by Dr. Arista Lahiri, Dr. Sweety Suman Jha (IIT Kharagpur), Dr. Madhumita Dobe, Dr. Chandrashekhar Taklikar (AIIH&PH, Kolkata)
   This course provides a comprehensive understanding of health promotion and education interventions, covering planning, implementation, and evaluation strategies.
   Link: https://onlinecourses.nptel.ac.in/noc22_ge18/preview
6. NPTEL course: A Hybrid Course on Water Quality – An Approach to People's Water Data, by IIT Madras
   This hybrid course emphasizes practical fieldwork, including water sample collection and analysis, engaging with communities to assess water quality.
   Link: https://elearn.nptel.ac.in/shop/iit-workshops/completed/a-hybrid-course-on-water-quality-an-approach-to-peoples-water-data/?v=c86ee0d9d7ed

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0413202]: Field Project (FP)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- Hands-on, real-world experience in applying engineering concepts through practical problem-solving and teamwork.
- The ability to analyze real-world field situations by identifying key challenges and requirements.
- The skills to apply engineering knowledge, tools, and techniques to develop effective solutions.
- The capability to critically evaluate their fieldwork outcomes in terms of impact, feasibility, and sustainability.

Course Outcomes: After completing this course, students will be able to

CO1: Assess field conditions and identify problems through observation and interaction with stakeholders.
CO2: Develop and **execute** a practical, field-based solution or prototype aligned with the identified needs.
CO3: Reflect on and evaluate the project outcomes in terms of their technical, social, and ethical impact.

COURSE GUIDELINES

C. Group Formation:

- Form a group of 3-4 students that share a similar interest in each batch, Duration: 24 hours (divided into manageable sessions or shifts).
- The group should be cohesive, sharing and caring, contribute to the task assigned.
- The task carried out need to be maintained in LOG book by each group.

D. Field Project Execution Guidelines

5. **Team Formation and Topic Selection:**
    - Students form groups of 3-4.
    - Select a project aligned with an engineering problem or theme, such as:
        - Environmental monitoring and solutions.
        - Designing small-scale engineering systems.
        - Infrastructure or community development.
        - Renewable energy solutions.
6. **Proposal Submission:**
    - Prepare a proposal that includes:
        - Project title and objectives.
        - Problem statement and proposed solution.
        - Field location and timeline.
        - Required resources.
    - Obtain faculty mentor approval.
7. **Fieldwork:**
    - Conduct site visits, data collection, and stakeholder interactions.
    - Design or develop the solution based on field observations.

- Ensure proper documentation of all activities.

8. **Reporting and Presentation:**
   - Prepare a detailed report with:
     - Objectives, methodology, and field observations.
     - Design, implementation, and results.
     - Challenges faced and lessons learned.
   - Present the report and findings to faculty and peers.

Reference Books:

R1. Walesh, S. G. *Engineering Your Future: The Professional Practice of Engineering*. Cengage Learning, 2012. Real-world applications of engineering principles, teamwork, and ethical practices.

R2. Phillips, R., and Johns, J. *Fieldwork for Human Geography*. Sage Publications, 2012. Field research methodologies, data collection techniques, and stakeholder engagement.

R3. Oberlender, G. D. *Project Management for Engineering and Construction*. McGraw-Hill Education, 2014. Planning and managing projects with practical tools for engineers.

R4. Williams, D. E. *Sustainable Design: Ecology, Architecture, and Planning*. Wiley, 2007. Field-based solutions emphasizing sustainability and environmental impact.

R5. Martin, M. W., and Schinzinger, R. *Introduction to Engineering Ethics*. McGraw-Hill, 2005. Ethical considerations in fieldwork and engineering projects.

Websites and Online Resources:

For Planning and Conducting Projects:

W1. Engineering Projects in Community Service (EPICS)
- Website: https://engineering.purdue.edu/EPICS
- Focus: Resources for field-based projects benefiting communities.

W2. Community Tool Box
- Website: https://ctb.ku.edu
- Focus: Guidelines for project planning, stakeholder engagement, and evaluation.

W3. National Geographic Education – Fieldwork Resources
- Website: https://education.nationalgeographic.org/
- Focus: Tips for conducting fieldwork, documenting findings, and analyzing data.

W4. BetterEvaluation
- Website: https://www.betterevaluation.org
- Focus: Frameworks and tools for project evaluation and impact assessment.

W5. Design for Change (DFC)
- Website: https://www.dfcworld.com
- Focus: Step-by-step guidance for impactful, design-based field projects.

W6. PDCA (Plan-Do-Check-Act) Methodology
- Website: https://deming.org/explore/pdsa
- Focus: Tools for iterative project planning and improvement during field execution.

Relevant MOOCs Course (Course name and Weblink)

5. Project Management, by Prof. Ramesh Anbanandam, IIT Roorkee,
   Link: https://onlinecourses.nptel.ac.in/noc24_mg01/preview.
6. Project Planning & Control, by Prof. Koshy Varghese, IIT Madras,
   Link: https://onlinecourses.nptel.ac.in/noc19_ce30/preview.
7. Project Management: Planning, Execution, Evaluation and Control, by Prof. Sanjib Chowdhury, IIT Kharagpur.
8. Link: https://onlinecourses.nptel.ac.in/noc24_mg78/preview.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Electronics and Computer Engineering (E&CE)

[0413203]: Co-Curricular Activity (CCA)

Semester	Credits	Teaching Scheme	Examination Scheme
4	1	P: 2 Hrs./ Week	CIE (TW): 25 Marks

Prerequisite: Students should have prior knowledge of

- Basic understanding of core engineering concepts relevant to the chosen field of work.
- Knowledge of teamwork, communication, and project planning.
- Awareness of safety protocols and ethical considerations for fieldwork.

Course Objectives: The objective of this course is to provide students with

- An opportunity to acquire skills and competencies beyond the core curriculum.
- A foundation for holistic personality development.
- Preparation for future academic, professional, and personal growth.

Course Outcomes: After completing this course, students will be able to

CO1: Demonstrate the ability to lead and participate in teams.

CO2: Develop several important life skills such as leadership, organization, confidence time management, and socialization.

CO3: Improve self-confidence and decision-making abilities.

CO4: Experience the importance of community involvement.

COURSE GUIDELINES

As part of the implementation of autonomy with effective from Academic Year 2025-26 for the UG Co-curricular activities are included as credit courses in the curriculum. Accordingly, the number of credits is incorporated in curriculum structure.

BACKGROUND

SCTR's Pune Institute of Computer Technology believes in wholistic development of student catering to the requirements of engineering attributes (program outcomes) prescribed by Washington Accord and NBA through the implementation of Outcome Based Education. There is a limited scope of attaining all the program outcomes through classroom and laboratory teaching learning process. To expand the scope of learning to acquire all the attributes, PICT proposes to institutionalize and formalize the ongoing extra and co-curricular activities which are being carried out by students by awarding due credits and a certificate at the time of their graduation in addition to the University degree certificate. The purpose of Co and extracurricular activities is primarily the acquisition of skills and competencies in areas that are not directly part of the curriculum.

SCOPE

Co-curricular activity (CCA) is an activity, performed by students, that falls outside the realm of the regular academics of college or university education. Such activities are generally social, philanthropic, and often involve others of the same age. However, as part of autonomy and NEP 2020 guidelines some of the credits are included in the curriculum as mandatory for CCA. CCA includes but are not limited to Community Service Organizations (NCC, NSS), Cultural / Ethnic Organizations, Engineering Academic Honor Societies, Engineering Clubs/ Organizations, Orientation Programs, Health Related Organizations, Professional Engineering Societies – Student Chapters, Research(Voluntary Basis), Sports, educational

activities that include, seminars, workshops, project competitions, hackathons, debate competitions, and mathematics, robotics, and engineering teams and contests.

A student can earn one/two credits per year.

The activity hours accumulated throughout the year shall be calculated by the Co-Curricular Activity Committee (CCAC) to fix the number of credits to be granted to students at the end of the year. (Note: 30 hours =1credit)

MODE OF IMPLEMENTATION

12. A committee called Co-Curricular Activity Committee (CCAC) consisting of Dean Student Affairs and all the functional in charges of various activities shall facilitate the activities.

13. Identification and inclusion of Co-Curricular Activities to be considered for Credit System.

14. Mapping each activity to the program outcomes, design the assessment methodology.

15. Define the scope, methodology, number of hours required of each activity

16. Announcement of activity calendar

17. Registration and enrollment of interested students.

18. Allocation of faculty mentors to interested students based on the activity and expertise/interest.

19. Carry out the activities, submission of weekly report in the form of logbook.

20. Submission of detailed report in prescribed format mentioning all the activities carried out along with certificates, mementoes, photographs etc.

21. End-semester assessment and certificate of appropriate credits with the grade Outstanding, Excellent, Very Good, Good, Satisfactory etc.

22. Award of consolidated certificate at the time of graduation.

LIST OF VARIOUS CO-CURRICULAR ACTIVITIES

35. ADDICTION- Annual Social Gathering
36. Alumni Association
37. Art Circle
38. Astro Club
39. Automobile Club
40. AWS Cloud Club
41. Career Guidance Cell
42. Code Chef
43. CSI
44. Cyber Security Club
45. Debate Society DEBSOC
46. Defense Aspirant Club
47. Entrepreneurship Development Cell
48. Ethicraft Club
49. Finance club (PFISOC)
50. FOSS Club
51. Game Development Club (Game Utopia)
52. IEEE (PISB)
53. IEEE APS
54. Impetus & Concepts (INC)
55. Model United Nations (MUN)
56. National Service Scheme (NSS)
57. PICTOREAL
58. ROBOCON
59. Smart India Hackathon (SIH)
60. Social media Cell
61. Sports
62. Startup and Innovation Cell
63. Student Welfare & Discipline
64. TechFiesta (PICT International Hackathon)
65. ACM (PASC)
66. TEDx PICT
67. Training and Placement
68. Universal Human Values (UHV)

Annexures

Annexure-I

Structure of Multi-Disciplinary Minor Courses

The structure for the multidisciplinary Minor courses is as follows.

			Teaching Scheme (Hours/Week)				Credits				Examination Scheme and Marks						
Sem	**Course code**	**Name of Course**	**L**	**P**	**T**	**Total**	**L**	**P**	**T**	**Total credits**	**Theory**			**Practical**			**Semester**
											CIE	**ISE**	**ESE**	**CIE**	**ESE**		**Total**
											[20]	**[20]**	**[60]**	**TW**	**P**	**OR**	**550**
3	**03051X1**	MDM-1	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
3	**03052X1**	MDM-1 #	-	2	-	**2**	-	1	-	**1**	-	-	-	-	-	25	**25**
4	**04051X2**	MDM-2	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
4	**04052X2**	MDM-2 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
5	**05051X3**	MDM-3	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
5	**05052X3**	MDM-3 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
6	**06051X4**	MDM-4	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
6	**06052X4**	MDM-4 #	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
8	**08053X5**	MDM-5	-	-	2	**2**	-	-	2	**2**	-	-	-	50	-	-	**50**
		Total	**8**	**8**	**2**	**18**	**8**	**4**	**2**	**14**	**80**	**80**	**240**	**125**	**0**	**25**	**550**

Note: In course code X is basket number. #: is laboratory or tutorial as per course requirements.

1. Students are expected to choose one of the eligible domains of MDM at the beginning of the Semester III.
2. Students will complete the chosen set of all multidisciplinary minor courses mentioned under the chosen MDM domain.
3. Students are not permitted to change from one domain to another.
4. Refer to the last column of following table for eligibility to choose a particular MDM domain.

Lis of Multi-Disciplinary Minor Domains

Label	Multi-Disciplinary Minor Domains	SY		TY		B-Tech	Offered to students of B Tech Program
		MD1-1	MD2-2	MD3-3	MD4-4	MD5-5	
		Sem-III	Sem-IV	Sem-V	Sem-VI	Sem-VII/VIII	
MD1	**Smart and Sustainable Systems (SSS)**	Fundamentals of Smart and Sustainable Systems (FSSS) & Tut	IoT for Smart and Sustainable Systems (ISSS) & Lab	Data Analytics for Smart and Sustainable Systems (DASSS) & Lab	Security for Smart and Sustainable Systems (SSS&S) Smart and Sustainable System Development (SSD) Lab	Smart and Sustainable System Development (SSD)	**ALL**
MD2	**Finance and Management (F&M)**	Fundamentals of Financial Engineering (FFE) & Tut	Banking, Financial Services and Insurance (BFSI) &Tut	Fundamentals of Stock Market (FSM) &Tut	Fintech: Foundations & Applications (FFA) &Tut	Financial Derivatives & Risk Management (FDRM)	**ALL**
MD3	**3D- Printing (3DP)**	3D modeling and Design (3MD) & Lab	Fundamentals of Additive Manufacturing (FAM)& Lab	3D Printing Materials and Processes (3DPMP)	Industry 4.0 and Digital Manufacturing (IDM)	Applied 3D Printing and Prototyping Lab (A3DPPL)	**ALL**
MD4	**Electric Vehicles (EV)**	EV foundation – Principles and Concepts (EVPC) & Lab	Advanced Motor Technologies and Power Electronics for EV(AMT) & Lab	EV Powertrain Dynamics and Control System (PDC) Tut/Lab	Intelligent EV Systems: AI IoT and Automation (IEV)	Capstone Project in Electric Mobility	**ALL**
MD5	**Applied Mathematics for Engineering (AME)**	Linear Algebra with Python & Lab	Statistical Techniques and Numerical Methods with R & Lab	Fuzzy Logic and Graph Theory with Matlab/Python & Lab	Optimization Techniques & Lab	Field Study/Case Study	**ALL**
MD6	**Software Development (SD)**	Data Structures and Algorithms (DSA) & Lab	Object Oriented Programming (OOP) &Lab	Database and Management Systems (DBMS) & Lab	Web Development (WD) & Lab	System Programming and Operating System (SPOS)	**Only E&TCE**
MD7	**Autonomous and Intelligent Systems (AIS)**	Digital Systems and Organization (DSO) & Lab	Smart System Engineering (SSE) & Lab	Embedded IoT Systems (EIS) & Lab	Autonomous Systems (AS) & Lab	Cyber Physical Systems: Screen Mode (CPS) / Capstone Project	**All except E&TCE**
MD8	**Embedded Systems (ES)**	Fundamental of Microcontroller (FM) & Lab	Embedded Processors –I (EP -I) & Lab	Microcontrollers and IoT (MI) & Lab	Embedded Systems and RTOS (ES-RTOS) & Lab	Capstone Project using Microcontrollers lab (CPML)	**All Except E&TCE**
MD9	**AI & Machine Learning (AI-ML)**	Statistical Data Analysis & Lab	Machine Learning (ML) & Lab	Natural Language Processing (NLP) & Lab	Artificial Intelligence (AI) & Lab	Deep Learning (DL)	**Only E&CE**

Link: **Detailed Syllabus**

Annexure -II

Guidelines for Open elective Courses

1. Open Elective – I will be offered in third semester as foreign language as prescribed in the structure.
2. Open Electives – II, III, IV will be offered through SWAYAM/NPTEL MOOCs of Equivalent Credits.
3. Departments shall prepare the baskets of open elective courses from discipline/faculty other than respective major programs. Students may choose any course from the basket without adhering to any one stream.
4. Credits & Grade will be awarded based on the Marks Obtained through the certification including assignments and proctored examination as per the MOOCs Policy.

			Teaching Scheme (Hours/Week)				Credits				Examination Scheme and Marks						
Sem	Course code	Name of the Course	L	P	T	Total	L	P	T	Total	Theory			Practical			Total
											CIE [20]	ISE [20]	ESE [60]	CIE TW	ESE P	ESE OR	
3	OE-I	Foreign Language Studies (FLS)	-	-	2	2	-	-	2	2	-	-	-	50	-	-	50
4	OE-II	MOOCs	-	-	2	2	-	-	2	2			50	-	-	-	50
5	OE-III	MOOCs	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50
6	OE-IV	MOOCs	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50

Guidelines for MOOCs

1. The department shall release a list of approved SWAYAM-NPTEL courses before the commencement of every semester.
2. Students shall register for the approved Courses as per the schedule announced by SWAYAM-NPTEL.
3. A student shall undergo the courses only from the list notified by the department through SWAYAM/NPTEL platform and complete all the assignments and examination requirements as specified by SWAYAM/NPTEL.
4. SWAYAM-NPTEL Courses are considered for transfer of credits only if the student concerned has successfully completed and obtained the SWAYAM-NPTEL Certificate.
5. The credit equivalence for SWAYAM-NPTEL Courses: 12 weeks – 3credits; 8 weeks – 2 credits; 4 weeks – 1 credit.
6. Equivalent marks will be considered for awarding the grades as specified in examination rules and regulations. The weightage for assignments is 40%, while the weightage for the proctored examination will be 60% for award calculating SGPA/CGPA. Students must score a minimum of 40% of the total marks by combining both assignments and proctored examinations

7. A student must submit the original SWAYAM-NPTEL Course Certificates to the Head of the Department concerned, with a written request for the transfer of the equivalent credits. On verification of the SWAYAM-NPTEL Course Certificates and approval by the head of the department, credits will be awarded.
8. The Institute shall not reimburse any fees/expenses a student may incur for the SWAYAM-NPTEL Courses.
9. If the SWAYAM/NPTEL course calendar does not align with the institute's calendar, the department shall facilitate and conduct examination of the relevant course of equivalent credits in physical/virtual mode and award the credits accordingly.

Detailed Syllabus for Foreign Language Studies

Choose any one course from the following courses and report that to department

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Common to all

[0306301]: Foreign Language Studies - German (FLSG)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	T: 2 Hrs./ Week	CIE: 50 Marks

Prerequisite: Nil

Course Objectives: The objective of this course is to provide students with

- Ccommunicate about everyday topics in German.
- Learn basic German grammar rules.
- Build a practical German vocabulary.
- Gain awareness of German culture.

Course Outcomes: After completing this course, students will be able to

CO1: Introduce themselves and others in German.
CO2: Describe daily life and their surroundings
CO3: Discuss time, jobs, and health in German.
CO4: Plan leisure activities and travel in German

COURSE CONTENTS

Module-I	Introduction, Personal Information, and Basic Grammar	6 Hrs.

Themes:

- Introducing oneself and others
- Hobbies
- Days of the week, months, seasons

Grammar:

- W questions
- Personal pronouns
- Simple sentences
- Verb conjugation
- Articles (definite and indefinite)
- Plurals
- Verbs "to have" and "to be"

Module Content:

- Introduction to German greetings and how to introduce oneself.
- Practicing conjugation of common verbs.
- Learning W-questions and using personal pronouns in conversation.
- Discussing hobbies and daily routines.
- Days of the week, months, and seasons in German.
- Building simple sentences using the conjugated verb forms and personal pronouns.

- Grammar practice: Definite and indefinite articles, plural forms.
- Introducing the verbs “haben” (to have) and “sein” (to be) with conjugation practice.

Activities:

- **Role-play:** Students practice introducing themselves, asking and answering W-questions.
- **Group discussion:** Students talk about their hobbies, days of the week, and favorite months/seasons using the vocabulary they learned.
- **Grammar Quiz:** Personal pronouns, articles, and verb conjugations.

Module-II	City Life, Directions, and Food	6 Hrs.

Themes:

- In the city (naming places, buildings, means of transport, basic directions)
- Food, drink, family, groceries, meals

Grammar:

- Articles and plural forms
- Negation (kein, nicht)
- Imperative forms

Module Content:

- Vocabulary related to city life: buildings, streets, means of transport.
- Giving and asking for directions.
- Learning the imperative mood for giving directions and requests.
- Vocabulary related to food, meals, and drinks.
- Talking about family and daily meal routines.
- Grammar: Using “kein” and “nicht” to form negations.
- Practice with the accusative case.

Activities:

- **City tour role-play:** Students practice asking for and giving directions.
- **Group activity:** Create a menu with German food items, then role-play ordering food.
- **Grammar exercise:** Negation using "kein" and "nicht."

Module-III	Everyday Life, Time, Professions, and Health	6 Hrs.

Themes:

- Everyday life, telling time, making appointments
- Professions
- Health and the body

Grammar:

- Prepositions: “am,” “um,” “von…bis”
- Modal verbs
- Possessive articles
- Perfect tense

Module Content:

- Telling time and scheduling appointments.
- Using prepositions (am, um, von…bis) in sentences.
- Practice with modal verbs for expressing necessity or ability.
- Talking about professions and workplace vocabulary.
- Discussing health, body parts, and feelings.

- Practice using the perfect tense for past actions.

Activities:

- **Time-based role-play:** Scheduling appointments and practicing telling time.
- **Profession Bingo:** Students match professions with corresponding vocabulary.
- **Health questionnaire:** Ask classmates about their health using body-related vocabulary and modal verbs.

Module-IV	Leisure, Travel	6 Hrs.

Themes:

- Leisure activities and celebrations
- Travel, holiday plans, weather

Grammar:

- Separable verbs
- Accusative case (continued)
- Imperative and modal verbs (review)

Module Content:

- Discussing hobbies, leisure activities, and holiday celebrations.
- Using separable verbs in the context of free time.
- Grammar review: Imperative mood, modal verbs.
- Talking about holiday plans, travel vocabulary, and discussing weather.
- Review of key grammar concepts throughout the course.

Activities:

- **Group activity:** Plan a holiday trip in German, using travel-related vocabulary and separable verbs.
- **Weather forecast role-play:** Students practice talking about the weather and making holiday plans.
- **Final review quiz:** Comprehensive review of grammar topics such as accusative, modal verbs, perfect tense, and imperative.

Reference Books:

R1: Goyal, M. *Netzwerk: Deutsch als Fremdsprache A1*. Goyal Publishers, 2015.

R2: Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)

Relevant Online Courses (Course name and Weblink)

1. NPTEL Course: German - I By Prof. Milind Brahme, IIT Madras, NPTEL
   Link: https://onlinecourses.nptel.ac.in/noc21_hs30/preview
2. PICT - Powerlingo Foreign Languages Institute
   Link: https://pict.edu/pict/
3. **FACTS ABOUT GERMANY:**
   Link: https://www.tatsachen-ueber-deutschland.de/en
4. **ONLINE GERMAN-ENGLISH DICTIONARY:**
   Link: http://www.leo.org/

Second Year B. Tech (S. Y B. Tech) AY (2025-26)

Common to all

[0306302]: Foreign Language Studies - Japanese (FLSJ)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	T: 2 Hrs./ Week	ISE: NA Marks CIE: 50 Marks ESE: NA Marks

Prerequisite: Nil

Course Objectives: The objective of this course is to provide students with

- Enable students to communicate in basic Japanese about themselves and everyday topics.
- Develop an understanding of fundamental Japanese grammar, including particles and basic verb forms.
- Build a vocabulary related to daily life, city environments, food, leisure, and travel.
- Introduce students to aspects of Japanese culture and customs.

Course Outcomes: After completing this course, students will be able to

CO1: Introduce themselves and others, and talk about their hobbies in Japanese.

CO2: Describe places in the city, give directions, and order food in Japanese.

CO3: Discuss daily routines, professions, and basic health in Japanese.

CO4: Talk about their leisure activities and travel plans in Japanese.

COURSE CONTENTS

Module-I	Introduction, Personal Information, and Basic Grammar	6 Hrs.

Themes:

- Introduction to Japanese scripts (Hiragana, Katakana)
- Introducing oneself and others (name, nationality, etc.)
- Hobbies

Grammar:

- Basic sentence structure (Subject-Object-Verb)
- Particles: wa (は), ga (が), mo (も)
- Pronouns: watashi (私), anata (あなた)
- Counters (basic introduction)

Module Content:

- Introduction to Hiragana and Katakana, basic stroke order and pronunciation.
- Greetings and introductions: Hajimemashite, Yoroshiku onegaishimasu.
- Using particles to indicate the topic and subject of a sentence.
- Talking about hobbies using simple sentence structures.
- Counting simple objects (using basic counters).

Activities:

- **Writing practice:** Hiragana and Katakana characters.
- **Role-play:** Introducing oneself to a classmate and asking about hobbies.

- Counting objects in the classroom (e.g., pencils, books).

Module-II	City Life, Directions, and Food	6 Hrs.

Themes:

- Places in the city (train station, school, supermarket, etc.)
- Asking for and giving directions
- Food and drinks

Grammar:

- Locational particles: ni (に), e (へ)
- Directional words: migi (右), hidari (左), mae (前), ushiro (後ろ)
- Verb arimasu/imasu (あります/います)

Module Content:

- Vocabulary for common places in a city.
- Giving and understanding basic directions using landmarks.
- Talking about food and drinks, ordering in a restaurant.
- Using arimasu/imasu to indicate the existence of things/people.

Activities:

- **City map activity:** Pointing out places and giving directions.
- **Restaurant role-play:** Ordering food and drinks.
- Describing the contents of a room using arimasu/imasu.

Module-III	Everyday Life, Time, Professions, and Health	6 Hrs.

Themes:

- Daily routines
- Telling time and making appointments
- Professions
- Basic health vocabulary

Grammar:

- Time expressions: ji (時), fun (分), gozen (午前), gogo (午後)
- Verb conjugation (present and past tense)
- Particles kara (から) and made (まで) to indicate time duration

Module Content:

- Describing daily routines using time expressions and verbs.
- Asking about and stating professions.
- Basic vocabulary related to health and common ailments.
- Making simple appointments.

Activities:

- **Daily routine presentation:** Describing one's daily schedule.
- **Role-play:** Making an appointment with a doctor.
- **Profession guessing game.**

Module-IV	Leisure, Travel	6 Hrs.

Themes:

- Hobbies and leisure activities
- Travel and holiday plans

- Weather

Grammar:

- ~tai desu (～たいです) to express desires
- Adjectives (review and expansion)
- Conditional form ~tara (～たら) for hypothetical situations

Module Content:

- Talking about hobbies and things you want to do.
- Describing travel plans and destinations.
- Talking about the weather.
- Using conditional sentences to express hypothetical travel scenarios.

Activities:

- **Holiday plan presentation:** Describing a dream vacation.
- **Role Play:** Weather forecast.
- **Sentence construction:** Expressing desires and hypothetical situations using ~tai desu and ~tara.

Reference Books:

R1: Yamamoto, N. *Shin Nihongo no Kiso I (Romanized Edition)*. Association for Overseas Technical Scholars (AOTS), 3A Corporation, June 1990.

R2: *Minna no Nihongo*. 3A Network, Goyal Publishers.

R3: Mizutani, Osamu, and Nobuko Mizutani. *Introduction to Modern Japanese*. Japan Times, November 1992.

R4: Nichimo, A. *250 Essential Kanji for Everyday Use*. 2nd rev. ed., Tuttle Publishing, January 2004.

R5: *Japanese for Busy People*. 3rd ed., Association for Japanese Language Teaching, Kodansha Tokyo, Kodansha International, November 2011.

Relevant Online Courses (Course name and Weblink)

1. NPTEL Course: Introduction to Japanese Language and Culture by Prof. Vatsala Misra, IIT Kanpur
   Link: https://onlinecourses.nptel.ac.in/noc19_hs52/preview
2. PICT - Powerlingo Foreign Languages Institute
   Link: https://pict.edu/pict/