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 Artificial Intelligence (AI) and Data Science

(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

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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
											CIE	ISE	ESE	CIE	ESE		
											[20]	[20]	[60]	TW	P	OR	
PCC	**4303101**	Discrete Mathematics (DM)	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
PCC	**4303102**	Data Structures (DS)	3	-	-	**3**	3	-	-	**3**	20	20	60	-	-	-	**100**
PCC	**4303103**	Artificial Intelligence (AI)	3	-	-	**3**	3	-	-	**3**	20	20	60	-	-	-	**100**
PCC	**4303204**	Data Structures Lab (DSL)	-	2	-	**2**	-	1	-	**1**	-	-	-	25	25	-	**50**
PCC	**4303205**	Artificial Intelligence & Data Science Lab (AIDSL)	-	4	-	**4**	-	2	-	**2**	-	-	-	50	50	-	**100**
MDM	**03051X1**	MDM-1	2	-	-	**2**	2	-	-	**2**	20	20	60	-	-	-	**100**
MDM	**03053X1**	MDM-1 #	-	-	1	**1**	-	-	1	**1**	-	-	-	25	-	-	**25**
OE	**0306301**	Open Elective-I: Foreign Language Studies (FLS)	-	-	2	**2**	-	-	2	**2**	-	-	-	50	-	-	**50**
AEC	**0308202**	Professional Development and Career Readiness (PDCR)	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
EEM	**4309101**	Management Information Systems (MIS)	2	-	-	**2**	2	-	-	**2**	-	-	-	50	-	-	**50**
VEC	**0311101**	Universal Human Values (UHV)	2	-	-	**2**	2	-	-	**2**	-	-	-	25	-	-	**25**
CEP	**03132XX**	Community Engagement project (CEP) /Field project (FP) /CCA **$**	-	2	-	**2**	-	1	-	**1**	-	-	-	25	-	-	**25**
		Total	**14**	**10**	**3**	**27**	**13**	**5**	**3**	**22**	**80**	**80**	**240**	**275**	**75**	**0**	**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	CIE [20]	ISE [20]	ESE [60]	CIE TW	ESE P	ESE OR	Total
PCC	4403106	Machine Learning (ML)	3	-	-	3	3	-	-	3	20	20	60	-	-	-	100
PCC	4403207	Database Management Systems (DBMS)	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
PCC	4403108	Operating Systems (OS)	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
PCC	4403109	Fundamentals of Computer Networks (FCN)	1	-	-	1	1	-	-	1	-	-	-	25		-	25
PCC	4403210	Laboratory Practice-1 (LP-1)	-	4	-	4	-	2	-	2	-	-	-	50	50	-	100
VSEC	4407203	Key Skill Enhancement Lab (KSEL)	-	4	-	4	-	2	-	2	-	-	-	50	-	-	50
MDM	04051X2	MDM-2	2	-	-	2	2	-	-	2	20	20	60	-	-	-	100
MDM	04053X2	MDM-2 #	-	-	1	1	-	-	1	1	-	-	-	25	-	-	25
OE	04063XX	Open Elective-II *	-	-	2	2	-	-	2	2	-	-	50	-	-	-	50
AEC	0408203	Collaborative Skills, Digital Ethics, and Cyber Security (CDC)	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
EEM	4409102	Project Management (PM)	2	-	-	2	2	-	-	2	-	-	-	25	-	-	25
VEC	0411103	Indian Constitution and Social Responsibility (ICSR)	1	-	-	1	1	-	-	1	-	-	-	25	-	-	25
CEP	04132XX	Community Engagement project (CEP) /Field project (FP) /CCA **$**	-	2	-	2	-	1	-	1	-	-	-	25	-	-	25
		Total	**13**	**14**	**2**	**29**	**13**	**7**	**2**	**22**	**80**	**80**	**290**	**250**	**50**	**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)
Artificial Intelligence (AI) and Data Science

[4303101]: Discrete Mathematics (DM)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	L: 2 Hrs./ Week	CIE: 20 Marks ISE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Basic Concepts of Mathematics

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

- Analyze and construct rigorous mathematical arguments using propositional logic, proof techniques (induction, contradiction), and axiomatic set theory to validate solutions in discrete structures
- Apply relations, functions, and combinatorial principles to model real-world computing problems such as network optimization, data compression, and algorithm efficiency
- Design algorithmic solutions for graph/tree-based problems (e.g., shortest paths, spanning trees) using methods like Dijkstra's, Prim's, and Kruskal's algorithms
- Evaluate algebraic structures (groups, rings, fields) for symmetry and error-correction properties, and apply coding theory to design polynomial codes
- Develop mathematical maturity by interpreting formal proofs, generating original results, and communicating solutions with precision

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

CO1: **Formulate** problems using set theory, propositional logic, and relations; apply formal proof techniques (mathematical induction) to validate solutions and explain reasoning clearly.

CO2: **Apply** combinatorial rules (permutations, combinations, binomial identities) and algorithmic generation methods to solve counting problems in computational and real-world contexts.

CO3: **Model** engineering problems (e.g., network routing, data compression) using graphs and trees; solve them via algorithms like Dijkstra's, Prim's, and Huffman coding.

CO4: **Analyze** algebraic structures (groups, rings, fields) and their properties; apply coding theory principles to error detection/correction.

COURSE CONTENTS

Module-I	Foundational Discrete Structures	08 Hrs.

Set Theory: Axiomatic vs. naïve set theory, set operations, cardinality, inclusion-exclusion principle, finite/infinite sets, countable/uncountable sets, power sets, and diagonalization arguments.

Logic: Propositional logic, equivalences, translating English sentences, proof techniques (mathematical induction, strong induction).

Relations: Properties, closures, equivalence relations, partial orderings, Hasse diagrams, lattices, partitions, transitive closure (Warshall's algorithm).

Functions: Injective/surjective/bijective functions, compositions, inverses, pigeonhole principle

Module-II	Combinatorial Principles	06 Hrs.
Basic counting rules (sum, product, subtraction), permutations/combinations, binomial coefficients, and identities, generalized permutations/combinations, algorithms for generating permutations, Recurrence relations, generating functions		
Module-III	**Graph Theory and Trees**	**06 Hrs.**
Graph Theory: Terminology, isomorphism, connectivity, Euler/Hamilton paths, planar graphs, graph coloring, shortest-path algorithms (Dijkstra's) Trees: Properties, traversals, Huffman coding, spanning trees (Prim's, Kruskal's), max-flow min-cut theorem		
Module-IV	**Algebraic Systems**	**06 Hrs.**
Groups, rings, fields, homomorphisms, normal subgroups, and congruence relations. Coding theory basics, polynomial rings, Galois theory (field/group theory)		
Text Books:		
T1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978-0-07-288008-3		
T2. C. L. Liu, "Elements of Discrete Mathematics", TMH, ISBN 10:0-07-066913-9.		
Reference Books:		
R1. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8.		
Relevant MOOCs Course (Course name and Weblink)		
• Discrete Mathematics: https://nptel.ac.in/courses/106106183 • Discrete Structures: https://nptel.ac.in/courses/106105192		
Relevant Topics for Self-study:		
Predicate Logic		

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science
[4303102]: Data Structures (DS)

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

Prerequisite: Students should have prior knowledge of

- Programming
- Problem Solving

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

- To understand the fundamentals of data structures, array operations, storage representations, and basic searching and sorting algorithms
- To learn linked lists, their dynamic memory management, and their operations, including different types of linked lists. Also, to understand stacks and queues, their abstract data types, and their applications
- To introduce trees, their terminology, representations, and traversals. To explore binary search trees (BST) and their operations. Also, to cover graphs, their storage representation, traversals, and minimum spanning tree algorithms
- To understand hashing concepts, hash functions, collision resolution strategies, and file handling concepts, including sequential and direct access file organizations

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

CO1: Demonstrate use of Array to store and process data and understand the computational efficiency of the principal algorithms for searching and sorting

CO2: Demonstrate use of Linked List to store and process data and apply principles of data structures-stack and queue to solve computational problems

CO3: Apply non-linear data structures-Trees and Graphs for solving problems of various domain.

CO4: Identify and **articulate** the complexity goals and benefits of a good hashing scheme and analyze the functionalities confined to secondary storage.

COURSE CONTENTS

Module-I	Fundamentals of Data Structures	09 Hrs.

Basics of Data Structures, Array Fundamentals: Array as an Abstract Data Type, Operations on Array, Merging of two arrays, Storage Representation and their Address Calculation: Row major and Column Major.

Searching and Sorting Operations Using Array; Search algorithms: linear search, sentinel search, binary search, Fibonacci search; Sorting algorithms: selection sort, bubble sort, insertion sort, Shell sort; divide and conquer, merge sort, quicksort

Module-II	Linear Data Structures	09 Hrs.

Linked List: Introduction, of Linked Lists, Realization of linked list using dynamic memory management, operations, Linked List as ADT, Types of Linked List: singly linked, linear and Circular Linked Lists, Doubly Linked List, Doubly Circular Linked List, Primitive Operations on Linked List

Stack: Basic concept, Abstract Data Type, Representation of Stacks Using Sequential Organization, Applications- Expression Evaluation and Conversion, Parenthesis Matching

Queue: Queue as Abstract Data Type, Representation of Queue using Sequential organization, Queue Operations, Variants of Queue

Module-III	**Non-Linear Data Structures**	**09 Hrs.**

Trees: basic terminology, representation using sequential and linked organization, Binary tree- properties, binary tree traversals (recursive and non-recursive), Binary Search Tree (BST), BST operations, threaded binary search tree- concepts, threading, insertion and deletion of nodes in inorder threaded binary search tree, in order traversal of in-order threaded binary search tree.

Graphs: Basic Concepts, Storage representation, Adjacency matrix, adjacency list, Traversals-depth first and breadth first, Minimum spanning Tree- Prims and Kruskal Algorithms, Dijkstra's Single source shortest path

Module-IV	**Hashing and File Handling**	**09 Hrs.**

Hashing: Concepts, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, closed addressing and separate chaining.

File Handling: concept, need, primitive operations. Sequential file organization- concept and primitive operations, Direct Access File- Concepts and Primitive operations

Text Books:

T1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786.

T2. M Folk, B Zoellick, G. Riccardi, "File Structures", Pearson Education", ISBN:81-7758-37-5.

T3. Peter Brass, "Advanced Data Structures", Cambridge University Press, ISBN: 978-1-107-43982-5

Reference Books:

R1. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0.

R2. Michael J Folk, "File Structures an Object-Oriented Approach with C++", Pearson Education, ISBN: 81-7758-373-5.

R3. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++", Second Edition, University Press, ISBN: 81-7371522 X.

Relevant MOOCs Course (Course name and Weblink)

- https://nptel.ac.in/courses/106/102/106102064/
- https://nptel.ac.in/courses/106/105/106105085
- https://nptel.ac.in/courses/106/106/106106127

Relevant Topics for Self-study:

Balanced Binary Search Trees

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science
[4303103]: Artificial Intelligence (AI)

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

Prerequisite: Students should have prior knowledge of

- Problem Solving

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

- To introduce basic concepts and techniques of Artificial Intelligence (AI).
- To apply informed search techniques for different applications.
- To learn various knowledge representation techniques and writing Prolog programs.
- To learn about the latest techniques for developing AI systems.

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

CO1: Identify problems that are amenable to solutions by specific AI methods.
CO2: State the utility of different types of AI agents.
CO3: Apply different informed search techniques for solving real world problems.
CO4: Use knowledge representation techniques for AI systems.

COURSE CONTENTS

Module-I	Problem Solving and Searching Techniques	09 Hrs.

Introduction to Artificial Intelligence, background and applications, Turing test, Weak AI, Strong AI, Narrow AI, Artificial General Intelligence, Super AI, rational agent approaches to AI, Introduction to intelligent agents, their structure, behavior and task environment. Problem Solving and Searching Techniques: Problem characteristics, production systems, control strategies, breadth-first search, depth-first search, hill climbing and its variations, heuristics search techniques: best-first search, A* algorithm, constraint satisfaction problem, means-end analysis, introduction to game playing, min-max and alpha-beta pruning algorithms.

Module-II	Knowledge Representation and Reasoning	09 Hrs.

Knowledge Representation: Introduction to Knowledge Representation, Knowledge agent, Predicate logic, WFF, Inference rule & theorem proving: forward chaining, backward chaining, resolution; Propositional knowledge, Boolean circuit agents. Rule Based Systems, Knowledge Reasoning: Forward reasoning: Conflict resolution, backward reasoning: Use of backtracking, Structured Knowledge Reasoning: Semantic Net - slots, inheritance, Frames- exceptions and defaults attached predicates, Conceptual Dependency formalism, Reasoning Under Uncertainty: Source of Uncertainty, Probabilistic Reasoning and Uncertainty; Probability theory; Bayes Theorem and Bayesian networks, Certainty Factor, Dempster-Shafer theory, Non Monotonic Reasoning, Truth maintenance Systems, Overview of Fuzzy Logic.

Module-III	Understanding Natural Languages and Game Theory	09 Hrs.

Components and steps of communication, the contrast between formal and natural languages in the context of grammar, Chomsky hierarchy of grammars, parsing, and semantics, Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented transition nets.

Game Playing: Overview and Examples.
Domain: Overview, Minmax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems.

Module-IV	**AI: The Present and The Future**	**09 Hrs.**

Symbolic AI, Data-driven AI and Machine Learning, Introduction to Machine Learning and Deep Learning based AI, some applications of symbolic and data driven AI, Interpretable and Explainable AI, Ethics of AI: benefits and risks of AI.

Text Books:

T1. Russell, Stuart, J. and Norvig, Peter, Artificial Intelligence - A Modern Approach, Pearson, 4th edition, 2020

T2. Bratko, Ivan, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 4th edition, 2012

Reference Books:

R1. Kaushik, Saroj, Artificial Intelligence, Cengage Learning India, 2011.

R2. Rich, Elaine and Knight, Kelvin, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2010

Relevant MOOCs Course (Course name and Weblink)

- https://nptel.ac.in/courses/106106226
- https://nptel.ac.in/courses/106106140
- https://nptel.ac.in/courses/106102220

Relevant Topics for Self-study:

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science
[4303204]: Data Structures Lab (DSL)

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

Prerequisite: Students should have prior knowledge of

- Programming
- Problem Solving

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

- To develop skills in applying data structures to solve engineering problems.
- To implement and analyze searching and sorting algorithms.
- To implement linear data structures such as stacks, queues, and linked lists, and their applications.
- To implement non-linear data structures such as trees and graphs, and their applications.
- To understand and implement hashing techniques.

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

CO1: Apply linear data structures like array, stacks, queues, and linked lists to solve real-world problems.
CO2: Implement various searching and sorting algorithms.
CO3: Apply non-linear data structures like trees and graphs to solve real-world problems.
CO4: Implement hashing techniques and collision resolution strategies.
CO5: Design and implement solutions for problems involving data storage and retrieval using appropriate data structures.

COURSE CONTENTS

Expt. No.	Problem Statement	Hrs.	CO
1.	Write a **Python** program for magic square. A magic square is an n*n matrix of integers such that the sum of each row, column, and diagonal is the same. The figure given below is an example of magic square for case n=5. In this example, the common sum is 65.	2	CO1
2.	Create a program that takes a sorted array and lets users choose between: Linear search (with sentinel) Binary search Fibonacci search Compare time complexities for datasets of size 100, 1000, 10k elements.	2	CO2
3.	Write a Python program to compute following computation on matrix: a) Addition of two matrices B) Subtraction of two matrices c) Multiplication of two matrices d) Transpose of a matrix	2	CO1
4.	Build a Music Playlist Manager using doubly circular linked list to: • Add/remove songs • Shuffle playlist (rearrange nodes randomly)	2	CO1

	• Loop through songs forward/backward. **OR** Write C++ program for storing binary number using doubly linked lists. Write functions a) To compute 1's and 2's complement b) Add two binary numbers		
5.	Develop a stack-based Multi-Bracket Validator tool to check nested brackets (), [], {}) in code/text files. *Extension: Highlight erroneous lines and suggest fixes.* **OR** Evaluate expressions like 3 4 + 5 * using a stack. Add an "undo" feature using a secondary stack.	2	CO1
6.	Queues are frequently used in computer programming, and a typical example is the creation of a job queue by an operating system. If the operating system does not use priorities, then the jobs are processed in the order they enter the system. Write C++ program for simulating job queue. Write functions to add job and delete job from queue. **OR** Implement a priority queue for Hospital Emergency Room where: • Critical patients jump the queue • Regular patients follow FIFO	2	CO1
7.	A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation. **OR** Create an inordered threaded binary search tree and perform inorder and preorder traversals on it without using stack/recursion. Analyze time complexity of the algorithm.	2	CO3
8.	Using adjacency lists, build a social network analyzer to: • Find mutual friends (common neighbors) • Identify influencers (nodes with highest degree) • Detect communities (connected components). **OR** You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.	2	CO3
9.	Build a Password Manager with Collision Handling: Create a hash table storing (website, password) pairs using: • Chaining (linked lists) • Linear Probing/ Double Hashing Compare collision rates for different hash functions.	2	CO4
10.	The department maintains student information. The file contains roll number, name, division and address. Allow users to add, delete information of student. Display information about a particular	2	CO5

	employee. If the record of student does not exist an appropriate message is displayed. If it is, then the system displays the student details. Use sequential file to main the data.		

Text Books:

T1. Horowitz, Sahani, Dinesh Mehata, "Fundamentals of Data Structures in C++", Galgotia Publisher, ISBN: 8175152788, 9788175152786.

T2. M Folk, B Zoellick, G. Riccardi, "File Structures", Pearson Education", ISBN:81-7758-37-5

Reference Books:

R1. A. Aho, J. Hopcroft, J. Ulman, "Data Structures and Algorithms", Pearson Education, 1998, ISBN-0-201-43578-0.

R2. Michael J Folk, "File Structures an Object Oriented Approach with C++", Pearson Education, ISBN: 81-7758-373-5.

Any Special Guidelines:

Additional problem statements may be provided to test the understanding of the students.

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[4303205]: Artificial Intelligence & Data Science Lab (AIDSL)

Semester	Credits	Teaching Scheme	Examination Scheme
3	2	P: 4 Hrs. / Week	CIE (TW): 50 Marks ESE (P): 50 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

- To develop real-world problem-solving ability by applying AI and DS based techniques.
- To enable the student to apply AI techniques in applications which involve perception, reasoning and planning.

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

CO1: **Evaluate and apply** core knowledge of AI on various real-world problems.
CO2: **Illustrate and demonstrate** AI tools for different dynamic applications.
CO3: **Apply** statistical methods to analyze and interpret data.
CO4: **Use** Python libraries such as NumPy, Pandas, Matplotlib, and Seaborn for data manipulation, analysis, and visualization.

COURSE CONTENTS

Expt. No.	Problem Statement	Hrs.	CO
1	Write a program for Water jug problem / Towers of Hanoi	2	CO1
2	Write a program to solve n-queens problem using Hill-climbing / simulated annealing / A* algorithm	2	CO1
3	Write a program for sorting using appropriate knowledge representation and reasoning techniques.	2	CO1
4	Write a program for the Information Retrieval System using appropriate NLP tools (such as NLTK, Open NLP, …) a. Text tokenization b. Count word frequency c. Remove stop words d. POS tagging	2	CO2
5	Write a program for the Tic-Tac-Toe game.	2	CO2
6	**Working with Numpy Arrays** Aim: Understand and manipulate numerical data using NumPy arrays Tasks: Create arrays, perform basic operations, and visualize data Tools: NumPy, Matplotlib	2	CO4
7	**Working with Pandas DataFrames** Aim: Learn data manipulation and analysis using Pandas Tasks: Create DataFrames, handle missing values, merge datasets Tools: Pandas, NumPy	2	CO4
8	**Basic Plots using Matplotlib** Aim: Visualize data using basic plots (line, bar, scatter) Tasks: Plot different types of data, customize plots	2	CO4

	Tools: Matplotlib		
9	**Frequency Distributions and Averages** Aim: Understand data distribution and central tendency measures Tasks: Calculate mean, median, mode; plot histograms Tools: Pandas, Matplotlib	2	CO3
10	**Variability and Normal Curves** Aim: Analyze data variability and normal distribution Tasks: Calculate variance, standard deviation; plot normal curves Tools: SciPy, Matplotlib	2	CO3
11	**Correlation and Scatter Plots** Aim: Visualize relationships between variables Tasks: Calculate correlation coefficient; plot scatter plots Tools: Pandas, Matplotlib	2	CO3
12	**Data Preprocessing and Feature Engineering** Aim: Learn data preprocessing techniques and feature engineering Tasks: Handle missing values, encode categorical variables Tools: Pandas, Scikit-learn	2	CO3
13	**Introduction to Time Series Analysis** Aim: Understand basic concepts of time series data analysis Tasks: Plot time series data; calculate moving averages Tools: Pandas, Matplotlib	2	CO3
14	Mini project	2	CO4

Text Books:

T1. Russell, Stuart, J. and Norvig, Peter, Artificial Intelligence - A Modern Approach, Pearson, 4th edition, 2020

T2. Bratko, Ivan, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 4th edition, 2012

Reference Books:

R1. Kaushik, Saroj, Artificial Intelligence, Cengage Learning India, 2011.

R2. Rich, Elaine and Knight, Kelvin, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2010

Relevant MOOCs Course (Course name and Weblink)

1. NPTEL Course "Data Science for Engineers"
   https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. SWAYAM Course "Python for Data Science"
   https://onlinecourses.nptel.ac.in/noc22_cs32/preview

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

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Artificial Intelligence (AI) and Data Science [03053X1]: Multidisciplinary Minor Tutorial (MDM-1)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
3	**1**	**Tut.: 1 Hrs./ Week**	**CIE (TW): 25 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Artificial Intelligence (AI) and Data Science [0306301]: Open Elective-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)
Artificial Intelligence (AI) and Data Science

[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)
Artificial Intelligence (AI) and Data Science

[4309101]: Management Information System (MIS)

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

Prerequisite: Students should have prior knowledge of

- General Management and Administration Knowledge

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

- An understanding of the concepts of Management Information Systems and Business Intelligence.
- The ability to recognize the need for information systems in today's global business environment, along with relevant tools and technologies.
- A comprehensive understanding of the concepts of decision support systems for business applications.
- Insights into artificial intelligence and data science as they relate to Management Information Systems.

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

CO1: Explain the concepts of Management Information System and Business intelligence for MIS.
CO2: Illustrate the need of information systems in global business and ethical issues
CO3: Illustrate the concepts of decision support systems for business applications
CO4: Integrate artificial intelligence and data science methodologies into Management Information Systems to solve complex business problems

COURSE CONTENT

Module-I	Management Information System and its Evolution	06 Hrs.

Management information system: Concept, MIS: Definition, Role of MIS, Impact of MIS, MIS & the User, Management as a Control System: The functions of Management, Managerial Roles, The Levels of Management[R3]. MIS: A Support to the Management, Management effectiveness and MIS, Organization as a System. Decision Making, Information, Knowledge and Business intelligence, Business intelligence for MTS.

Module-II	Organization, Management and Network Enterprise	06 Hrs.

Information systems in today's global business: The Role of information system, Perspective's on Information System. Global E-business and collaboration: Business Processes, Types of Information Systems. System for Collaboration and Team Work: Tools and technologies for collaboration and team work, E-mail and Instant Messaging, Social Networking, Virtual worlds, Internet based Collaboration Environments. Information system organization and strategy, Ethical and social issues

Module-III	Business Applications	06 Hrs.

Introduction to e-business systems: Functional Business systems, cross functional Enterprise systems. Customer Relationship Management: The Business focus, Enterprise Resource Planning: The business backbone, Supply chain Management: Business Network. Electronic Commerce Systems:

Fundamentals, e-commerce applications and issues. Decision su pport systems: Decision support in Business, DSS Components, Decision Supports Trends, OLTP, Data Mining for Decision Support, Knowledge Management System.		
Module-IV	**Artificial Intelligence & Data Science for MIS**	**06 Hrs.**
Business and AI, An overview of Artificial Intelligence, Neural Network, Fuzzy Logic System, Genetic Algorithms, Virtual Reality, Intelligent Agents, Expert Systems: Components, Applications, Developing Expert Systems, The Value of Expert Systems: Benefits & Limitations. MIS in Data Science: Transition into data science for a Business Intelligence (BI)/MIS professional: performing detective analytics and generate insights from reports, statistics to support your insights about reports, present your findings to the right group, explore an open-source tool to generate reports or to perform detective analysis, the model building/ predictive modeling steps, Methods to evaluate your model's performance.		
Textbooks:		
T1. Stephen P. Robbins, David A. Decenzo, 2016, Fundamentals of Management, Pearson Education, 9th Edition		
T2. Harold Koontz, O'Donnell and Heinz Weihrich, 2012. Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill		
T3. Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage. 2014		
Reference Books:		
R1. Richard L. Daft, Principles of Management, Cengage Learning. 2009		
R2. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999		
R3. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008		
Relevant MOOCs Course (Course name and Weblink)		
https://onlinecourses.swayam2.ac.in/ini24_mg01/preview : Banaras Hindu University https://onlinecourses.nptel.ac.in/noc22_mg104/preview : IIT Kharagpur https://archive.nptel.ac.in/courses/110/105/110105146/ : IIT Kharagpur		
Relevant Topics for Self-study:		
Career Related Options based on own choice		

Second Year
B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[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

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Artificial Intelligence (AI) and Data Science

[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

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Artificial Intelligence (AI) and Data Science

[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)
Artificial Intelligence (AI) and Data Science

[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)
Artificial Intelligence (AI) and Data Science

[4403106]: Machine Learning (ML)

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

Prerequisite: Students should have prior knowledge of

- Fundamentals of python, data analysis, inferential and descriptive statistics.

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

- Knowledge of key concepts of machine learning from a mathematically well motivated perspective.
- Familiarize the students with the two broad categories of machine learning algorithms supervised and unsupervised.

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

CO1: Explain the basics and mathematical concepts of Machine Learning.
CO2: Apply data exploratory analysis before applying machine learning.
CO3: Compare machine learning techniques.
CO4: Use Machine learning in real life applications.

COURSE CONTENTS

Module-I	Introduction to Machine Learning	09 Hrs.

Machine Learning Definition, Types of learning: Supervised learning, unsupervised learning, Reinforcement learning, Semi-supervised learning, Classification, Regression, and Clustering, Data: Data Vs Information Vs Knowledge, Training Data, Validation Data and Testing Data, Machine Learning Applications.

Performance Measures: Confusion Matrix, Classification Accuracy, Precision, Recall or Sensitivity, Support, F1 Score, AUC (Area Under ROC curve), Mean Absolute Error (MAE), Mean Square Error (MSE), R Squared (R2)

Module-II	Supervised Learning	09 Hrs.

Regression: Linear/Polynomial Regression, Regularization (Lasso/Ridge)
Classification: Logistic Regression, Decision Trees, Support Vector Machines (SVMs)
Model Evaluation: Cross-validation, ROC curves, and hyperparameter tuning basics

Module-III	Unsupervised Learning and Ensemble Methods	09 Hrs.

Clustering: K-Means, Hierarchical Clustering, DBSCAN
Dimensionality Reduction: t-SNE, advanced PCA applications
Ensemble Methods: Bagging (Random Forests), Boosting (AdaBoost, XGBoost)

Module-IV	Reinforcement Learning Fundamentals	09 Hrs.

Agent-Environment Interaction: States, actions, rewards, and policies
Markov Decision Processes: Transition probabilities, value functions, and Bellman equations
Exploration vs Exploitation: ε-greedy strategies and Thompson sampling

Key Algorithms: Q-Learning and Deep Q-Networks (DQN), Policy Gradient Methods (REINFORCE, Actor-Critic)
Proximal Policy Optimization (PPO)

Text Books:

T1.	Ethem Alpaydin, Introduction to Machine Learning, PHI 2nd Edition-2013
T2.	Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
T3.	Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012

Reference Books:

R1.	C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
R2.	Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

Relevant MOOCs Course (Course name and Weblink)

1. Introduction to Machine Learning: https://nptel.ac.in/courses/106/106/106106139/
2. Machine Learning: https://nptel.ac.in/courses/106/106/106106202/
3. Machine Learning for Science and Engineering applications:
4. https://nptel.ac.in/courses/106/106/106106198/
5. Introduction to Machine Learning: https://nptel.ac.in/courses/106/105/106105152/
6. Deep Learning (Part-I): https://nptel.ac.in/courses/106/106/106106184/
7. Deep Learning: https://onlinecourses.nptel.ac.in/noc19_cs54/preview
8. Naive Bayes from Scratch: https://courses.analyticsvidhya.com/courses/naive-bayes
9. Getting Started with Neural Networks: https://courses.analyticsvidhya.com/courses/getting-started-with-neural-networks
10. Machine Learning – Offered by Stanford Online - https://www.coursera.org/learn/machine-learning

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[4403207]: Database Management Systems (DBMS)

Semester	Credits	Teaching Scheme	Examination Scheme
4	2	L: 2 Hrs./ Week	CIE: 20 Marks ISE: 20 Marks ESE: 60 Marks

Prerequisite: Students should have prior knowledge of

- Data Structures
- Problem Solving

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

- To provide a comprehensive understanding of database management systems (DBMS) and data warehousing principles.
- To enable students to design, implement, and manage relational databases effectively.
- To equip students with the skills to model and design data warehouses for business intelligence and data analysis.
- To develop students' ability to query, transform, and analyze data using SQL.

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

CO1: Design and implement relational databases using the ER model and relational model.
CO2: Construct SQL queries to retrieve, manipulate, and analyze data.
CO3: Design and model data warehouses using dimensional modeling techniques.
CO4: Apply data transformation techniques for data cleaning, integration, and preparation.

COURSE CONTENTS

Module-I	Database Fundamentals	08 Hrs.

ER-Model: Entities, attributes, relationships, keys, cardinality constraints, participation constraints, ER diagrams.
Relational Model: Relations, attributes, tuples, domains, keys, relational schema, integrity constraints (primary key, foreign key, entity integrity, referential integrity).
Relational Algebra: Selection, projection, union, intersection, difference, Cartesian product, join (theta join, equijoin, natural join), division.
Data Types: Common data types (integer, float, string, date, boolean), considerations for choosing appropriate data types.
Data Normalization: Functional dependencies, Decomposition and Normalization (1NF, 2NF, 3NF, BCNF).

Module-II	Structured Query Language (SQL)	07 Hrs.

SQL Basics: Data definition language (DDL) statements (CREATE, ALTER, DROP), data manipulation language (DML) statements (SELECT, INSERT, UPDATE, DELETE), data control language (DCL) statements (GRANT, REVOKE).

SQL Queries: SELECT statement, WHERE clause, ORDER BY clause, GROUP BY clause, aggregate functions (COUNT, SUM, AVG, MIN, MAX), HAVING clause, joins (inner join, left join, right join, full outer join), subqueries, set operations (UNION, INTERSECT, EXCEPT).
Integrity Constraints in SQL: Implementing primary key, foreign key, and other constraints using SQL.
SQL Views: Creating and using views for data abstraction and security. File Structure (B and B+ trees)

Module-III	**Data Warehousing Modeling**	**05 Hrs.**

Data Warehouse Concepts: Definition, characteristics, benefits, data warehouse architecture.
Dimensional Modeling: Star schema, snowflake schema, fact tables, dimension tables, measures, dimensions, attributes.
Concept Hierarchies: Defining and implementing concept hierarchies for drill-down and roll-up analysis.
Measures: Types of measures (additive, semi-additive, non-additive), categorization of measures, computations on measures.
OLAP Operations: Roll-up, drill-down, slice, dice, pivot.

Module-IV	**Data Transformation and Warehousing Implementation**	**06 Hrs.**

Data Transformation: Data cleaning (handling missing values, outliers, inconsistencies), data integration (schema integration, entity resolution), data transformation functions (string manipulation, date/time conversion, numerical transformations).
Data Transformation Techniques: Normalization (min-max normalization, z-score normalization), discretization (equal-width binning, equal-frequency binning), sampling (random sampling, stratified sampling), compression (lossless compression, lossy compression).
ETL/ELT Concepts ETL compared to ELT
Data Warehouse Implementation: Data loading, indexing, query optimization, performance tuning.

Text Books:

T1. Connolly, T., & Begg, C. (2015). Database Systems: A Practical Approach to Design, Implementation, and Management (6th ed.). Pearson Education.

T2. Inmon, W. H. (2005). Building the Data Warehouse (4th ed.). John Wiley & Sons.

Reference Books:

R1. Date, C. J. (2003). An Introduction to Database Systems (8th ed.). Addison-Wesley.

R2. Kimball, R., & Ross, M. (2013). The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling (3rd ed.). John Wiley & Sons

Relevant MOOCs Course (Course name and Weblink)

- http://www.nptelvideos.com/lecture.php?id=6518

Relevant Topic for Self-study:

NoSQL, MongoDB

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[4403108]: Operating Systems (OS)

Semester	Credits	Teaching Scheme	Examination Scheme
4	2	L: 2 Hrs./ Week	CIE: 20 Marks ISE: 20 Marks ESE: 60 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 (e.g., C, Python, Java).
- **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	08 Hrs.

Basic Computer Organization and Architecture: Von 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.

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	06 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: OS 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.

T4. **"Modern Operating Systems"** by Andrew S. Tanenbaum.
(Comprehensive resource for OS design principles and various real-world OS like Unix/Linux)

Reference Books:

R1. "Computer Systems: A Programmer's Perspective" by Randal E. Bryant and David R. O'Halloran.

R2. "Operating Systems: Design and Implementation" by Andrew S. Tanenbaum and Herbert Bos.

Relevant MOOCs Course (Course name and Weblink)
• https://nptel.ac.in/courses/106105214 • https://nptel.ac.in/courses/106102132
Relevant Topic for Self-study:

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[4403109]: Fundamentals of Computer Networks (FCN)

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

Prerequisite: Students should have prior knowledge of

- Basic Computer Knowledge

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

- Understand the fundamental concepts of networking standards, protocols and technologies

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

CO1: Analyze network models, topologies, and protocols to design and troubleshoot computer networks, including error detection, flow control, and addressing schemes (IPv4/IPv6, sub-netting, NAT, CIDR).

CO2: Implement transport and application layer protocols (TCP, UDP, DNS, HTTP, FTP) while addressing congestion control, QoS, and network security considerations in client-server and hybrid architectures.

COURSE CONTENTS

Module-I	INTRODUCTION TO COMPUTER NETWORKS	04 Hrs.

Types of Networks: Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks,
Network Models: The OSI Reference Model, TCP/IP Model
Network Typologies, Network Devices
Network Architecture: Client Server, Peer to Peer, Hybrid

Module-II	DATA LINK LAYER	03 Hrs.

Error detection and correction, Parity Bits, Hamming Codes (11/12-bits) and CRC.
Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol.
WAN Connectivity: PPP and HDLC, MAC Sub layer

Module-III	NETWORK LAYER	03 Hrs.

IP Protocol: Classes of IP (Network addressing), IPv4, IPv6, Network Address Translation, Sub-netting, CIDR.
Network layer Protocols: ARP, RARP, ICMP, IGMP.

Module-IV	TRANSPORT & APPLICATION LAYER	05 Hrs.

Transport Layer: Process to Process Delivery, Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS)
Application Layer: Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, DHCP, SNMP.

Text Books:

T1. Fourauzan B.,"Data Communications and Networking",5th Edition,Tata McGraw Hill,Publications, ISBN:0–07 – 058408 – 7

T2.	Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson India, 2012.
Reference Books:	
R1.	Kurose, Ross, "Computer Networking a Top Down Approach Featuring the Internet", Pearson, ISBN-10: 0132856204
R2.	L. Peterson and B. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan-Kaufmann, 2012.
Relevant MOOCs Course (Course name and Weblink)	
• https://archive.nptel.ac.in/courses/106/105/106105183/	
Relevant Topic for Self-study:	

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[4403210]: Laboratory Practice-1 (LP-1)

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

Prerequisite: Students should have prior knowledge of

- Fundamentals of programming, python, exploratory analysis and logic building skills.

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

- A comprehensive understanding of classification and regression algorithms and their applications.
- Hands-on experience in implementing machine learning techniques

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

CO1: Apply machine learning algorithms

CO2: Design and implement relational databases using the ER model and relational model.

CO3: Implement SQL queries to create, populate, and query databases.

CO4: Design and implement a data warehouse using dimensional modeling.

COURSE CONTENTS

Expt. No.	Problem Statement	Hrs.	CO
	Machine Learning		
1.	Write a Python program to implement Simple and Multiple Linear Regression	**2**	CO1
2.	Write a Python program to implement Logistic Regression	**2**	CO1
3.	Implement Decision tree and Random Forest Algorithm.	**2**	CO1
4.	Write a program to implement K-Nearest Neighbors algorithm.	**2**	CO1
5.	Write a program to implement SVM classification.	**2**	CO1
6	Implement K-means clustering.	**2**	CO1
7.	Implement Reinforcement Learning Algorithm using Q-learning technique.	**2**	CO1
8.	Mini Project	**2**	CO1
	Database Management Systems		
1.	Library Database Design: Design an ER diagram for a library database system. The system should store information about books (title, ISBN, author, publication year, genre), patrons (patron ID, name, address, phone number), and borrowing records (borrow date, return date). Convert the ER diagram into a relational schema, specifying primary keys, foreign keys, and data types for each attribute.	**2**	CO2
2.	Relational Algebra Operations: Given the relational schema created in Problem 1, write relational algebra expressions to perform the following operations: • Find all patrons who have borrowed a book published after 2010.	**2**	CO2

	• List the titles of all books borrowed by a specific patron (given patron ID). Find the average number of books borrowed by each patron.		
3.	Online Store Database: Create SQL DDL statements to define the relational schema for an online store database. The database should include tables for customers, products, orders, and order items. Implement appropriate integrity constraints (primary keys, foreign keys, NOT NULL constraints).	**2**	CO2
4.	SQL Querying: Write SQL queries to perform the following operations on the online store database created in Problem 3: Retrieve the names and email addresses of all customers who have placed an order in the last month. Calculate the total revenue generated by each product category. Find the top 10 customers who have spent the most money on the store.	**2**	CO3
5.	SQL Views and Indexes: Create a view that combines customer and order information, showing the customer's name, order ID, and order date. Create indexes on frequently queried columns to improve query performance.	**2**	CO3
6.	Sales Data Warehouse Design: Design a star schema for a sales data warehouse. The fact table should store information about sales transactions (sales date, product ID, customer ID, quantity, sales amount). Identify appropriate dimensions (time, product, customer, location) and their attributes.	**2**	CO4
7.	Snowflake Schema Conversion: Convert the star schema designed in Problem 6 into a snowflake schema by normalizing one or more dimensions. Discuss the trade-offs between star and snowflake schemas in terms of query performance and data storage.	**2**	CO4
8.	OLAP Operations: Given the sales data warehouse designed in Problem 6, describe how you would perform the following OLAP operations: Roll-up: Aggregate sales data from daily to monthly or yearly levels. Drill-down: Examine sales data for a specific product category or customer segment. Slice and Dice: Filter sales data based on specific criteria (e.g., sales in a specific region during a specific time period).	**2**	CO4

Text Books:

T1. Tom.M.Mitchell, "Machine Learning", McGraw Hill International Edition, 2017

T2. C Bishop, "Pattern Recognition and Machine Learning ", Springer, 2006.

T3. Connolly, T., & Begg, C. (2015). Database Systems: A Practical Approach to Design, Implementation, and Management (6th ed.). Pearson Education.

T4. Inmon, W. H. (2005). Building the Data Warehouse (4th ed.). John Wiley & Sons.

Reference Books:

R1. Ian Goodfellow, Yoshua Bengio, AaronCourville, "Deep Learning", The MIT Press Cambridge, Massachusetts, London, England., 2016

R2.	Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.
R3.	Date, C. J. (2003). An Introduction to Database Systems (8th ed.). Addison-Wesley.
R4.	Kimball, R., & Ross, M. (2013). The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling (3rd ed.). John Wiley & Sons

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[4407203]: Key Skill Enhancement Lab (KSEL)

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

Prerequisite: Students should have prior knowledge of

- Basic of programming

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

- To provide hands-on experience in understanding and implementing core concepts of operating systems
- To develop proficiency in system-level programming and debugging techniques in a real-world operating system environment
- To develop proficiency in excel.

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

CO1: Analyze and implement operating system concepts using system-level programming techniques.

CO2: Develop competence in working with modern operating system environments like Linux/Unix for system-level programming.

CO3: Apply advanced Excel techniques on data.

CO4: Design and implement IoT applications using Arduino and sensors to control LEDs, process analog data, and communicate effectively with various devices.

COURSE CONTENTS

Expt. No.	Problem Statement	Hrs.	CO
	Operating System		
1.	**Linux System Calls and Process Management** Aim: To 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. **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. **Shell Development** Design a minimal shell that parses user commands, launches processes, and handles background/foreground execution	4	CO1
2.	**CPU Scheduling Algorithms**	4	CO1

	Aim: To implement and evaluate CPU scheduling algorithms for optimizing process execution. Description: **Algorithm Implementation** • First-Come-First-Serve (FCFS) • Shortest Job First (SJF) • Round Robin (RR) • Priority Scheduling **Performance Analysis** Calculate metrics like average waiting time, turnaround time, and CPU utilization for varying input cases. **Comparative Study** a) Generate a table comparing algorithm efficiency under different workloads (e.g., varying burst/arrival times)		
3.	**Memory Management Techniques** Aim: To simulate paging and segmentation for efficient memory allocation and fault handling. Description: **Paging** • Implement page table structures and simulate FIFO/LRU page replacement. • Trigger and resolve page faults dynamically. **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	2	CO2
4.	**IPC and Synchronization** Aim: To implement inter-process communication and synchronization to resolve concurrency issues. Description: **IPC Mechanisms** Create programs using pipes, shared memory, and message queues for data exchange. **Synchronization**	2	CO2

	Use semaphores or mutexes to solve the producer-consumer problem, avoiding race conditions. **Deadlock Analysis** Simulate deadlock scenarios and apply prevention/detection strategies (e.g., resource allocation graphs)		
	Advanced Excel		
5.	**Data Entry and Formatting** • Basic Data Entry and Formatting Aim: To develop foundational skills in entering data accurately and applying basic formatting techniques to enhance readability. • Sorting and Filtering Data Aim: To learn how to organize data effectively by sorting and filtering to extract relevant information from larger datasets. • Conditional Formatting Aim: To utilize conditional formatting techniques to visually highlight important data points based on specific criteria.	2	CO3
6.	**Data Analysis and Visualization** • Simple Formula Usage Aim: To understand and apply basic mathematical functions such as SUM, AVERAGE, and COUNT for performing essential calculations. • Creating Basic Charts Aim: To gain proficiency in visualizing data through simple chart types, enabling better interpretation of trends and comparisons. • Using Functions like IF and VLOOKUP Aim: To apply conditional logic with the IF function and perform lookups with VLOOKUP to retrieve data from specified ranges. • Generating PivotTables Aim: To master the creation of PivotTables for summarizing and analyzing large datasets dynamically. • Advanced Formulas (e.g., INDEX MATCH) Aim: To enhance data retrieval capabilities by learning advanced formulas like INDEX MATCH for more flexible lookups compared to VLOOKUP.	2	CO3
7.	**Automation and Advanced Techniques** • **Creating Interactive Dashboards** Aim: To design user-friendly dashboards that integrate various Excel features, allowing for interactive data exploration and visualization. • **Introduction to Macros**	2	CO3

	Aim: To introduce the basics of automation in Excel by recording macros, enabling users to streamline repetitive tasks efficiently.		
	IoT Basics		
8.	**Study** of Raspberry-Pi/ Beagle board/ Arduino and other microcontroller.	2	CO4
9.	**Basic LED Control & Digital Input/Output** • Conditional LED activation based on counter values (green <100, yellow 101–200, red >200) using if statements and digitalWrite(). • LED control via serial input (e.g., 'b' for blinking green, 'g' for solid green) using Serial.read() and digitalWrite()	2	CO4
10.	**Analog Sensor Integration & Data Processing** • RGB LED control via three potentiometers using analogRead() and PWM (analogWrite()). • Temperature sensor data logging to the serial monitor using analogRead() and serial output. • Temperature display in Fahrenheit with max/min tracking using map(), Serial.println(), and variables. • Real-time temperature graphing via the Arduino Serial Plotter.	2	CO4
11.	**Advanced Communication & Sensor Applications** • IR obstacle detection with LED alerts, involving sensor libraries and interrupt handling. • Bluetooth and Wi-Fi Control: LED control via Bluetooth and Wi-Fi modules (e.g., HC-05) and custom Android apps	2	CO4

Text Books:

T1. Mark G Sobell, A Practical Guide to Linux Commands, Editors and Shell Programming, Prentice Hall, 1st Edition, July 2005, ISBN: 0-13-147823-0

T2. Neil Mathew, Richard Stones, Beginning Linux Programming, Wiley Publishing, Inc., 3rd Edition, 2004, ISBN 0-471-21821-9

T3. Alan G. Smith, " Introduction to Arduino: A piece of cake"

Reference Books:

R1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, Inc., 1st Edition, 2007.ISBN-10: 0596009526 | ISBN-13: 978-0596009526

R2. Maurice J. Bach, "Design of UNIX Operating System", PHI

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Artificial Intelligence (AI) and Data Science [04051X2]: Multidisciplinary Minor (MDM-2)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**2**	**L: 2 Hrs./ Week**	**CIE: 20 Marks** **ISE: 20 Marks** **ESE: 60 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Artificial Intelligence (AI) and Data Science [04053X2]: Multidisciplinary Minor Tutorial (MDM-2)			
Semester	**Credits**	**Teaching Scheme**	**Examination Scheme**
4	**1**	**Tut.: 1 Hrs./ Week**	**CIE (TW): 25 Marks**
Refer Annexure-I			

Second Year B. Tech (S. Y B. Tech) AY (2025-26) Artificial Intelligence (AI) and Data Science [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)
Artificial Intelligence (AI) and Data Science

[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**	2	4

	Digital Ethics i. Digital Literacy Skills, ii. Digital Etiquette, iii. Digital Life Skills		
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)
Artificial Intelligence (AI) and Data Science

[4409102]: Project Management (PM)

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

Prerequisite: Students should have prior knowledge of

- Basic Management and Business Principles.

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

- An introduction to the core concepts and principles of project management, including stewardship, systems thinking, and adaptability.
- Understanding of the project lifecycle (initiation, planning, execution, monitoring, closing) and methodologies such as predictive, agile, and hybrid approaches.
- Ability to identify key stakeholders (e.g., sponsors, teams, clients) and their roles in project governance, decision-making, and value delivery.
- Framework for analyzing project constraints (scope, time, cost, quality, risk) and critical success factors such as clear goals, communication, and risk management

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

CO1: Define and explain fundamental project management terminology.
CO2: Analyze and apply different project management methodologies.
CO3: Identify and categorize project stakeholders.
CO4: Assess project constraints and **define** success criteria.

COURSE CONTENT

Module-I	Introduction to Project Management	06 Hrs.

Definition and characteristics of a project, Phases of project management (Initiation, Planning, Execution, Monitoring & Control, Closure), The role of a project manager and project stakeholders, Project constraints (scope, time, cost, quality, risk), Introduction to the triple constraint of project management.

Module-II	Project Planning and Scheduling	06 Hrs.

Importance of project planning,Work Breakdown Structure (WBS), Gantt charts, PERT charts, and Network diagrams, Resource allocation and levelling, Time and cost estimation techniques

Module-III	Project Risk Management	06 Hrs

Definition and types of project risks (technical, financial, operational), Risk management process (identification, assessment, response planning),Risk matrix and risk prioritization, Tools and techniques for managing project risks, Developing a risk management plan.

Module-IV	Project Monitoring, Control, and Closing	06 Hrs.

Importance of project monitoring and control, Earned Value Management (EVM) and Key Performance Indicators (KPIs), Managing project changes (change requests, scope creep),Techniques for closing a project successfully, Post-project evaluation and lessons learned

Textbooks:

T1. "Project Management: A Systems Approach to Planning, Scheduling, and

	Controlling" Harold Kerzner, Wiley
T2.	**"Project Management: The Managerial Process"** Erik W. Larson & Clifford F. Gray, McGraw-Hill
Reference Books:	
R1.	Program Management: A Planning Approach" - James P. Lewis
R2.	"Agile Project Management: Creating Innovative Products" - Jim Highsmith
Relevant MOOCs Course (Course name and Weblink)	
https://nptel.ac.in/courses/110107081	
Relevant Topics for Self-study:	

Second Year B. Tech (S. Y B. Tech) AY (2025-26)
Artificial Intelligence (AI) and Data Science

[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)
Artificial Intelligence (AI) and Data Science

[0413201]: 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)
Artificial Intelligence (AI) and Data Science

[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)
Artificial Intelligence (AI) and Data Science

[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**	**150**	**0**	**0**	**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.

List 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	ISE	ESE	CIE	ESE		
											[20]	[20]	[60]	TW	P	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/