SYLLABUS

(With effect from 2026 -27)

Bachelor Degree

In

Computer Science & Engineering

(Artificial Intelligence & Machine Learning)

III & IV Semester

Out Come Based Education

With

Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka

[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
Accredited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]

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VISION

"To develop skilled professionals in the field of Artificial Intelligence & Machine Learning contributing globally to the benefit of industry and society."

MISSION

- *To impart knowledge in cutting edge Artificial Intelligence technologies that meets industry standards.*
- *Tocollaborate with industry to uplift innovative research and development in Artificial Intelligence & Machine Learning and related domains to meet societal demands.*
- *To produce successful Computer Science and Engineering graduates with a specialization in Artificial Intelligence & Machine Learning with personal and professional responsibilities, and a commitment to lifelong learning.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

***P**rofessionalism*
***E**mpathy*
***S**ynergy*
***C**ommitment*
***E**thics*

Department of Computer Science and Engineering (AI & ML)

The Vision of the department is:

"To develop skilled professionals in the field of Artificial Intelligence & Machine Learning contributing globally to the benefit of industry and society".

The mission of the department is:

DM1: To impart knowledge in cutting edge Artificial Intelligence technologies that meets industry standards.

{Required to create professionally competent engineers}

DM2: To collaborate with industry to uplift innovative research and development in Artificial Intelligence & Machine Learning and related domains to meet societal demands.
{Required to create professionally competent engineers and socially responsible engineers}

DM3: To produce successful Computer Science and Engineering graduates with a specialization in Artificial Intelligence & Machine Learning with personal and professional responsibilities and a commitment to lifelong learning.
{Required to create professionally competent engineers}

Program Educational Objectives (PEOs)

PEO1: Graduates will have the ability to adapt, contribute and innovate new technologies and systems in the key domains of Artificial Intelligence and Machine Learning.

PEO2: Graduates will be able to pursue higher education in reputed institutions with AI Specialization.

PEO3: Graduates will have the ability to explore research areas and produce outstanding contribution in various areas of Artificial Intelligence and Machine Learning.

PEO4: Graduates will be ethically and socially responsible solution providers and entrepreneurs in the field of Computer Science and Engineering with AI/ML Specialization.

The National Board of Accreditation (NBA) has defined twelve Program Outcomes for Under Graduate (UG) engineering programs as listed below.

Program Outcomes (POs)

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

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

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

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

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

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

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

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

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

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

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

The Under Graduate (UG) of B.E Computer Science & Engineering Program has defined **Program Specific Outcomes (PSO**) which are listed below.

PSO1: Apply the knowledge of programming and designing algorithms to develop solutions for engineering problems pertaining to AI&M

PSO2: Analyse and develop models in Machine Learning, Deep Learning using knowledge of AI and modern tools.

B.E-P25 SCHEME- SECOND YEAR (THIRD SEMESTER) CREDITS & COMPONENTS

Sl. no	Category	Course Code	Course Title	Bos	Teaching & Learning in Hrs per week				Total no. of Hrs per Semester	Credits	Examination Marks and Duration				Total Marks CIE +SEE
					CI		LI	TW + SL			Max. Marks CIE	Duration CIE (hours)	Max. Marks SEE	Duration SEE (hours)	
					L	T	P	SL							
1.	BSC	P25MACS301	Probability and Statistics	Maths	2	2	-	5	90	3	50	1.5	50	3	100
2.	PCC	P25CI302	Data Structures	Resp. dept.	3	-	-	5	90	3	50	1.5	50	3	100
3.	PCC	P25CI303	AI Augmented OOP's using Java	Resp. dept.	3	-	-	5	90	3	50	1.5	50	3	100
4.	PCC	P25CI304	Operating Systems	Resp. dept.	3	-	-	5	90	3	50	1.5	50	3	100
5.	PCC	P25CI305	Exploratory Data Analysis	Resp. dept.	3	-	-	5	60	3	50	1.5	50	3	100
6.	PCCL	P25CIL306	Data Structure Laboratory.	Resp. dept.	-	-	2	1	30	1	50	2	50	3	100
7.	PCCL	P25CIL307	AI Augmented OOPS with Java Laboratory	Resp. dept.	-	-	2	1	30	1	50	2	50	3	100
8.	PBL	P25PBL3083C	Industry Agile Project Studio	-	-	-	4	20	60	2	50	2	50	3	100
9.	HMSC	P25HSMC309A	Employability Enhancement Skills - III	HSMC	1	-	-	20	30	1	50	1 (MCQ)	50	2 (MCQ)	100
10.	MAND	P25MAN310X	NSS/Yoga/Phy. Edu. /Music/ Dance/Drama/Art	HSMC	-	-	-	-	30	-	50	1 (MCQ)	50	2 (MCQ)	PP/NP/50
11.	MAND		AICTE Activity Points	(students have to earn 100 activity points between 01 to 08 semester)							Compulsory requirement for the award of a degree				
	TOTAL									**20**	**500**		**450**		**950**
	BRIDGE COURSE		B.E [Lateral Entry Students]												
12.	MAND	P25MADIP301	Additional Mathematics - I		2	2	-	2	90	-	100	3	-	-	100
13.	MAND	P25HDIP309	Additional Communicative English - I		-	2	-	-	30	-	100	3	-	-	100

B.E-P25 SCHEME- SECOND YEAR (FOURTH SEMESTER) CREDITS & COMPONENTS

Sl. no	Category	Course Code	Course Title	Bos	Teaching & Learning in Hrs per week				Total no. of Hrs per Semester	Credits	Examination Marks and Duration				Total Marks CIE +SEE
					CI		LI	TW + SL			Max. Marks CIE	Duration CIE (hours)	Max. Marks SEE	Duration SEE (hours)	
					L	T	P	SL							
1.	BSC	P25MACS401	Advanced Linear Algebra	Maths	2	2*	-	5	90	3	50	1.5	50	3	100
2.	PCC	P25CI402	Database Management System	Resp. dept.	3	-	-	5	90	3	50	1.5	50	3	100
3.	PCC	P25CI403	Design and Analysis of Algorithms.	Resp. dept.	3	-	-	5	90	3	50	1.5	50	3	100
4.	PCC	P25CI404	Machine Learning	Resp. dept.	3	-	-	5	90	3	50	1.5	50	3	100
5.	PCC	P25CI405	IOS App Development with Swift	Resp. dept.	3	-	-	5	60	3	50	1.5	50	3	100
6.	PCCL	P25CIL406	Database Management System Laboratory.	Resp. dept.	-	-	2	1	30	1	50	2	50	3	100
7.	PCCL	P25CIL407	Design and Analysis of Algorithms Laboratory.	Resp. dept.	-	-	2	1	30	1	50	2	50	3	100
8.	PBL	P25PBL4083C	Industry Agile Project Studio	Resp. dept.	-	-	4	2	60	2	50	2	50	3	100
9.	HMSC	P25HSMC409A	Employability Enhancement Skills - IV	HSMC	1	-	-	2	30	1	50	1 (MCQ)	50	2 (MCQ)	100
10.	MAND	P25MAN410X	NSS/Yoga/Phy. Edu./Music/ Dance/Drama/Art		-	-	-	-	-	-	50	1 (MCQ)	50	2 (MCQ)	PP/NP/50
11.	MAND		AICTE Activity Points	(students have to earn 100 activity points between 01 to 08 semester)							Compulsory requirement for the award of a degree				
TOTAL										**20**	**500**		**450**		**950**
	BRIDGE COURSE		B.E [Lateral Entry Students]												
12.	MAND	P25MADIP401	Additional Mathematics - II		2	2	-	2	90	-	100	3	-	-	100
13.	MAND	P25HDIP409	Additional Communicative English - II		-	2	-	-	30	-	100	3	-	-	100

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Probability and Statistics		
Course Code: P25MACS301	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 2:2:0	**SEE Marks: 100 Marks**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 40 Hours	**Exam Hours: 3Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Basic concepts of calculus, statistics and probability.

Course learning Objectives:

CLO1: Understand statistical methods and probability distributions for analyzing engineering data.
CLO2: Apply stochastic models and Markov chains to computational problems.
CLO3: Develop statistical inference techniques for data-driven decision making.
CLO4: Analyze sampling distributions and hypothesis testing methods.
CLO5: Utilize R programming for statistical computation, simulation, and data analysis.

Unit 1:	**Hrs: 8**

Introduction to Statistics: Introduction, frequency distributions, Measure of central tendency-mean, median and mode - for grouped and ungrouped data, illustrative examples. Measure of dispersion-quartile and mean deviation - for grouped and ungrouped data. Moments, method of moments. Fitting of the curves $y=ax+b$, $y=ax^2+bx+c$, $y=$ by using the method of least squares.

Text Book Mapping: Textbook-1: Chapter 1, 7,
Textbook-2: Chapter-1, 4,
Textbook-3: Chapter-24

Unit 2:	**Hrs: 8**

Probability distribution: Introduction to probability, Random Variables, Distribution function, Probability mass function and Probability density function. Discrete Probability distributions – Introduction and Motivation, Binomial and Poisson's distribution. Continuous Probability distribution - Exponential and Normal Distribution.

Text Book Mapping: Textbook-1: Chapter-3, Textbook-2: Chapter-2, Textbook-3: Chapter-26,
Textbook-4: Chapter-5, 6, Textbook-5: Chapter-4, 5

Unit 3:	**Hrs: 8**

Joint Probability distributions: Joint probability distribution - for two discrete random variables, expectation, covariance and correlation.

Markov Chain: Introduction to Stochastic Process, Probability vector, Stochastic matrix, regular stochastic matrices, Markov chain, higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states.

Text Book Mapping: Textbook-4: Chapter-7

Unit4:	Hrs: 8
Sampling theory: Sampling Theory-Introduction, Random sampling. Sampling from finite and infinite populations, Sampling distributions, Statistical hypotheses, Null Hypotheses, Tests of hypotheses and significance, Type-I and Type-II errors, level of significance, one tailed and two tailed tests, tests of significance for large and small samples, Students 't' test and Chi-square test.	
Text Book Mapping: Textbook-1: Chapter-8, Textbook-3: Chapter-27, Textbook-4: Chapter-8, Textbook-5: Chapter-6	
Unit 5:	**Hrs: 8**
Statistical Inference: Basics of Time series analysis-semi average and moving average methods. Correlation and regression, Karl Pearson's coefficient, lines of regression, multiple regression, non-linear correlation. Introduction to R, Functions, Control flow and Loops, working with vectors and matrices, reading of data, writing data, working with data, manipulating data, simulation.	
Text Book Mapping: Textbook-1: Chapter-4, Textbook-2: Chapter-1, Textbook-4: Chapter-6, Textbook-4: Chapter-2, Textbook-5: Chapter-11	

Course Outcomes

CO1	Apply descriptive statistical measures and curve-fitting techniques to analyze engineering data.
CO2	Analyze random phenomena using probability distributions, joint probability, and Markov chain models in computational applications.
CO3	Apply sampling theory, hypothesis testing, correlation, regression, time-series analysis, and R programming to perform statistical inference on engineering data.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Probability & Statistics for Engineers & Scientists	Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye	9th edition, 2017	Pearson Education
2.	Practical Statistics for Data Scientists	Peter Bruce, Andrew Bruce & Peter Gedeck	2nd edition 2020,	O'Reilly Media, Inc.
Reference Books:				
1.	Higher Engineering Mathematics	B.S. Grewal,	45th Edition, 2025	Khanna Publishers, New Delhi.
2.	Introduction to Probability and Statistics using R	G. Jay Kerns	First Edition, 2010	
3.	Engineering Mathematics	N.P. Bali and Manish Goyal		Laxmi Publications

Web links and Video Lectures (e-resources)
1. https://www.khanacademy.org/math/statistics-probability?utm_source=chatgpt.com 2. https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/?utm_source=chatgpt.com 3. https://web.mit.edu/~jnt/www/prob.html?utm_source=chatgpt.com 4. https://online.stat.psu.edu/statprogram?utm_source=chatgpt.com 5. https://www.r-project.org?utm_source=chatgpt.com

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Data Structures		
Course Code: P25CI302	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P):3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 40Hours	**Exam Hours: 3Hours**	
Team work + Self-study Hrs: 50Hours		
Credits: 3		

Prerequisite:

Fundamentals of programming using C/C++, basic knowledge of arrays, functions, pointers, and problem-solving techniques.

Course learning Objectives:

CLO1: To introduce the fundamental concepts of data structures, pointers, structures, and dynamic memory allocation.

CLO2: To provide knowledge of linear data structures such as linked lists, stacks, and queues along with their representations and operations.

CLO3: To familiarize the concepts of recursion, hashing techniques, and collision resolution strategies for efficient data management.

CLO4: To introduce non-linear data structures such as trees, binary search trees, AVL trees, tries, and heaps with their applications.

CLO5: To develop an understanding of selecting appropriate data structures for solving computational problems.

Unit 1:	**Hrs: 8**

Introduction: Basic Terminology-Elementary Data Structure Organization, Classification of Data Structures.

Pointers: Introduction, Pointers and arrays, Arrays of Pointers. Structures: Introduction, Array of Structures and Functions-Passing Individual Members, Passing the Entire Structure, Passing Structures through Pointers, Self-referential Structures, Dynamic memory Allocation.

Text Book Mapping: Textbook 1: 2.1, 2.2, 1.11.1, 3.7, 3.8, 5.1, 5.3, 5.4, 5.5, Appendix- A

Unit 2:	**Hrs: 8**

Linked Lists: Introduction to linked lists, Operations on lists, singly linked lists, Circular linked lists, Doubly Linked lists, Applications of linked lists: Polynomial Representation, Evaluation of polynomials.

Text Book Mapping: Textbook 1: 6.1, 6.2, 6.3, 6.4, 6.8

Unit 3:	**Hrs: 8**

Stacks: Introduction to Stacks, Operations on Stack, linked representation of stacks, operations on a linked stack, Applications of Stacks: Implementing Parentheses Checker, Conversion of Expression: infix to postfix, Evaluation of Expressions: prefix expression, postfix expression.

Recursion: Recursion fundamentals, Factorial of a number, Fibonacci series, Tower of Hanoi, GCD of two numbers.

Text Book Mapping: Textbook 1: 7.1, 7.2, 7.3, 7.4, 7.5, 7.7.2, 7.7.3, 7.7.4

Unit4:	Hrs: 8
Queues: Introduction to Queues, Operations on Queue. **Types of Queues:** Circular Queues, Deques, Priority Queues. **Hashing:** Introduction, hash tables, hash functions, different hash functions, collisions: collision resolution by open addressing, Collision Resolution by Chaining, Applications of hashing.	
Text Book Mapping: Textbook 1: 8.1, 8.2, 8.3, 8.4, 15.1, 15.2, 15.3, 15.4, 15.5, 15.7	
Unit 5:	**Hrs: 8**
Trees: Binary trees and terminology, Tree traversals - preorder, inorder, postorder, level order, Binary Search Tree operations, AVL trees- Inserting a New Node in an AVL Tree, Tries, Heap concepts- binary heaps, heap Sort.	
Text Book Mapping: Textbook 1: 9.1, 9.2, 9.4, 10.1, 10.2, 10.4, 11.5, 12.1, 12.1.1, 14.13	

Course Outcomes

CO1	Understand the fundamental concepts of data structures for organizing and managing data efficiently.
CO2	Apply linear and non-linear data structures to solve computational problems and real-time applications.
CO3	Analyze and select appropriate non-linear data structures for designing efficient solutions to computational problems.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition (Latest)	Publisher
1.	Data Structures using C	Reema Thareja	2nd Edition, 2018	Oxford University Press.
Reference Books:				
1.	Data Structures and Algorithms Made Easy	Narasimha Karumanchi	5th Edition, 2017	CareerMonk
2.	Introduction to Algorithms	Thomas H. Cormen Charles E. Leiserson Ronald L. Rivest Clifford Stein	3rd edition, 2022	The MIT Press
3.	Fundamentals of Data Structures in C	E. Horowitzand Sartaj Sahani, Susan Anderson-Freed	2nd Edition, 2008	Universities Press

Web links and Video Lectures (e-resources)

1. https://nptel.ac.in/courses/106102064/
2. https://www.nesoacademy.org/cs/01-data-structure
3. https://www.youtube.com/playlist?list=PLBlnK6fEyqRj9lld8sWIUNwlKfdUoPd1Y

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Semester: 3rd Sem	**Scheme: P25**	
Course Title: AI Augmented OOP's using Java		
Course Code: P25CI303	**CIE Marks: 50**	**CIE Weightage:**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage:**
Teaching hours of Pedagogy: 40	**Exam Hours: 3 Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Programming in C++ and python

Course learning Objectives:

CLO1: Understand the fundamental object-oriented principles to design, compile, and execute basic Java classes and constructors while using AI tools.
CLO2: Analyze complex class hierarchies, recursive code paths, and method overloading mechanics
CLO3: Design modular component architectures and multi-tier exception handling rules by utilizing AI tools.
CLO4: Evaluate legacy imperative loops against functional pipeline alternatives
CLO5: Create compliant JSON data schemas and database scripts inside AI Database environments

Unit 1:	**Hrs: 8**

Java Language

Object-Oriented Programming ,Two Paradigms ,Abstraction ,The Three OOP Principles, A First Simple Program, Entering the Program, Compiling the Program ,A Closer Look at the First Sample Program, A Second Short Program, Introducing Classes, Class Fundamentals ,The General Form of a Class ,A Simple class, Declaring Objects ,Introducing Methods, Adding a Method to the Box Class, Returning a Value, Adding a Method That Takes Parameters, Constructors, Parameterized Constructors ,The this Keyword, Instance Variable Hiding, Garbage Collection, The finalize( ) Method.

Text Book Mapping: Text Book-1: Chapter -2, Chapter -6

Unit 2:	**Hrs: 8**

Methods & Inheritance

A Closer Look at Methods and Classes ,Overloading Methods, Overloading Constructors ,Using Objects as Parameters, A Closer Look at Argument Passing ,Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes, Inheritance ,Inheritance Basics ,Member Access and Inheritance ,A Super class Variable Can Reference a Subclass Object ,Using super, Using super to Call Superclass Constructors, Creating a Multilevel Hierarchy ,Method Overriding .

Text Book Mapping: Text Book-1: Chapter -7, Chapter -8

Unit 3:	**Hrs: 8**

Packages, Interfaces & Exception Handling

Packages and Interfaces, Packages: Defining a Package, Finding Packages and CLASSPATH, A Short Package Example, Access Protection, An Access Example, Importing Packages, Interfaces, Defining an Interface, Implementing Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces, Interfaces Can Be Extended A More Practical Example.

Exception Handling, Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, displaying a Description of an Exception, Multiple catch Clauses, Nested try Statements, throw, throws, Finally.	
Text Book Mapping: Text Book-1: Unit-9, Unit-10	
Unit4:	**Hrs: 8**
Lambda expressions Modern Java Lambda expressions, Lambdas in a nutshell, Where and how to use lambdas, Functional interface, Function descriptor, putting lambdas into practice: the execute-around pattern, Step 1: Remember behavior parameterization, Step 2: Use a functional interface to pass behaviors, Step 3: Execute a behavior!, Step 4: Pass lambdas ,Using functional interfaces ,Predicate, Consumer, Function , Type checking, type inference, and restrictions ,Type checking ,Same lambda, different functional interfaces ,Type inference ,Using local variables	
Text Book Mapping: Text Book-2: Chapter 3: 3.1 to 3.6	
Unit 5:	**Hrs: 8**
JSON Parsing Overview of JSON, JSON Syntax and the Data It Represents JSON Compared with XML, JSON in Oracle AI Database, Overview of **JSON in Oracle AI Database:** Data Types for JSON Data, JSON null and SQL NULL, JSON Columns in Database Tables, Use SQL with JSON Data, Use PL/SQL with JSON Data, Use JavaScript with JSON Data, JSON Data Type, JSON Data Type Constructor, SQL/JSON Function JSON_SCALAR, SQL/JSON Function JSON_SERIALIZE, JSON Constructor, JSON_SCALAR, and JSON_SERIALIZE: Summary, Textual JSON Objects That Represent Extended Scalar Values, Comparison and Sorting of JSON Data Type Values, Comparison of SQL Values with JSON Data Type Values, Oracle AI Database Support for JSON	
Text Book Mapping: Text Book-3: Chapter -1, Chapter -2	

Course Outcomes

CO1	Explain core Java OOP principles and baseline code structures using AI generation tools and conversational assistants for compiler error debugging**(Cognitive Level: K2 - Understand/Explain):**
CO2	Apply class hierarchies and complex inheritance mechanisms to build reusable programming logic optimized via automated refactoring engines.(Cognitive Level: K3 - Apply)
CO3	Design modular, decoupled software architectures using packages, custom interfaces, and robust multi-tier exception-handling frameworks.(Cognitive Level: K6 - Create/Design)
CO4	Formulate functional-style declarative expressions using Java Lambdas and Streams by analyzing legacy procedural loops with AI code work-spaces.(Cognitive Level: K4 - Analyze/Formulate)
CO5	Create AI-optimized JSON data parser structures and vector-friendly storage configurations inside modern, operational Oracle AI Database environments. (Cognitive Level: K6 - Create):

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Java complete Reference,	Herbert Schildt	Ningth Edtion Copyright ©2014	McGraw-Hill Edition,
2.	Java 8 in Action Lambdas, streams, and functional-style programming	Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft	Copyright ©2019	Manning Publications Co. All rights reserved.
3.	JSON Developer's Guide,	Drew Adams,	Copyright © 2015, 2025, Oracle and/or its affiliates.	Oracle JSON development, product management, and quality assurance teams.
Reference Books:				
1.	Java Generics and Collections	Maurice Naftalin and Philip Wadler	Copyright © 2020	O'Reilly's Publication

Web links and Video Lectures (e-resources)

1. https://vcfvct.wordpress.com/wp-content/uploads/2016/06/java8inaction.pd
2. https://www.sietk.org/downloads/javabook.pdf
3. https://docs.oracle.com/en/database/oracle/oracle-database/18/adjsn/index.html

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)

1. Flip Class
2. Seminar/ poster Presentation
3. Individual Role play/Team Demonstration/ Collaborative Activity
4. Case study
5. Learn by Doing

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Operating Systems		
Course Code: P25CI304	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P):2:2:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 40	**Exam Hours: 3 Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Programming in C or python

Course learning Objectives:

CLO1: To understand the fundamental concepts of Operating Systems.

Unit 1:	**Hrs: 8**

Introduction: Definition; Computer-System Organization; Computer-System Architecture; Operating-System Operations.
Operating-System Structures: Operating-System Services; User and Operating-System Interface; System Calls; Types of System Calls.
Processes: Basic concept of Process; Process Scheduling; Operations on Processes; Inter-process Communication.

Text Book Mapping: Text Book 1: Chapter 1: 1.1, 1.2, 1.3, 1.4
Chapter 2: 2.1, 2.2, 2.3
Chapter 3: 3.1, 3.2, 3.3, 3.4

Unit 2:	**Hrs: 8**

Threads and Concurrency: Overview, Multi core Programming, Multithreading Models.
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multi-processor Scheduling.

Text Book Mapping: Text Book 1: Chapter 4: 4.1, 4.2, 4.3.
Chapter 5: 5.1, 5.2, 5.3, 5.5.

Unit 3:	**Hrs: 8**

Synchronization Tools: Background; Critical Section Problem; Petersons solution; Hardware support for synchronization; Mutex Locks; Semaphores.
Synchronization Examples: Classic problems of Synchronization-Bounded-buffer problem, Readers-writers Problem, Dining Philosophers problem.

Text Book Mapping: Text Book 1: Chapter 6: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6.
Chapter 7: 7.1.

Unit4:	**Hrs: 8**

Deadlocks: System Model; Deadlock Characterization; Methods for Handling Deadlocks; Deadlock Prevention, Deadlock Avoidance; Deadlock detection; Recovery from deadlock
Main Memory: Background; Contiguous Memory allocation; Paging.

Text Book Mapping: Text Book 1: Chapter 8: 8.1, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8
Chapter 9: 9.1, 9.2, 9.3.

Unit 5:	**Hrs: 8**
Virtual Memory: Background; Demand Paging; Copy-on-write; Page Replacement: Basic Page replacement; FIFO Page replacement; optimal Page replacement; LRU Page replacement; LRU-approximation page replacement; Thrashing-Cause of thrashing, working set Model, Page fault Frequency. **Mass-Storage Structure:** Overview: Hard Disk drives; HDD scheduling - FCFS, SCAN C-SCAN, Selection of Disk Scheduling Algorithm.	
Text Book Mapping: Text Book 1: Chapter 10: 10.1, 10.2, 10.3, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.4.5, 10.6. Chapter 11: 11.1, 11.2.	

Course Outcomes

CO1	**Understand** the fundamental concepts and algorithms that underlie operating system.
CO2	**Apply** Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms and Deadlock detection & avoidance techniques to solve Operating System Functionalities.
CO3	**Analyze** the performance of different operating system algorithms/techniques.

Suggested Learning Resources:

Textbooks:

Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Operating System Concepts	Abraham Silberschatz, Peter Galvin, Greg Gagne	2023 & Global Edition	Wiley
Reference Books:				
1.	Operating Systems, A concept–based evolutionary approach	P Chakra borty	2023 & 1st Edition	Jaico
2.	Modern Operating Systems	Andrew S Tanenbaum, Herbert Bos	2010 & 4th Edition	Pearson

Web links and Video Lectures (e-resources)

1. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/ index.html.
2. https://nptel.ac.in/courses/106/105/106105214/.

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)

1. Role Playing
2. Seminars/Peer teaching
3. Quiz
4. Posters
5. Case study
6. Open Ended Questions

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Exploratory Data Analysis		
Course Code: P25CI305	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 40	**Exam Hours: 3 Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Python Programming

Course learning Objectives:

CLO1: Understand and apply statistical concepts to analyze data.
CLO2: Comprehend and run Python code for commonly used EDA practices and data Visualization techniques.
CLO3: Understand and produce effective data visualizations that allow for data storytelling, such as data exploration and hypothesis testing.

Unit 1:	**Hrs: 8**

Introduction to Exploratory Data Analysis (EDA): Understanding data science, The significance of EDA, Steps in EDA, Data Types: Numerical, Discrete, Continuous and Categorical data.
Data-Measurement Scales: Nominal, Ordinal, Interval, Ratio, Comparing EDA with Classical and Bayesian Analysis.
Data Visualization: Line, Bar, Histogram, scatter, pie and Table chart (for seaborn tips and Iris dataset)

Text Book Mapping: Chapters: Chapter 1(Page Nos.: 9-20), Chapter 2(Page Nos.: 36-57,61)

Unit 2:	**Hrs: 8**

Merging database - Style dataframes: Concatenating along with an axis, using df.merge with an inner join, using the pd.merge() method with a left join, using the pd.merge() method with a right join, using pd.merge() methods with outer join, Merging on index, Reshaping and pivoting.
Transformation Techniques: Performing data deduplication, Replacing values, Handling missing data, Renaming axis indexes..

Textbook Map: Chapters: Chapter 4(Page Nos.:94-121)

Unit 3:	**Hrs: 8**

Descriptive Statistics: Understanding statistics, Measures of central tendency, Measures of dispersion.
Grouping Datasets: Understanding groupby(), Groupby mechanics, Data aggregation, Pivot tables.

Textbook Map: Chapters: Chapter 5(138-159), Chapter 6(Page Nos.: 163-182)

Unit4:	**Hrs: 8**

Correlation: Types of analysis – Understanding univariate, bivariate and multivariate analysis.
Time Series Analysis (TSA): Fundamentals of TSA, Characteristics of TSA, Time-based indexing, Visualizing time series, Grouping time series data and resampling time series data.

Textbook Map: Chapters: Chapter 7(Page Nos.: 192-199), Chapter 8(Page Nos.: 216-229)

Unit 5:	Hrs: 8
Hypothesis testing: Hypothesis testing principle, Types of hypothesis testing. **Regression:** Understanding regression, Types of regression. **Model development and evaluation:** Constructing a linear regression model, Implementing a multiple linear regression model.	
Textbook Map: Chapters: Chapter 9(Page Nos.: 235-254)	

Course Outcomes

CO1	**Understand** and explore the fundamental concepts of Data Exploration.
CO2	**Apply** the computational approaches to perform Data Exploration.
CO3	**Analyze** the different techniques to perform data exploration for a given application.
CO4	**Demonstrate** exploratory data analysis on datasets and provide interpretations through relevant visualization tools.
CO5	**Understand** and explore the fundamental concepts of Data Exploration.

Suggested Learning Resources:

Textbooks:

Sl. No.	Title	Author	Year & Edition	Publisher
1.	Hands-On Exploratory Data Analysis with Python	Suresh Kumar Mukhiya, UsmanAhmed,	2020	Packt

Reference Books:

1.	Data Exploration and Visualization	AnamitraDehMukh, Nimbalkar	2022, 1st Edition	Technical Publications
2.	Exploratory Data Analysis With Python	AyodeleOluleye	2023, 1st Edition	Packt,
3.	Python for Data Analysis	WesMckinney	2017, 2nd Edition	O'Reilly Media,

Web links and Video Lectures (e-resources)

1) DataVisualization,ExploringandExplainingwithData,JefferyDComm,,James.J.Cochran, Michael.J.Fry, 1st Cengage, 202
2) https://www.perlego.com/book/3815910/data-visualization-exploring-and-explaining-with-data-pdf.
3) Exploratory Data Analysis (EDA) Using Python | Python Data Analysis | Python Training | Edureka http://www.youtube.com/watch?v=-o3AxdVcUtQ
4) Preview: Data Analytics with Python | SWAYAM
5) http://www.youtube.com/watch?v=TPivN7tpdwc
6) http://www.youtube.com/watch?v=csXmVBw8cdo

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Seminar/ poster Presentation 2. Learn by Doing

Semester: 3rd Semester	**Scheme: P25**	
Course Title: Data Structure Laboratory.		
Course Code: P25CIL306	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P)	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:	**Exam Hours:**	
Team work + Self-study Hrs:		
Credits: 1		

Prerequisite:

Fundamentals of programming using C, basic knowledge of arrays, functions, pointers, and problem-solving techniques.

Course learning Objectives:

CLO1: To provide practical exposure to the implementation of fundamental and advanced data structures using C programming.

CLO2: To enable students to develop and analyze application-based solutions using appropriate data structure operations.

Lab Experiments

1.	Design and develop a **Student Record Management System** using **structures and dynamic memory allocation** in C. The system should maintain student details such as **USN, name, semester, marks obtained in different subjects, and grade**. The program should dynamically allocate memory for storing student records and provide functionalities to manage student information efficiently. The system should support the following operations: 1. Create and store student records dynamically using pointers. 2. Display all student records. 3. Search for a student record using USN. 4. Update the details of an existing student. 5. Delete a student record from the system. 6. Calculate and display the average marks and grade of each student.
2.	Develop an **Employee Payroll Management System** using structures and pointers. The system should store employee details such as **employee ID, name, designation, basic salary, allowances, deductions, and net salary**. The system should perform the following operations: 1. Create employee records dynamically. 2. Calculate gross salary and net salary. 3. Display employee payroll details. 4. Search employee information using employee ID. 5. Update salary details.
3.	Develop a program to represent polynomial expressions using **linked lists** and perform polynomial operations. Each node should store the coefficient and exponent of a polynomial term. The system should support: 1. Creation of polynomial expressions. 2. Displaying polynomial expressions. 3. Evaluation of polynomial for a given value of x.

4.	Design a **Music Playlist Management System** using a doubly linked list. Each node should store song details such as **song ID, title, artist, and duration**. The system should support: 1. Adding new songs to the playlist. 2. Removing songs from the playlist. 3. Displaying songs in forward order. 4. Displaying songs in reverse order. 5. Searching songs by title.
5.	Design and develop a **Browser History Management System** using a stack data structure. The system should maintain the history of visited web pages and allow users to navigate through previously visited pages. The system should support the following operations: 1. Visit a new webpage and add it to the history. 2. Navigate back to the previously visited webpage. 3. Display the current webpage. 4. Display the complete browsing history. 5. Clear browsing history.
6.	Design and develop a **recursive problem-solving module** to demonstrate the application of recursion in solving computational problems used in mathematical modelling and system simulations. Implement the following operations using recursive techniques: **1. Disk Movement Automation System (Tower of Hanoi)** Simulate the movement of disks between three pegs using the Tower of Hanoi algorithm. The objective is to move *n* disks from the source peg to the destination peg using an auxiliary peg while following the recursive strategy and minimum movement constraints. **2. Traffic Signal Timing Synchronization (GCD of Two Numbers)** Develop a recursive solution to calculate the GCD of two traffic signal cycles to determine the common interval at which two signals synchronize. **3. Recursive Data Analysis (Finding Largest Element in a Dataset)** Implement a recursive approach to determine the largest value among *n* elements in a dataset such as sensor readings or examination scores. The solution should process the dataset recursively without using loops or sorting functions.
7.	Design and develop a **Food Delivery Order Management System** using a double-ended queue. The system should manage customer orders where urgent orders can be added at the front and normal orders are added at the rear. The system should support: 1. Add urgent orders at the front. 2. Add normal orders at the rear. 3. Deliver orders from the front. 4. Cancel the last added order from the rear. 5. Display pending orders.
8.	Design a **File Indexing System** using hashing techniques. The system should store file information using a hash table where each file is identified by a unique key. The system should support: 1. Insert file records into the hash table. 2. Search files using file key. 3. Delete file records. 4. Handle collisions using: • Linear probing • Chaining

9.	Develop a **Student Database Management System** using a Binary Search Tree (BST). Each node should store student information such as **USN, name, and marks**. The system should support: 1. Insert student records. 2. Search student details using USN. 3. Display records using: • Inorder traversal • Preorder traversal • Postorder traversal
10.	Design and develop a **Student Rank Management System** using heap sort. The system should arrange student records based on their total marks and generate a rank list. Each student record contains: **USN**, **Student Name** and **Total Marks.** The system should: 1. Accept student details. 2. Store student records. 3. Apply heap sort to arrange students based on marks. 4. Display the rank-wise student list.

Course Outcomes: On completion of this course, students are able to:	
CO1:	Design algorithms using different data structures like List, Stack, Queue, Hashing and Trees.
CO2:	Develop programs with suitable data structure based on the requirements of the real time applications.

Semester: 3rd Semester	**Scheme: P25**	
Course Title: AI Augmented OOPS with Java Laboratory.		
Course Code: P25CIL307	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P)	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:	**Exam Hours:**	
Team work + Self-study Hrs:		
Credits: 1		

Prerequisite:

Programming in C++ and python

Course learning Objectives:

CLO1: Illustrate the concept of Interfaces, Packages, Exception, Multithreading and Generics in Java.
CLO2: Understand the java applets and event handling.
CLO3: Development of Java Application using the concept of Abstract Window Toolkit and swings**.**

Lab Experiments

1.	Write a program to find the sum of the series 1 + 1/ (2*2) + 1/(3*3) + 1/(4*4) + ….. +1/(n*n).
2.	Write a program that accepts three numbers from the user and prints "increasing" if the numbers are in increasing order, "decreasing" if the numbers are in decreasing order, and "Neither increasing or decreasing order" otherwise.
3.	Generate a Java class showcasing compile-time polymorphism. Create three overloaded constructors (default, cube, full dimensions) and an overloaded method that accepts another instance of the object as a parameter.
4.	Write Java program demonstrating a 3-tier multi-level class hierarchy: Box, BoxWeight, and BoxShipment. Explicitly show how 'super' is used to pass arguments up the chain, handle access modifiers, and implement runtime method overriding.
5.	Write a java program to handle the following exceptions based on choice made by the user by writing suitable try and catch block. i) ArithmeticException ii) ArrayIndexOutOfBoundsException iii) NumberFormatException iv) StringIndexOutOfBoundException v) NullPointerException
6.	Create two classes called HDFCAccount and StateBankAccount. that implements all the methods defined in interface Account.Declare the methods getBalance, deposit and withdraw in Account interface. HDFCAccount uses member variables deposits and withdrawals for maintaining the balance, where as State BankAccount uses only balance to maintain the balance. In the main method create objects of HDFCAccount and StateBankAccount, but assigned them to the reference of the interface Account. Also write an method to print balance in main which prints the balance amount.

7.	Create a package CIE which has two classes- Student and Internals. The class Student has members like usn, name, sem. The class internals has an array that stores the internal marks scored in six courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Student. This class has an array thatstores the SEE marks scored in six courses of the current semester of the student. Import the two packages in a file that declares the final marks of N students in all six courses.
8.	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
9.	To design and implement a flexible file-processing component using the Execute-Around Pattern in Java. The goal is to separate operational boilerplate code (resource allocation, opening, and closing of BufferedReader) from the actual business logic (processing the file contents) by parameterizing behavior using a custom Functional Interface and Lambda Expressions.
10.	To parse a raw JSON data array into structured domain objects and filter out invalid or malformed data records. The goal is to replace complex, nested if-else loops with clean, readable lambda expressions utilizing the built-in Predicate and Function interfaces for validation and mapping.

Course Outcomes:

CO1:	Apply fundamental Java constructs, control structures, and exceptional handling flows to solve mathematical sequences, conditional logic evaluations, and runtime data failures.
CO2:	Design modular and reusable object-oriented systems by using multi-level inheritance hierarchies, method overloading/overriding polymorphism, structural package compilation, and polymorphic interface contracts.
CO3:	Construct modern, high-performance applications that utilize asynchronous multi-threaded workers, resource-defensive lambda execute-around expressions, and declarative functional streams to filter complex JSON structures.

Semester: 3rd Semester	**Scheme: P25**	
Course Title: Industry Agile Project Studio		
Course Code: P25PBL3083C	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 2:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 42	**Exam Hours: 03**	
Team work + Self-study Hrs:		
Credits: 2		

Prerequisite:

Nil. Working knowledge of Python and basic machine learning concepts is desirable.

Course learning Objectives: This course will enable the students to:

CLO1: Develop a recommendation-system data foundation by generating synthetic datasets, engineering customer and product features, and implementing ETL pipelines for recommender model development.

CLO2: Build and evaluate baseline recommendation models using popularity-based, collaborative filtering, and matrix factorization techniques as benchmark recommenders.

CLO3: Design and implement hybrid recommendation systems by combining embeddings, vector search, content-based filtering, collaborative signals, and Learn-to-Rank models to improve recommendation performance.

CLO4: Develop conversational recommendation solutions using Retrieval-Augmented Generation (RAG), vector databases, prompt engineering, and open-source large language models.

CLO5: Deploy, evaluate, and demonstrate production-ready recommendation services using FastAPI, dashboards, A/B testing, and industry-standard recommendation metrics.

Unit 1:	**Hrs: 14**

Data Engineering and Baseline Recommender

Sprint Goal: Build UrbanNest Furnishings' data foundation and benchmark baseline recommenders.

Tasks:

- Collect or generate data – download Kaggle furniture datasets or generate synthetic data with SDV, YData Synthetic or Faker (target 500+ products, 2000+ users).
- Create the product dataset (category, material, colour, style, price, rating) with product descriptions for embeddings, and generate user purchase, view, cart and wishlist data.
- Clean and pre-process the data – normalise names and categories, handle missing prices/discounts, build master product tables and encode categorical variables.
- Engineer customer-level RFM features (Recency, Frequency, Monetary) and product attribute features.
- Build an ETL pipeline with Prefect or Airflow (ingestion, transformation, scheduled runs, logged metrics) and a sparse user–item interaction matrix, handling cold-start users/items.
- Implement Popularity, user-based CF, item-based CF and ALS matrix-factorisation baselines; evaluate with Precision@K, Recall@K, MAP@K, Coverage, Diversity, RMSE and MAE.
- Write the Sprint 1 SRS document (architecture overview, data governance and privacy, security controls, MLOps strategy) and unit tests.

Deliverables:

- Week 1 – Synthetic Furniture Dataset with data dictionary, feature-engineering pipeline (RFM and product features), EDA report and cleaned dataset (CSV/Parquet).

- Week 2 – ETL pipeline (Prefect/Airflow DAG) with baseline recommenders (Popularity, CF, ALS), evaluation report, unit tests and SRS Sprint 1.

Text Book Mapping:

Unit 2:	**Hrs: 14**

Embeddings, Vector Database, Hybrid Models and RAG

Sprint Goal: Build embedding-based, hybrid and conversational recommenders that improve on the baseline.

Tasks:

- Create product description text from attributes and generate sentence-transformer embeddings (all-MiniLM-L6-v2, all-mpnet-base-v2 or bge-base-en-v1.5).
- Set up a vector database (ChromaDB, FAISS or Milvus), index the embeddings and implement vector search for content-based recommendation.
- Design hybrid recommendation logic combining CF score, embedding similarity, price sensitivity, style preference and simulated CTR; build the (user, item) feature matrix for Learn-to-Rank.
- Train a Learn-to-Rank model (XGBoost/LightGBM, pairwise or lambdarank objective), tune with Optuna and implement the hybrid_recommend function; compare against the baseline on NDCG@10 and Precision.
- Set up a RAG framework (LangChain, Haystack or LlamaIndex), connect the vector store as retriever and run an open-source LLM locally (Llama 3, Mistral or Phi-3 via Ollama, llama.cpp or vLLM).
- Build the RAG chain (query → retrieve products → generate response), write 10–15 personalisation prompt templates and evaluate response quality and hallucination.

Deliverables:

- Week 3 – Product embeddings and vector database with content-based recommender, embedding evaluation and search demo.
- Week 4 – Hybrid recommender with trained LTR model, Optuna hyperparameter study and evaluation report (hybrid vs baseline).
- Week 5 – RAG pipeline with local LLM integration, personalisation prompts, conversational recommender chat interface and RAG evaluation.

Text Book Mapping:

Unit 3:	**Hrs: 14**

MLOps, Deployment, Governance and Final Benchmarking

Sprint Goal: Productionise the recommender as a deployed service with a dashboard and A/B test analysis.

Tasks:

- Design the API architecture – endpoints for collaborative, embedding, hybrid and conversational recommendation, request/response schemas and authentication.
- Implement the FastAPI recommendation service exposing all recommendation models.
- Build a Streamlit or Gradio dashboard with user selector, product cards with images, filters and

a chat interface for the RAG recommender.

- Integrate all models into the dashboard and run an A/B test simulation comparing baseline versus hybrid and RAG recommenders.
- Finalise the API documentation (OpenAPI spec, usage examples) and the complete SRS, and present the final demonstration.

Deliverables:

Week 6 – Deployed FastAPI recommendation service with Streamlit/Gradio dashboard, A/B test results, and complete API and SRS documentation with final demonstration.

Text Book Mapping:

Course Outcomes

CO1	Generate and engineer a synthetic furniture dataset with RFM features and an ETL pipeline, and implement and evaluate baseline recommenders (Popularity, CF, ALS).
CO2	Build embedding-based, hybrid Learn-to-Rank and RAG-powered conversational recommenders with a vector database and a local LLM, demonstrating measurable NDCG improvement.
CO3	Deploy the recommender as a FastAPI service with a dashboard, run an A/B test comparing models, and document the system through API and SRS documentation.

Suggested Learning Resources:				
Textbooks:				
Sl. No.	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Recommender Systems: The Textbook Link: https://doi.org/10.1007/978-3-319-29659-3	Charu C. Aggarwal	2016, 1st Edition	Independently Published (Amazon KDP)
2.	Practical Recommender Systems Link: https://www.manning.com/books/practical-recommender-systems	Kim Falk	2019, 1st Edition	
3.	Hands-On Large Language Models: Language Understanding and Generation Link: https://www.llm-book.com/	Jay Alammar, Maarten Grootendorst	2024, 1st Edition	
Reference Books:				
1.	FastAPI Documentation Link: https://fastapi.tiangolo.com/	Sebastián Ramírez	Latest version	FastAPI (open source)
2.	LangChain Python Documentation Link: https://python.langchain.com/docs/	LangChain	Latest version	LangChain (open source)
3.	Sentence-Transformers Documentation Link: https://www.sbert.net/	UKPLab / Hugging Face	Latest version	Sentence-Transformers (open source)

Web links and Video Lectures (e-resources)
1. SDV (Synthetic Data Vault) Documentation: https://docs.sdv.dev/ 2. Implicit – Fast Collaborative Filtering: https://implicit.readthedocs.io/ 3. Prefect Documentation: https://docs.prefect.io/ 4. Google Research – Recommender Systems: https://research.google/pubs/tag/recommender-systems/ 5. Surprise – Recommender System Library: https://surpriselib.com/

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Individual Role play/Team Demonstration/ Collaborative Activity: Students rotate through various roles of project teams and give weekly sprint walkthroughs of their findings and dashboards. 2. Case study: Each team adopts one of the several scenarios and carries it through all three sprints.

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Employability Enhancement Skills - III		
Course Code: P25HSMC309A	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:2:0	**SEE Marks: 100**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 42 Hours	**Exam Hours: 2Hours**	
Team work + Self-study Hrs: As per the self-study components indicated unit-wise		
Credits: 1		

Prerequisite:

Basic mathematics and fundamentals of English grammar.

Course learning Objectives:

CLO1: Perform calculations involving percentages, profit & loss and discounts.
CLO2: Explain concepts behind logical reasoning modules of direction sense and blood relations.
CLO3: Prepare students for the job recruitment process and competitive exams.
CLO4: Develop problem solving skills.
CLO5: Apply programming constructs of C language to solve real-world problems.

Unit 1:	**Hrs: 8**

Quantitative Aptitude: Number System – Divisibility & Remainder, Multiples & Factors, Integers, HCF & LCM, Decimal Fractions, Surds & Indices, Simplification. **Self-study component:** Linear equations.

Unit 2:	**Hrs: 8**

Quantitative Aptitude: Percentages, Profits, Loss and Discounts.
Logical Reasoning: Blood Relations.
Self-study component: *Inferred meaning, Chain rule.*

Unit 3:	**Hrs: 8**

Logical Reasoning: Direction Sense Test.
Verbal Ability: Change of Speech and Voice, Sentence Correction.
Self-study component: *Height & distance.*

Unit 4:	**Hrs: 8**

C-PROGRAMMING – I

Introduction: Keywords and Identifier, Variables and Constants, Data Types, Input/Output, Operators, Simple Programs.

Flow Control: If…else, for Loop, while Loop, break and continue, switch…case, goto, Control Flow Examples, Simple Programs.

Functions: Functions, User-defined Functions, Function Types, Recursion, Storage Class, Programs.

Arrays: Arrays, Multi-dimensional Arrays, Arrays & Functions, Programs.

Self-study component: Evaluation of Expression.

Unit 5:	Hrs: 8

C-PROGRAMMING – II

Pointers: Pointers, Pointers & Arrays, Pointers and Functions, Memory Allocation, Array & Pointer Examples.

Strings: String Functions, String Examples, Programs.

Structure and Union: Structure, Struct & Pointers, Struct & Function, Unions, Programs.

Programming Files: Files Input/Output.

Self-study component: *Error handling during I/O operations.*

Course Outcomes

CO1	Exhibit amplified level of confidence to express themselves in English.
CO2	Solve the problems based on number systems, percentages, profit & loss and discounts.
CO3	Solve logical reasoning problems based on direction sense and blood relations.
CO4	Apply suitable programming constructs of C language and / or suitable data structures to solve the given problem.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition (Latest)	Publisher
1.	The C Programming Language	Brian W. Kernighan & Dennis M. Ritchie	2nd Ed., 1988	Prentice Hall
2.	C in Depth	S. K. Srivastava & Deepali Srivastava	3rd Ed., 2018	BPB Publications
3.	Quantitative Aptitude	Dr. R. S. Aggarwal	RevisedEd., 2022	S. Chand
4.	Verbal Reasoning	Dr. R. S. Aggarwal	RevisedEd., 2018	S. Chand

Reference Books:

1.	Programming in ANSI C	E. Balagurusamy	8th Ed., 2019	Tata McGraw Hill
2.	Quantitative Aptitude	Arun Sharma	Latest Ed.	McGraw Hill Education

Web links and Video Lectures (e-resources)

1. Problem Solving through Programming in C (NPTEL, IIT Kharagpur) – https://archive.nptel.ac.in/courses/106/105/106105171/
2. C programming tutorials and practice – https://www.programiz.com/c-programming
3. Aptitude and reasoning practice – https://www.indiabix.com/
4. Aptitude preparation resources – https://www.geeksforgeeks.org/aptitude/ 5. C practice problems – https://www.hackerrank.com/domains/c

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)

1. Flip Class on aptitude concepts
2. Peer quiz / rapid-fire rounds on number systems and reasoning
3. Pair programming for C fundamentals (Learn by Doing)
4. Timed problem-solving drills simulating placement tests
5. Seminar / poster presentation on real-world applications of C

Semester: 3rd Sem	**Scheme: P25**	
Course Title: National Service Scheme (NSS)		
Course Code: P25MAN3101	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks:**	**SEE Weightage:**
Teaching hours of Pedagogy: 24P	**Exam Hours: 1.5 Hours**	
Team work + Self-study Hrs: As per the self-study components indicated unit-wise		
Credits: 0		

Prerequisite:

Course learning Objectives:

CLO1: Understand the community in general in which they work.
CLO2: Identify the needs and problems of the community and involve them in problem - solving.
CLO3: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CLO4: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Unit 1:	**Hrs: 4**

RURAL ECONOMY, AGRICULTURE AND LIVELIHOODS

Rural economy and livelihood opportunities. Organic farming and sustainable agricultural practices. Indian agriculture – **Past, Present and Future**. Agricultural marketing and connectivity between farmers and markets. Role of cooperatives, self-help groups and farmer organizations. Waste management in rural areas – **5 R's: Refuse, Reduce, Reuse, Repurpose and Recycle**. Role of public, private and government organizations in rural development.

Unit 2:	**Hrs: 4**

WOMEN EMPOWERMENT AND COMMUNITY PARTICIPATION

Importance of women's participation in social and economic development. Formation and functioning of women's groups and Self-Help Groups (SHGs). Information and awareness campaigns for women. Role of women in household income generation and entrepreneurship. Social and economic issues affecting rural women. Identification of local resources and community strengths. Community participation, leadership and collective decision-making.

Unit 3:	**Hrs: 4**

WATER, WASTE AND ENVIRONMENTAL SUSTAINABILITY

Importance of water conservation in rural areas. Sources, utilization and challenges of rural water resources. Rainwater harvesting and groundwater recharge. Sustainable water management systems for rural areas. Role of different stakeholders in planning and implementation. Solid waste management and the 5 R's. Environmental protection, sanitation and community participation. Plantation and adoption of plants – **"Know Your Plants"**.

Unit 4:	Hrs: 6
RURAL DEVELOPMENT, EDUCATION AND GOVERNMENT INITIATIVES Role of education in rural development. Identification of challenges faced by rural schools. Supporting schools to improve enrolment and continuation in higher/technical/vocational education. School infrastructure and rejuvenation initiatives. Major Government of India initiatives for socio-economic development: Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharat, Make in India, MUDRA Scheme, Skill Development and Entrepreneurship programmes. Role of government departments, NGOs and other stakeholders in implementation.	
Unit 5:	**Hrs: 6**
SOCIAL RESPONSIBILITY, OUTREACH AND COMMUNITY DEVELOPMENT Social connect and responsibilities of students towards the community. Public awareness under rural outreach programmes. Planning and conducting awareness campaigns. National integration and social harmony. Community participation and social responsibility. Preparing an actionable business proposal for enhancing village income. Identification of local problems and preparation of community-based solutions. Documentation, presentation and evaluation of community engagement activities.	

Course Outcomes

CO1	Explain the major social, economic, agricultural and livelihood characteristics of rural communities.
CO2	Identify and propose sustainable practices related to organic farming, waste management, water conservation and environmental protection.
CO3	Demonstrate awareness of the role of women, community organizations, government agencies and other stakeholders in rural development.
CO4	Identify community needs and develop feasible solutions or proposals for improving education, livelihoods, infrastructure and village income.
CO5	Plan and participate effectively in community outreach, awareness, social harmony and environmental activities while demonstrating social responsibility, teamwork and leadership.

Suggested Learning Resources:

Textbooks:

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. **Government of Karnataka,** NSS cell, activities reports and its manual.
3. **Government of India, NSS cell, Activities reports and its manual.**

Reference Books:

1.	Rural Development: Principles, Policies and Management	Katar Singh		Sage Publications
2.	Agriculture and Rural Development	M. S. Swaminathan	2009	

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

At the end of every semester, activity report should be submitted for evaluation.

Pedagogy - Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

SI No	Topic	Group size	Location	Activity execution	Report	Evaluation
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	Individual /Team	Farmers land/Villages/ roadside / community area/ College campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	NSS officer /coordinators as per rubrics
2.	Waste management Public, Private and Govt organization, 5 R's.	Individual /Team	Villages/ City Areas / Grama panchayat/ public associations/Govern ment Schemes officers/ campus etc.. ...	Site selection /proper consultation/Continuous monitoring/ Information board		
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	Individual /Team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc.....	Group selection/pro per consultation/Continuous monitoring/ Information board		
4.	Water conservation techniques - Role of different stakeholders Implementation.	Individual /Team	Villages/ City Areas / Grama panchayat/ public associations/Govern ment Schemes officers/ campus etc.. ...	site selection / proper consultation/Continuous monitoring/ Information board		
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	Individual /Team		Group selection/pro per consultation/Continuous monitoring/ Information board		

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	Individu al /Team	Local government / private/ aided schools/Govern men t Schemes officers/ etc.....	School selection/proper consultation/Conti nuo us monitoring/ Information board		
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	Individu al /Team	Villages/ City Areas / Grama panchayat/ publ ic associations/Go vern ment Schemes	site selection/proper c onsultation/Contin uo us monitoring/ Information board		
8.	Contribution to any national level initiative of Government of India. For Eg. Digital India, Skill India, Swachh Bharat, Atmanirbh ar Bharath, Make in India, Mudra scheme, Skill development progr ams etc.	Individu al /Team		Group selection/pro per consultation/Conti nuo us monitoring / Information board		
9.	Spreading public awareness under rural outreac h programs. (minimum5 programs). Social connect and responsibilities.	Individu al /Team		Group selection/pro per consultation/Conti nuo us monitoring / Information board		
10.	Plantation and adoption of plants. Know your plants.	Individu al /Team		Place selection/proper co nsultation/Continuo us monitoring / Information board		

Semester: 3rd Sem	**Scheme: P25**	
Course Title: YOGA		
Course Code: P25MAN3102	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24P	**Exam Hours: 1.5 Hours**	
Team work + Self-study Hrs:		
Credits: 0		

Prerequisite:

Basic knowledge of human body and physical movements, willingness to participate in yogic practices, and awareness of basic health and safety practices. No prior knowledge of Yoga is required.

Course learning Objectives:

CLO1: Explain the origin, history, philosophy, objectives, and different schools of Yoga, along with its role in promoting holistic health and well-being.

CLO2: Understand and apply the rules, regulations, and ethical practices associated with Yogic exercises, including the significance of prayer and Suryanamaskara.

CLO3: Demonstrate the correct techniques of selected Yogasanas, such as sitting, standing, prone, and supine postures, while observing appropriate precautions.

CLO4: Analyse the physical, mental, and therapeutic benefits of Yogic practices and distinguish between authentic Yogic practices and common misconceptions about Yoga.

CLO5: Adopt Yoga as a regular lifestyle practice to enhance physical fitness, mental wellness, discipline, and overall quality of life.

Unit 1:	**Hrs: 4**

Introduction of Yoga

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga.

Unit 2:	**Hrs: 4**

Prayer

Importance of prayer Brief introduction of yogic practices for Yogic practices for common man to promote positive health, Rules and regulations: Rules to be followed during yogic practices by practitioner

Unit 3:	**Hrs: 4**

Suryanamaskara

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds, Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices

Unit 4:	**Hrs: 6**

Asanas - Sitting

Different types of Asanas: Asana, Need, importance of Asana. Different types of asanas. Asana its meaning by name, technique, precautionary measures and benefits of each asana, Sitting 1. Padmasana, 2. Vajrasana, Standing 1. Vrikshana, 2. Trikonasana.

Unit 5:	**Hrs: 6**

Asanas – Prone Line

Different types of Asanas: Asana, Need, importance of Asana. Different types of asanas. Asana its meaning by name, technique, precautionary measures and benefits of each asana. Prone line 1. Bhujangasana, 2. Shalabhasana, Supine line 1. Utthitadvipadasana, 2. Ardhahalasana

Course Outcomes

CO1	
CO2	
CO3	
CO4	
CO5	

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition**	**Publisher**
1.	The Yoga Tradition: Its History, Literature, Philosophy, and Practice	Georg Feuerstein	2001	Hohm Press
2.	The Complete Book of Yoga: Harmony of Body and Mind	Sri Ananda	2017	Orient Paperbacks
3.	Light on the Yoga Sutras of Patanjali	B. K. S. Iyengar	2012	HarperCollins
4.	Science of Divinity and Realization of Self	Vethathiri Maharishi	---	Vethathiri Maharishi Store, Erode
Reference Books:				
1.	Principles and Practice of Yoga in Health Care	Sat Bir Singh Khalsa, Lorenzo Cohen, Timothy McCall, Shirley Telles & Holger Cramer	2024	Jessica Kingsley Publishers / Handspring Publishing
2.	Yoga in School Health	I. V. Basavaraddi	2009	Morarji Desai National Institute of Yoga (MDNIY), New Delhi
3.	Yoga Research and Application	H. R. Nagendra	---	Vivekananda Kendra Yoga Prakashana, Bengaluru
4.	A Glimpses of the Human Body	Shirley Telles	1999	Vivekananda Kendra Yoga Prakashana, Bengaluru

Web links and Video Lectures (e-resources)
1. Ministry of AYUSH – Common Yoga Protocol 2. Morarji Desai National Institute of Yoga (MDNIY) 3. MDNIY – Video Gallery

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. **Flip Class:** Yoga history, origin, development and misconceptions. . 2. **Seminar/Poster Presentation:** Schools, meanings, definitions and importance of Yoga and prayer 3. **Role Play/Team Demonstration:** Rules, Suryanamaskara and selected Asanas. 4. **Case Study:** Application of Yoga for positive health and common misconceptions. 5. **Learn by Doing:** Suryanamaskara (12 counts, 2 rounds) and prescribed Asanas with technique, precautions and benefits.

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Physical Education		
Course Code: P25MAN3103	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24P	**Exam Hours: 1.5 Hours**	
Team work + Self-study Hrs:		
Credits: 0		

Prerequisite:

Basic awareness of physical fitness, health, wellness, and willingness to participate in sports and physical activities.

Course learning Objectives:

CLO1: Develop awareness of the importance of a healthy lifestyle, physical fitness, wellness, and regular physical activity.

CLO2: Assess and improve physical fitness through pre-fitness testing and structured activities focusing on strength, speed, flexibility, endurance, and general fitness.

CLO3: Develop fundamental physical skills through appropriate warm-up, free-hand exercises, and fitness activities.

CLO4: Acquire basic skills and techniques in selected traditional and team games such as Kabaddi and Kho-Kho.

CLO5: Promote teamwork, discipline, sportsmanship, coordination, leadership, and healthy competitive spirit through participation in physical and sporting activities.

Unit 1:	**Hrs: 4**

Orientation

A. Lifestyle

B. Health & Wellness

C. Pre - Fitness test.

Unit 2:	**Hrs: 4**

General Fitness & Components of Fitness

A. Warming up (Free-Hand exercises)

B. Strength – Push-up / Pull-ups

C. Speed – 30 Mtr Dash

Unit 3:	**Hrs: 16**

Games

Specific games (Any one game to be selected by the student)

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Course Outcomes

CO1	**(Bloom's Level 1 – Remember):** Recall the fundamental concepts of lifestyle, health, wellness, physical fitness, and components of fitness.
CO2	**(Bloom's Level 2 – Understand):** Explain the importance of warm-up, strength, speed, fitness exercises, and regular physical activity in maintaining health and overall well-being.
CO3	**(Bloom's Level 3 – Apply):** Demonstrate and apply the basic skills, techniques, and rules of Kabaddi or Kho-Kho and participate effectively in physical fitness and sports activities.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition**	**Publisher**
1.	A Textbook on Physical Education & Health Education: Fitness, Wellness and Nutrition	A. K. Uppal & P. P. Ranganathan	2018, 1st Edition	Friends Publications (India)
2.	Science of Sports Training	Dr. Hardayal Singh	2023, 1stEdition	Friends Publications (India)
3.	Kabaddi: Skills, Drills, Tactics and Strategies	Dr. Sudhakara G. & Dr. Ravindra Gouda S. M.	2020, 1stEdition	Sports Publication, New Delhi
4.	How to Play Kho-Kho	Naval Kishore	2016, 1stEdition	Sports Publications, New Delhi
Reference Books:				
1.	Corbin's Concepts of Fitness and Wellness: A Comprehensive Lifestyle Approach	Welk, G. J., Corbin, C. B., Corbin, W. R. & Welk, K. A.	2026, 13th Edition	McGraw Hill
2.	Measurement and Evaluation in Human Performance	James R. Morrow Jr., Dale P. Mood, Weimo Zhu & Minsoo Kang	2023, 6th Edition,	Human Kinetics
3.	A Text Book on Kabaddi: Kabaddi, Skills Techniques and Strategies	S. Muniraju	2015, 6th Edition	LAP Lambert Academic Publishing
4.	Manual of Kabaddi	Biswajit Sardar & Kavita Verma	2014, 1st Edition	International E Publication
5.	Kho-Kho	Sanjay Khalatkar	2016, 2nd Edition	Nachiket Prakashan

Web links and Video Lectures (e-resources)
1 World Health Organization (WHO), Physical Activity and Health: https://www.who.int/health topics/physical-activity
2. Khelo India Fitness Assessment, Sports Authority of India: https://schoolfitness.kheloindia.gov.in/
3. NPTEL–IIT Madras, Introduction to Exercise Physiology & Sports Performance: https://nptel.ac.in/courses/109106406
4. NPTEL–IIT Madras, Strength & Conditioning for the Indian Population: https://nptel.ac.in/courses/109106404
5. Amateur Kabaddi Federation of India (AKFI), Rules and Resources: https://www.indiankabaddi.org/
6. Kho Kho Federation of India (KKFI), Rules & Regulations: https://khokhofederation.in/rules regulations/
7. Kho Kho Federation of India (KKFI), Video Resources: https://khokhofederation.in/videos/

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Creative Arts and Culture		
Course Code: P25MAN3104	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24P	**Exam Hours:**	
Team work + Self-study Hrs:		
Credits: 0		

Prerequisite:

Basic awareness of physical fitness, health, wellness, and willingness to participate in sports and physical activities.

Course learning Objectives:

CLO1: Develop awareness of the importance of a healthy lifestyle, physical fitness, wellness, and regular physical activity..

CLO2: Assess and improve physical fitness through pre-fitness testing and structured activities focusing on strength, speed, flexibility, endurance, and general fitness.

CLO3: Develop fundamental physical skills through appropriate warm-up, free-hand exercises, and fitness activities.

CLO4: Acquire basic skills and techniques in selected traditional and team games such as Kabaddi and Kho-Kho.

CLO5: Promote teamwork, discipline, sportsmanship, coordination, leadership, and healthy competitive spirit through participation in physical and sporting activities.

Unit 1:	**Hrs: 4**

Introduction to Performing Arts

Performing arts as a form of cultural expression. Introduction to: Music, Dance, Drama/Theatre. Relationship between music, dance, drama. Role of performing arts in festivals, celebrations and social life. Introduction to classical, folk and contemporary forms.

Unit 2:	**Hrs: 6**

Fundamentals of Indian Music

Origin and evolution of Indian music. Overview of Indian classical music. Introduction to Carnatic and Hindustani music. Basic concepts: Nada, Shruti, Swara, Raga, Tala, Laya. Relationship between music, language, emotion and culture. Introduction to major forms: Geethe, Swarajathi, Varna, Kriti, Tillana. Introduction to notation, Eminent composers: Purandara Dasa, Tyagaraja, Mysore Vasudevacharya.

Unit 3:	**Hrs: 4**

DANCE: TRADITION, EXPRESSION

Introduction to Indian Dance: Meaning, origin and significance of dance. Dance as a medium of cultural expression. Classical and folk-dance traditions of India. Major Indian classical dance forms: Bharatanatyam, Kathak, Kathakali, Kuchipudi, Major folk and regional dance traditions. Traditional dance forms of Karnataka. **Elements of Dance:** Basic concepts of: Movement, Rhythm, Gesture, Expression, Posture, Coordination.

Unit 4:	**Hrs: 4**

DANCE PERFORMANCE

Introduction to **Abhinaya** and expression. Relationship between music, rhythm and movement. Dance as storytelling. **Practical Dance Activities,** Basic movement and rhythm exercises. Hand gestures and simple expressions. Group choreography. Folk/classical dance demonstration. Preparation of a short cultural dance presentation.

Unit 5:	Hrs: 6
DRAMA, THEATRE AND CREATIVE COMMUNICATION Introduction, meaning and significance of drama. Development of Indian theatre traditions, Classical, folk and modern theatre, regional theatre traditions. Drama as a medium of communication and social awareness. Characterization, Dialogue and Voice modulation. Body language and stage presence. Direction and stagecraft. Basic concepts of costume, props, lighting and sound. Public speaking. Anchoring and event hosting, mime and improvisation. Script writing. Short skit development, Drama for social awareness.	

Course Outcomes

CO1	**Describe and appreciate** Indian cultural heritage and the major traditions of music, dance and drama.
CO2	**Interpret and respond to** artistic expressions by recognizing their cultural, emotional and social dimensions.
CO3	**Communicate and collaborate effectively** in cultural performances, creative activities and group projects.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	Theory of Music	Vasantha Madhavi	*2007*	Prism Publication
2.	Indian Classical Dance	Kapila Vatsyayan		Publications Division, Government of India.
3.	The Natyasastra: English Translation with Critical Notes	Adya Rangacharya		Karnataka University
4.	Indian Theatre: Tradition and Modernity	Suresh A. Goel,		

Web links and Video Lectures (e-resources)

1. https://ignca.gov.in/online-digital-resources/
2. https://digital.nios.ac.in/topic.php?id=243en&

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Basic Engineering Mathematics – I		
Course Code: P25MADIP301	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P:S) 2:2:0:0		
Total number of Teaching Hrs:40	**Exam Hours:**	
No of lecture hours per week: 04		
Credits: 0		
Prerequisite:		
Course learning Objectives:		
To provide basic concepts of complex trigonometry, vector algebra, differential & integral calculus, vector differentiation and various methods of solving first order differential equations.		

Unit 1:	**Hrs: 8**
Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). **Vector Algebra:** Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems **Self-study components:** De-Moivre's theorem (without proof). Roots of complex number - Simple problems.	
Textbook Mapping:	**Textbook 1:** Chapter 19.1 – 19.4, 8.1 – 8.3.

Unit 2:	**Hrs: 8**
Differential Calculus: Polar curves –angle between the radius vector and the tangent pedal equation-Problems. Taylor's series and Maclaurin's series expansions- Illustrative examples. **Partial Differentiation:** Elementary problems. Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. **Self-study components:** Review of successive differentiation. Formulae for nth derivatives of standard functions- Liebnitz's theorem (without proof). Application to Jacobians, errors & approximations.	
Textbook Mapping:	**Textbook 1:** Chapter 4.4, 4.7, 4.8, 4.11, 5.1 – 5.6.

Unit 3:	**Hrs: 8**
Integral Calculus: reduction formulae for sinnx, cosn x and sinm x cosn x and evaluation of these with standard limits-Examples. Applications of integration to area, length of a given curve, volume and surface area of solids of revolution. **Self-study components:** Differentiation under integral sign (Integrals with constants limits)-Simple problems.	
Textbook Mapping:	**Textbook 1:** Chapter 6.1 – 6.13.

Unit 4:	**Hrs: 8**
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). **Self-study components:** Solenoidal and irrotational vector fields-Problems.	
Textbook Mapping:	**Textbook 1:** Chapter 8.3 – 8.7.

Unit 5:	Hrs: 8
Ordinary differential equations (ODE's): Introduction-solutions of first order and first-degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types. **Self-study components:** Applications of first order and first-degree ODE's - Orthogonal trajectories of Cartesian and polar curves. Newton's law of cooling, R-L circuits- Simple illustrative examples from engineering field.	
Textbook Mapping:	**Textbook 1:** 11.1, 11.2, 11.7 – 11.9.

Course Outcomes

CO1	Demonstrate the fundamental concepts–in complex numbers and vector algebra to analyze the problems arising in related area of engineering field.
CO2	Identify–partial derivatives to calculate rate of change of multivariate functions
CO3	Apply-the acquired knowledge of integration and differentiation to evaluate double and triple integrals to compute length surface area and volume of solids of revolution and identify velocity, acceleration of a particle moving in a space
CO4	Find analytical solutions by solving first order ODE's which arising in different branches of engineering.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition**	**Publisher**
1.	Higher Engineering Mathematics	B. S. Grewal	44th Ed.,2018.	Khanna Publishers, New Delhi
Reference books:				
1.	Advanced Engineering Mathematics,	E. Kreyszig	10th Ed., 2015.	John Wiley & Sons
2.	Engineering Mathematics	N. P. Bali and Manish Goyal	7th Ed., 2007.	Laxmi Publishers

Semester:3rd Sem	**Scheme: P25**	
Course Title: Additional Communicative English – I		
Course Code: P25HDIP309	**CIE Marks: 100**	**CIE Weightage: 100%**
Teaching hours/week (L:T:P) 0:2:0	**SEE Marks: -**	**SEE Marks: -**
Total number of Teaching Hrs:	**Exam Hours: 3Hrs**	
Teaching hours of Pedagogy: 30 Hours		
Credits: 0		
Prerequisite:		
Course learning Objectives:		

Unit 1:	**Hrs: 6**
Introduction to Communication Skills Introduction to communication, Meaning and process, Channels of communication, Elements of communication, Barriers to effective communication. Activities - Making introductions, Sharing personal information, Describing feelings and opinions.	
Unit 2:	**Hrs: 4**
Listening Skills I Hearing vs. Listening, Types of listening, Determinants of good listening, Active listening process, Barriers to listening, Activities - Listening for pronunciation practice, Listening for personal communication, Listening for communication - language functions	
Unit 3:	**Hrs: 6**
Speaking Skills I Basics of speaking, Elements and Functions of speaking, Structuring your speech, Focusing on fluency, Homographs and Signpost words. Activities – Free Speech and Pick and Speak	
Unit 4:	**Hrs: 4**
Reading Skills I Developing reading as a habit, Building confidence in reading, improving reading skills, Techniques of reading - skimming and scanning. Activities - understanding students' attitudes towards reading, countering common errors in reading, developing efficiency in reading. **Writing Skills I** Improving writing skills, Spellings and punctuation, Letter and Paragraph writing. Activity – Writing your personal story	
Unit 5:	**Hrs: 4**
Body Language and Presentation Skills Elements of body language, Types, Adapting positive body language, Cultural differences in body language. 4 Ps in presentations, Overcoming the fear of public speaking, Effective use of verbal and nonverbal presentation techniques. Activity – Group presentations	

Course Outcomes

CO1	Understand the role of communication in personal and professional success
CO2	Comprehend the types of technical literature to develop the competency of students to Apprehend the nature of formal communication requirements.
CO3	Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence
CO4	Demonstrate effective individual and teamwork to accomplish communication goals.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	Communication Skills	Sanjay Kumar and Pushpa Lata	2015	Oxford University Press
2.	Everyday Dialogues in English	Robert J.	2006	Dixson, Prentice-Hall of India Ltd.,
3.	Developing Communication Skills	Krishna Mohan& Meera Banerjee (Macmillan)		
4.	The Oxford Guide to Writing and Speaking	John Seely		Oxford.

Semester: 4th Sem	**Scheme: P25**	
Course Title: Advanced Linear Algebra		
Course Code: P25MACS401	**CIE Marks: 50**	**CIE Weightage:**
Teaching hours/week (L:T:P) 2:2:0	**SEE Marks: 100**	**SEE Weightage:**
Teaching hours of Pedagogy: 40 Hours	**Exam Hours: 3Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Basic concepts of linear algebra and calculus.

Course learning Objectives:

CLO1: Understand advanced matrix theory and its applications in computing systems.
CLO2: Analyze spectral methods and eigenvalue problems arising in computational applications.
CLO3: Apply matrix factorizations and orthogonalization techniques to data analysis problems.
CLO4: Utilize decomposition techniques for optimization and machine learning applications.
CLO5: Apply linear algebra concepts in computer graphics, graph theory, and data science

Unit 1:	**Hrs: 8**

Matrix theory

Special Matrices – Symmetric matrices, Orthogonal matrices, Complex matrices, unitary and normal matrices, Involutory and Nilpotent matrices – properties and problems, block matrices, polynomial of matrices, matrix arithmetic modulo p, application to cryptography – Hill ciper and toy block ciper methods.

Text Book Mapping: Textbook 3: Chapter 2.1 – 2.12, Text 2: 4.8 – 4.9.

Unit 2:	**Hrs: 8**

Spectral Methods

Geometrical interpretation of Eigenvalues and Eigenvectors, Diagonalization of real symmetric matrices, application to matrix powers, solving recurrences, system of linear differential equations, the matrix exponential, complex Eigen values and Eigen vectors. Minimal polynomials, minimal polynomial of block matrices.

Text Book Mapping: Textbook 2: Chapter 8.1 – 8.7, Text 3: Chapter 9.7 – 9.8.

Unit 3:	**Hrs: 8**

Matrix Factorization

Orthogonality and least square solutions: Real inner product spaces, Angles and Orthogonality, orthonormal bases, Gram-Schmidt orthogonalization process, Orthogonal projections and generalized Fourier series, application to least square approximations and curve fitting.

Text Book Mapping: Textbook 2: Chapter 11.1 – 11.5,

Unit4:	Hrs: 8
Decomposition and Quadratic forms: QR decomposition, Singular value decomposition, Quadratic forms and Nature of the Quadratic Forms, Quadratic form as a matrix product. Positive definite and semi definite matrices, Reduction of Quadratic form to canonical forms by Orthogonal Transformation, Normal canonical form. Rank, index and Signature.	
Text Book Mapping: Textbook 1: Chapter 7.1 – 7.4, Text 3: 10.7 – 10.8.	
Unit 5:	**Hrs: 8**
Multilinear Algebra Linear Functionals and the Dual Space, Dual Basis, Second Dual Space, Annihilators, Transpose of a linear Mapping. Bilinear forms and matrices, change of basis and congruent matrices, symmetric bilinear forms and quadratic forms, Sylvesters law of inertia, Hermitian forms.	
Text Book Mapping: Textbook 2: Chapter 11.1 – 11.6, 12.1 – 12.7.	

Course Outcomes

CO1	Analyze special matrices, eigenvalues, eigenvectors, and spectral properties for applications in computing, cryptography, and dynamical systems.
CO2	Apply orthogonality, matrix decomposition (QR, SVD), and quadratic-form reduction techniques to least-squares approximation and data analysis problems.
CO3	Apply multilinear algebra concepts, including dual spaces and bilinear forms, to problems in computer graphics, graph theory, and data science.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Linear Algebra and Its Applications	David C. Lay, Steven R. Lay, Judi J Mc. Donald	6th Edition, 2021	Pearson Education.
2.	Matrix Theory and Linear Algebra	Peter Selinger	First Ed. 2018	Creative commons License
3.	Linear Algebra	Seymour Lipschutz, Marc Lipson	4th Edition	McGraw-Hill Companies, Inc., New Delhi.
Reference Books:				
1.	Higher Engineering Mathematics	B.S. Grewal,		Khanna Publishers, New Delhi.
2.	Linear Algebra and its Applications	Gilbert Strang	4thedition, 2005	Brooks Cole.3.

Web links and Video Lectures (e-resources)
1. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/?utm 2. https://www.nptel.ac.in/courses/111107164?utm . 3. https://www.mathworks.com/help/matlab/linear-algebra.html?utm 4. https://ocw.mit.edu/courses/18-700-linear-algebra-fall-2013/?utm

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Semester: 4th Sem	**Scheme: P25**	
Course Title: Database Management System		
Course Code: P25CI402	**CIE Marks: 50**	**CIE Weightage:**
Teaching hours/week (L:T:P)	**SEE Marks: 50**	**SEE Weightage:**
Teaching hours of Pedagogy:	**Exam Hours: 3 Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Basic Computer Knowledge, Fundamentals of Data, Basic Programming Concepts

Course learning Objectives:

CLO1: Understand the fundamental principles, architectures, and models used in modern database systems.
CLO2: Apply database design methodologies to organize, store, and manage data efficiently.
CLO3: Develop database applications using appropriate query languages and data manipulation techniques.
CLO4: Analyze data management challenges related to integrity, consistency, concurrency, security, and reliability
CLO5: Explore modern database technologies and emerging trends for managing large-scale and diverse data

Unit 1:	**Hrs: 8**

Foundation

Database and Database Architecture: Introduction, characteristics of the database approach, Database models, Schemas and Instances, Three-Schema Architecture and Data Independence. ER model: Entity, Attributes, Relationship, Roles and Structural Constraints, ER Diagrams. ER-to-Relational Schema Mapping. Relational
Model: Relational Model Concepts and Relational Constraints.

Text Book Mapping: Text Book 1: Chapter 1: 1.1, 1.2, 1.3 Chapter 2: 2.1, 2.2
Chapter 3: 3.1, 3.2 Chapter 7

Unit 2:	**Hrs: 8**

Structured Query Language (SQL)

Basic SQL: Introduction, DDL Commands, DML commands, DQL Commands with various operators and other commands, Aggregation functions, Group By, Having. Set operation, Join operation, Subqueries, View, Assertion, Trigger.

Text Book Mapping: Text Book 1: Chapter 4, Chapter 5

Unit 3:	**Hrs: 8**

Database Design & Normalization

Basics of Functional Dependencies and Normalization for Relational Databases: Informal design guidelines for relation schema, Functional Dependencies: Definition, types, closure of FD. Normalization: 1NF, 2NF, 3NF, BCNF.

Text Book Mapping: Text Book 1: Chapter 15: 15.1, 15.2, 15.3

Unit4:	Hrs: 8
Transaction Processing & Concurrency Control **Introduction to Transaction Processing:** Introduction, Transaction states, ACID properties, Serializability: Conflict serializability, testing algorithms. Concurrency Control Protocols: 2-phase locking protocols, timestamp ordering protocols. Recovery Techniques: Log-based recovery, undo/redo, shadow paging.	
Text Book Mapping: Text Book 1: Chapter 21: 21.1, 21.2, 21.3, 21.5	
Unit 5:	**Hrs: 8**
NoSQL, Distributed database **NoSQL Databases:** Introduction, CAP theorem, BASE properties; Key-Value database, Document database, Column-family database and Graph database. **Database Security & Emerging Trends:** Authentication, Authorization, access control.	
Text Book Mapping: Text Book 2: Chapter 15	

Course Outcomes

CO1	Explain the concepts, architectures, models, and design principles of database systems.
CO2	Design efficient database schemas by applying appropriate data modeling and normalization techniques.
CO3	Develop database solutions using SQL and related database programming constructs for data definition, manipulation, and retrieval.
CO4	Analyze mechanisms for transaction management, concurrency control, recovery, and security in database environments.
CO5	Evaluate relational, NoSQL, and distributed database technologies for diverse application requirements.

OR

CO1	Explain the fundamental concepts, architectures, data models, and design principles of relational and non-relational database systems.
CO2	Apply data modeling, functional dependency rules, normalization techniques, and SQL constructs to design and develop database solutions for real-world applications.
CO3	Analyze transaction management mechanisms including serializability, ACID properties, concurrency control protocols and recovery techniques.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Fundamentals of Database System	Elmasri Ramez and Navathe Shamkant	2018 7th Edition	Pearson
2.	Big Data Black Book	DT Editorial Services	2016	DreamTech
Reference Books:				
1.	Database System Concepts	Silberschatz A., Korth H., Sudarshan S	6th edition	McGraw Hill
2.	Database Management Systems	Raghu Ramakrishnan and Johannes Gehrke	2003 & 3rd Edition	McGraw Hill

Web links and Video Lectures (e-resources)
1. https://nptel.ac.in/courses/106105175 2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs72 3. https://www.coursera.org/learn/database-management

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Semester: 4th Sem	**Scheme: P25**	
Course Title: Design and Analysis of Algorithms.		
Course Code: P25CI403	**CIE Marks: 50**	**CIE Weightage:**
Teaching hours/week (L:T:P)	**SEE Marks: 50**	**SEE Weightage:**
Teaching hours of Pedagogy:	**Exam Hours: 3 Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Data Structures and C Programming Language

Course Overview:

Design and Analysis of Algorithms provides the theoretical and analytical foundation required for designing efficient algorithms to solve computational problems. The course develops mathematical analysis skills, algorithmic thinking, and problem-solving abilities using various algorithm design paradigms.

Course learning Objectives:

CLO1: Understand the fundamental concepts of algorithm design and mathematical techniques for analysing the time complexity of algorithms.

CLO2: Explain and apply various algorithmic problem-solving paradigms, including brute force, decrease-and-conquer, divide-and-conquer, transform-and-conquer, greedy, and dynamic programming techniques.

CLO3: Analyze and compare the computational efficiency and complexity of algorithms for solving different computational problems.

CLO4: Design, implement, and evaluate efficient algorithms using appropriate algorithm design strategies to solve real-world computational problems.

Unit 1:	**Hrs: 8**

Algorithm Foundations and Mathematical Analysis

Algorithms, Fundamentals of Algorithmic Problem Solving, Fundamental Data Structures, Analysis framework, Asymptotic notations and efficiency classes, Mathematical analysis of non-recursive algorithms with examples [Maximum Element, Unique Elements], Mathematical analysis of recursive algorithms with examples [Factorial, Tower of Hanoi].

Text Book Mapping: Text Book – 1: 1.1, 1.2, 1.4, 2.1, 2.2, 2.3, 2.4

Unit 2:	**Hrs: 8**

Brute Force and Decrease-and-Conquer

Brute-force strategy, Selection sort and Brute-force string matching.

Exhaustive search [Travelling Salesman Problem, Knapsack Problem], Depth First Search, Breadth First Search.

Decrease-and-conquer strategy, Insertion sort, Topological sorting, Decrease by-a-Constant Factor Algorithm: Binary Search, Variable Size-Decrease Algorithms: Computing Median and the Selection Problem.

Text Book Mapping: Text Book – 1: 3.1, 3.2, 3.4, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5

Unit 3:	Hrs: 8
Divide and Conquer: Merge sort, Quick Sort, Multiplication of Large Integers and Strassen's Matrix Multiplication. **Space-time tradeoff:** Space – time tradeoff strategy, Comparison counting sort, Horspool algorithm, Boyer–Moore algorithm, Knuth-Morris-Pratt (KMP) Algorithm.	
Text Book Mapping: Text Book – 1: 5.1, 5.2, 5.4, 7.1, 7.2, 7.3. Text Book - 2: 32.4	
Unit4:	**Hrs: 8**
Transform and Conquer: Pre-sorting, Gaussian Elimination **Dynamic programming:** Strategy, Knapsack problem, Warshall's algorithm, Floyd's algorithm. **Greedy Technique:** Minimum spanning trees [Prim's and Kruskal's algorithms], Single-source shortest paths [Dijkstra's algorithm], Huffman trees and codes.	
Text Book Mapping: Text Book – 1: 6.1, 6.2, 8.1, 8.2, 8.4, 9.1, 9.2, 9.3, 9.4	
Unit 5:	**Hrs: 8**
Advanced Search and Computational Complexity Backtracking [n Queens Problem], Branch and Bound [Knapsack Problem, Travelling Salesman Problem], Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-complete problems [Clique problem], Approximation algorithms [Vertex cover].	
Text Book Mapping: Text Book – 1: 12.1, 12.2. Text Book – 2: 34.1, 34.2, 34.3, 34.5, 35.1	

Course Outcomes

CO1	Explain and analyse the fundamentals of algorithms, asymptotic notations, and time complexity of recursive and non-recursive algorithms.
CO2	Apply brute-force, decrease-and-conquer, divide-and-conquer, and space-time trade-off techniques to solve computational problems, and analyze their efficiency.
CO3	Analyze transform-and-conquer, dynamic programming, greedy, backtracking, branch-and-bound, and approximation techniques, and evaluate their suitability for solving optimization and computationally challenging problems.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd Edition, 2014	Pearson
2.	Introduction to Algorithms	Thomas H. Cormen, Charlese E Leiserson, Ronald L. Rivest, Clifford Stein	3rd Edition, 2009	The MIT Press
Reference Books:				
1.	Fundamentals of Computer Algorithms	Ellis Horowitz,Satraj Sahni and Rajasekhara M	2nd Edition, 2009	University Press Pvt. Ltd
2.	The Design and Analysis of Algorithms	Aho, J.Hopcroft, Ullman	1st Edition, 1974	Addison-Wesley

Web links and Video Lectures (e-resources)
1. https://www.coursera.org/course/algs4partI 2. https://onlinecourses.nptel.ac.in/noc19_cs47/preview

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Semester: 4th Sem	**Scheme: P25**	
Course Title: Machine Learning		
Course Code: P25CI404	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P): 3:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:	**Exam Hours: 3Hours**	
Team work + Self-study Hrs:		
Credits: 3		

Prerequisite:

Programming in Python

Course learning Objectives:

CLO1: Define machine learning and understand the basic theory underlying machine learning.
CLO2: Demonstrate the basic concepts of learning.
CLO3: Explore the basics concept of decision tree and rule based learning.
CLO4: Illustrate Bayesian techniques and Probabilistic Graphical Models for problems appear in machine learning

Unit 1:	**Hrs: 8**

Introduction to Machine Learning:

Need for Machine Learning, Machine Learning Explained, Machine Learning in relation to other fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process.

Understanding Data:

Data, Big data analytics and types of analytics, Big data Analysis framework, Descriptive statistics, Univariate data analysis and visualization, Bivariate data and multivariate data, Multivariate statistics, Essential mathematics for multivariate data. Overview of Hypothesis,Featured Engineering and Dimensionality Reduction Techniques.

Text Book Mapping: Text book 1: Chapter 1, Chapter 2 (2.1 to 2.10)

Unit 2:	**Hrs: 8**

Basics of Learning Theory:

Introduction to Learning and its types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modelling in Machine Learning, Learning Frameworks.

Similarity – based Learning:

Introduction to similarity or Instance based Learning, Nearest Neighbor Learning, Weighted K – Nearest Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).

Text Book Mapping: Text book 1: Chapter 3,Chapter 4

Unit 3:	**Hrs: 8**

Regression Analysis:

Introduction to Regression, Introduction to Linearity, Correlation and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Reidge and Lasso Regression

Decision Tree Learning: Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms, Validation and Pruning of Decision Trees.	
Text Book Mapping: Text book 1: Chapter 5 and Chapter 6	
Unit4:	**Hrs: 8**
Rule – based Learning: Introduction, Sequential Covering Algorithm, First Order Rule Learning, Induction as Inverted Deduction, Inverting Resolution, Analytical Learning or Explanation based Learning, Association Rule Mining **Bayesian Learning:** Introduction to probability based learning, Fundamentals of Bayes Theorem, Classification using Bayes Model, Naïve Bayes Algorithm for continuous attributes.	
Text Book Mapping: Text book 1: Chapter 7, Chapter 8.	
Unit 5:	**Hrs: 8**
Probabilistic Graphical Models: Introduction, Bayesian Belief Network, Markov Chain, Problems solved with HMM **Clustering algorithms :** Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach, Probability Model-based Methods, Cluster Evaluation Methods.	
Text Book Mapping: Text book 1: Chapter 9 and Chapter 13.	

Course Outcomes

CO1	Understand the basic concept of Machine Learning and data
CO2	Apply the basic concept of Learning.
CO3	Analyse various similarity – based learning and regression algorithms.
CO4	Analyse various decision tree and rule based learning
CO5	Apply the basics of Bayesian Model concepts and clustering techniques.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	Machine Learning	S Sridhar and M Vijayalakshmi	2021	Oxford Higher Education
Reference Books:				
1.	Machine Learning	Tom M. Mitchell	2013	McGraw-Hill Education
2.	Hands-on Machine Learning with Scikit-Learn & TensorFlow	Aurelien Geron	2019	O'Reilly

Web links and Video Lectures (e-resources)
1. https://www.nptel.ac.in/courses/106105152 2. https://developers.google.com/machine-learning/intro-to-ml 3. https://developers.google.com/machine-learning/crash-cours 4. https://sklearn.org/1.9/getting_started.html

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Flip Class 2. Seminar/ poster Presentation 3. Individual Role play/Team Demonstration/ Collaborative Activity 4. Case study 5. Learn by Doing

Semester: 4th Semester	**Scheme: P25**	
Course Title: IOS App Development with Swift		
Course Code: P25CI405	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 2:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 30	**Exam Hours:**	
Team work + Self-study Hrs:		
Credits: 2		

Prerequisite:

Basic Programming using C / Python / Java and Data Structures.

Course learning Objectives: This course will enable the students to:

CLO1: Understand the iOS development environment and write basic Swift programs.
CLO2: Design simple user interfaces using SwiftUI.
CLO3: Develop apps that store and manage dynamic data.
CLO4: Enhance apps with advanced features and improved user experience.
CLO5: Prepare, publish, and monetize iOS applications.

Unit 1:	**Hrs: 8**

Introduction to iOS Development & Swift Basics
Introduction to iOS ecosystem, Apple developer tools, Installing and exploring Xcode, Swift language overview, Variables and constants, Data types, Operators, Control structures (if, switch, loops),Functions and Optional.

Text Book Mapping:

Unit 2:	**Hrs: 8**

SwiftUI Fundamentals & UI Design
Introduction to Swift UI, Declarative UI design, Views and modifiers, Layout containers (HStack, VStack, ZStack), Text, images, shapes, Navigation views, Lists and forms, Using Xcode preview canvas.

Text Book Mapping:

Unit 3:	**Hrs: 8**

Data Handling & App Architecture
StatemanagementinSwiftUI,Propertywrappers(@State,@Binding,@ObservedObject),MVVM architecture, Handling user inputs, Working with JSON data, Networking basics and APIs, Data persistence(User Defaults, Core Data basics).

Text Book Mapping:

Unit4:	**Hrs: 8**

Advanced Swift UI & Device Features
Animations and transitions, Gestures and interactions, Creating reusable components, Integrating device capabilities (camera, location), Multimedia handling, Debugging tools, Performance optimization, Accessibility in apps.

Text Book Mapping:

Unit 5:	Hrs: 8
Testing, Deployment & Monetization App testing methods, Debugging techniques, Preparing apps for release, Apple Developer Program, App Store submission process, App marketing strategies, Monetization models (ads, paid apps, in- app Purchases), App maintenance and updates.	
Text Book Mapping:	

Course Outcomes

CO1	Explain the iOS application development environment and apply the fundamentals of the Swift programming language to develop simple applications.
CO2	Design interactive and responsive user interfaces using SwiftUI components and layout techniques.
CO3	Develop iOS applications using state management, MVVM architecture, networking APIs, and local data persistence.
CO4	Integrate advanced SwiftUI features and device capabilities to build feature-rich, accessible, and high-performance applications.
CO5	Test, deploy, publish, and maintain iOS applications using App Store guidelines and appropriate monetization strategies.

Suggested Learning Resources:				
Textbooks:				
Sl. No.	**Title**	**Author**	**Year & Edition (Latest)**	**Publisher**
1.	IOS App Development with Swift A Beginner to Pro Guide to SwiftUI, Xcode and Mobile App Design	Wilson Hayes	2025	Independently Published (Amazon KDP)
Reference Books:				
1.	Develop in Swift Fundamentals	Apple Education	2024	Apple Inc.
2.	IOS 18 Programming for Beginners	Ahmad Sahar	2025	Packet Publishing

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Coursera 2. Programming assignments 3. Learn by Doing

Semester: 4th Semester	**Scheme: P25**	
Course Title: Database Management System Laboratory.		
Course Code: P25CIL406	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 2:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy:	**Exam Hours:**	
Team work + Self-study Hrs:		
Credits: 1		

Prerequisite:

AI-augmented web development

Course learning Objectives:

CLO1: To understand and apply database design principles, including ER modeling, relational schema design, and normalization.

CLO2: To develop proficiency in SQL-based database creation, data manipulation, and complex query formulation.

CLO3: To design and implement database solutions using advanced database objects such as views, procedures, and triggers for real-world applications.

Lab Experiments	**Hrs: 8**

1. Design an ER diagram for a given database (application) and map it to a relational schema.

2. Apply normalisation (1NF through BCNF) to a denormalised dataset.

3. Write DDL statements to create a relational database with all constraint types (PK, FK, UNIQUE, CHECK).

4. Perform DML operations: insert, update, and delete on a multi-table database.

5. Write SELECT queries using GROUP BY, HAVING, and aggregate functions on a dataset.

6. Solve multi-table retrieval problems using all join types and correlated subqueries.

7. Create views, stored procedures, and triggers for a given database.

Course Outcomes:

CO1:	Apply database design principles to create ER models, relational schemas, and normalized databases.
CO2:	Construct and manipulate relational databases using SQL commands, constraints, and advanced query techniques.
CO3:	Develop database applications using views, stored procedures, and triggers to address real-world data management requirements

Semester: 4th Semester	**Scheme: P25**	
Course Title: Design And Analysis Of Algorithms Laboratory.		
Course Code: P25CIL407	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:2	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24 Hours	**Exam Hours: 3Hours**	
Team work + Self-study Hrs:		
Credits: 1		

Prerequisite:

Data Structures and C Programming Language

Course Overview:

The Design and Analysis of Algorithms Laboratory provides practical exposure to the implementation and analysis of fundamental algorithm design techniques. The course enables students to develop, test, and evaluate efficient algorithms using various design paradigms while enhancing their programming, analytical, and problem-solving skills through hands-on experiments.

Course learning Objectives:

CLO1: Develop programming skills by implementing fundamental algorithms for graph traversal, sorting, searching, and string matching..

CLO2: Apply various algorithm design paradigms, including divide-and-conquer, dynamic programming, greedy, backtracking, branch-and-bound, and approximation techniques to solve computational problems..

CLO3: Analyze and compare the performance of algorithms based on their correctness, time complexity, and space complexity using theoretical and experimental approaches.

CLO4: Design, implement, test, and evaluate efficient algorithmic solutions for real-world computational and optimization problems using appropriate data structures and programming techniques.

Sl. No	Lab Experiments
1	Implement and analyze Breadth-First Search (BFS) to identify all the nodes reachable from a given source vertex in a directed graph.
2	Implement and analyze Depth-First Search (DFS) to determine the connectivity of a graph.
3	Implement and analyze Topological Sorting for a given directed acyclic graph (DAG).
4	Implement and analyze the Merge Sort algorithm for different input sizes and evaluate its time complexity.
5	Implement and analyze the Quick Sort algorithm and study its performance for different input sizes.
6	Implement and analyze the Knuth–Morris–Pratt (KMP) String Matching Algorithm
7	Implement and analyze the 0/1 Knapsack problem using the Dynamic Programming approach.

8	Implement and analyze Prim's and Kruskal's algorithms to construct the Minimum Spanning Tree (MST) of a weighted graph.
9	Implement and analyze the Travelling Salesman Problem (TSP) using Branch and Bound.
10	Implement and analyze a 2-Approximation Algorithm for the Vertex Cover Problem and evaluate its performance.

Course Outcomes:

CO1:	Implement fundamental graph, sorting, and string-matching algorithms, and analyze their computational performance.
CO2:	Implement dynamic programming and greedy algorithms to solve optimization and graph problems, and analyze their computational efficiency.
CO3:	Implement branch-and-bound and approximation algorithms for combinatorial optimization problems, and evaluate their performance.

Semester: 4th Semester	**Scheme: P25**	
Course Title: Industry Agile Project Studio		
Course Code: P25PBL4083C	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 2:0:0	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 42	**Exam Hours: 03**	
Team work + Self-study Hrs:		
Credits: 2		

Prerequisite:

Nil. Working knowledge of Python and basic machine learning concepts is desirable.

Course learning Objectives: This course will enable the students to:

CLO1: Develop a recommendation-system data foundation by generating synthetic datasets, engineering customer and product features, and implementing ETL pipelines for recommender model development.

CLO2: Build and evaluate baseline recommendation models using popularity-based, collaborative filtering, and matrix factorization techniques as benchmark recommenders.

CLO3: Design and implement hybrid recommendation systems by combining embeddings, vector search, content-based filtering, collaborative signals, and Learn-to-Rank models to improve recommendation performance.

CLO4: Develop conversational recommendation solutions using Retrieval-Augmented Generation (RAG), vector databases, prompt engineering, and open-source large language models.

CLO5: Deploy, evaluate, and demonstrate production-ready recommendation services using FastAPI, dashboards, A/B testing, and industry-standard recommendation metrics.

Unit 1:	**Hrs: 14**

Data Engineering and Baseline Recommender

Sprint Goal: Build UrbanNest Furnishings' data foundation and benchmark baseline recommenders.

Tasks:

- Collect or generate data – download Kaggle furniture datasets or generate synthetic data with SDV, YData Synthetic or Faker (target 500+ products, 2000+ users).
- Create the product dataset (category, material, colour, style, price, rating) with product descriptions for embeddings, and generate user purchase, view, cart and wishlist data.
- Clean and pre-process the data – normalise names and categories, handle missing prices/discounts, build master product tables and encode categorical variables.
- Engineer customer-level RFM features (Recency, Frequency, Monetary) and product attribute features.
- Build an ETL pipeline with Prefect or Airflow (ingestion, transformation, scheduled runs, logged metrics) and a sparse user–item interaction matrix, handling cold-start users/items.
- Implement Popularity, user-based CF, item-based CF and ALS matrix-factorisation baselines; evaluate with Precision@K, Recall@K, MAP@K, Coverage, Diversity, RMSE and MAE.
- Write the Sprint 1 SRS document (architecture overview, data governance and privacy, security controls, MLOps strategy) and unit tests.

Deliverables:

- Week 1 – Synthetic Furniture Dataset with data dictionary, feature-engineering pipeline (RFM and product features), EDA report and cleaned dataset (CSV/Parquet).

- Week 2 – ETL pipeline (Prefect/Airflow DAG) with baseline recommenders (Popularity, CF, ALS), evaluation report, unit tests and SRS Sprint 1.

Text Book Mapping:

Unit 2:	**Hrs: 14**

Embeddings, Vector Database, Hybrid Models and RAG

Sprint Goal: Build embedding-based, hybrid and conversational recommenders that improve on the baseline.

Tasks:

- Create product description text from attributes and generate sentence-transformer embeddings (all-MiniLM-L6-v2, all-mpnet-base-v2 or bge-base-en-v1.5).
- Set up a vector database (ChromaDB, FAISS or Milvus), index the embeddings and implement vector search for content-based recommendation.
- Design hybrid recommendation logic combining CF score, embedding similarity, price sensitivity, style preference and simulated CTR; build the (user, item) feature matrix for Learn-to-Rank.
- Train a Learn-to-Rank model (XGBoost/LightGBM, pairwise or lambdarank objective), tune with Optuna and implement the hybrid_recommend function; compare against the baseline on NDCG@10 and Precision.
- Set up a RAG framework (LangChain, Haystack or LlamaIndex), connect the vector store as retriever and run an open-source LLM locally (Llama 3, Mistral or Phi-3 via Ollama, llama.cpp or vLLM).
- Build the RAG chain (query → retrieve products → generate response), write 10–15 personalisation prompt templates and evaluate response quality and hallucination.

Deliverables:

- Week 3 – Product embeddings and vector database with content-based recommender, embedding evaluation and search demo.
- Week 4 – Hybrid recommender with trained LTR model, Optuna hyperparameter study and evaluation report (hybrid vs baseline).
- Week 5 – RAG pipeline with local LLM integration, personalisation prompts, conversational recommender chat interface and RAG evaluation.

Text Book Mapping:

Unit 3:	**Hrs: 14**

MLOps, Deployment, Governance and Final Benchmarking

Sprint Goal: Productionise the recommender as a deployed service with a dashboard and A/B test analysis.

Tasks:

- Design the API architecture – endpoints for collaborative, embedding, hybrid and conversational recommendation, request/response schemas and authentication.
- Implement the FastAPI recommendation service exposing all recommendation models.
- Build a Streamlit or Gradio dashboard with user selector, product cards with images, filters and

a chat interface for the RAG recommender.

- Integrate all models into the dashboard and run an A/B test simulation comparing baseline versus hybrid and RAG recommenders.
- Finalise the API documentation (OpenAPI spec, usage examples) and the complete SRS, and present the final demonstration.

Deliverables:

Week 6 – Deployed FastAPI recommendation service with Streamlit/Gradio dashboard, A/B test results, and complete API and SRS documentation with final demonstration.

Text Book Mapping:

Course Outcomes

CO1	Generate and engineer a synthetic furniture dataset with RFM features and an ETL pipeline, and implement and evaluate baseline recommenders (Popularity, CF, ALS).
CO2	Build embedding-based, hybrid Learn-to-Rank and RAG-powered conversational recommenders with a vector database and a local LLM, demonstrating measurable NDCG improvement.
CO3	Deploy the recommender as a FastAPI service with a dashboard, run an A/B test comparing models, and document the system through API and SRS documentation.

Suggested Learning Resources:

Textbooks:

Sl. No.	Title	Author	Year & Edition (Latest)	Publisher
1.	Recommender Systems: The Textbook Link: https://doi.org/10.1007/978-3-319-29659-3	Charu C. Aggarwal	2016, 1st Edition	Independently Published (Amazon KDP)
2.	Practical Recommender Systems Link: https://www.manning.com/books/practical-recommender-systems	Kim Falk	2019, 1st Edition	
3.	Hands-On Large Language Models: Language Understanding and Generation Link: https://www.llm-book.com/	Jay Alammar, Maarten Grootendorst	2024, 1st Edition	

Reference Books:

1.	FastAPI Documentation Link: https://fastapi.tiangolo.com/	Sebastián Ramírez	Latest version	FastAPI (open source)
2.	LangChain Python Documentation Link: https://python.langchain.com/docs/	LangChain	Latest version	LangChain (open source)
3.	Sentence-Transformers Documentation Link: https://www.sbert.net/	UKPLab / Hugging Face	Latest version	Sentence-Transformers (open source)

Web links and Video Lectures (e-resources)
1. SDV (Synthetic Data Vault) Documentation: https://docs.sdv.dev/ 2. Implicit – Fast Collaborative Filtering: https://implicit.readthedocs.io/ 3. Prefect Documentation: https://docs.prefect.io/ 4. Google Research – Recommender Systems: https://research.google/pubs/tag/recommender-systems/ 5. Surprise – Recommender System Library: https://surpriselib.com/

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
3. Individual Role play/Team Demonstration/ Collaborative Activity: Students rotate through various roles of project teams and give weekly sprint walkthroughs of their findings and dashboards. 4. Case study: Each team adopts one of the several scenarios and carries it through all three sprints.

Semester: 4th Sem	**Scheme: P25**	
Course Title: Employability Enhancement Skills – IV		
Course Code: P25HSMC409A	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:2:0	**SEE Marks: 100**	**SEE Weightage:50%**
Teaching hours of Pedagogy: 48 Hours	**Exam Hours: 2Hours**	
Team work + Self-study Hrs: As per the self-study components indicated unit-wise		
Credits: 1		

Prerequisite:

Employability Enhancement Skills – III (C programming fundamentals)

Course learning Objectives:

CLO1: Perform calculations involving simple and compound interest, averages, alligations & mixtures, proportions, variations and partnership

CLO2: Explain concepts behind logical reasoning modules of series, coding & decoding, seating and data arrangements.

CLO3: Develop problem solving skills through data structures.

Unit 1:	**Hrs: 8**

Quantitative Aptitude: Simple and Compound Interest, Averages.

Logical Reasoning: Series, Coding & Decoding.

Self-study component: Mensuration.

Unit 2:	**Hrs: 8**

Quantitative Aptitude: Alligations and Mixtures, Ratios, Proportions and Variations.

Logical Reasoning: Seating Arrangement, Data Arrangement.

Self-study component: Types of cryptarithm.

Unit 3:	**Hrs: 8**

Quantitative Aptitude: Partnership.

Verbal Ability: Sentence Completion, Ordering of Sentences.

Self-study component: Game based assessments.

Unit 4:	**Hrs: 8**

DATA STRUCTURES I – PROBLEM SOLVING TECHNIQUES AND OBJECT-ORIENTED PROGRAMMING

Recursion: Introduction to recursion, Principle of mathematical induction, Fibonacci numbers, Recursion using arrays, Recursion using strings, Recursion using 2D arrays.

Time and Space Complexity: Order complexity analysis, Theoretical complexity analysis, Time complexity analysis of searching and recursive algorithms, Theoretical space complexity, Space complexity analysis of merge sort.

Backtracking: Introduction to Backtracking, Rat in a Maze, N-queen, Word Search.

Basics of OOP: Introduction to OOPs, Creating objects, Getters and setters, Constructors and related concepts, Inbuilt constructor and destructor, Example classes.

Advanced Concepts of OOP: Static members, Function overloading and related concepts, Abstraction, Encapsulation, Inheritance, Polymorphism, Virtual functions, Abstract classes, Exception handling.

Self-study component: Examples of Abstract Data Type.

Unit 5:	Hrs: 8

DATA STRUCTURES II – LINEAR DATA STRUCTURES AND TREES

Linked Lists: Introduction to linked list, Inserting node in linked list, Deleting node from linked list, Midpoint of linked list, Merge two sorted linked lists, Merge sort of a linked list, Reversing a linked list.

Stacks and Queues: Introduction to stacks, Stack using arrays, Dynamic Stack class, Stack using linked list, Inbuilt stack, Queue using arrays, Dynamic queue class, Queue using linked list, Inbuilt queue.

Generic Trees: Introduction to Trees, Making a tree node class, Taking a tree as input and printing, Tree traversals, Destructor for tree node class.

Binary Trees: Introduction to Binary Trees, Taking a binary tree as input and printing, Binary Tree traversals, Diameter of binary tree.

Binary Search Trees: Introduction to Binary Search Trees, Searching a node in BST, BST class, Inserting and Deleting nodes in BST, Types of balanced BSTs.

Self-study component: Huffman tree, Expression Trees.

Course Outcomes

CO1	Solve the problems based on simple and compound interests, averages, alligations & mixtures, ratios, proportions, variations and partnerships.
CO2	Solve logical reasoning problems based on seating arrangements, data arrangement and verbal ability skills of sentence corrections and ordering of sentences.
CO3	Analyze and represent various data structures and their operations.
CO4	Develop programs with suitable data structures based on the requirements of real-time applications.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition (Latest)	Publisher
1.	Data Structures and Algorithms	Narasimha Karumanchi	5th Ed., 2016	CareerMonk
2.	Data Structures Through C in Depth	S. K. Srivastava & Deepali Srivastava	2nd Ed., 2011	BPB Publications
3.	Quantitative Aptitude	Dr. R. S. Aggarwal	RevisedEd., 2022	S. Chand
4.	Verbal Reasoning	Dr. R. S. Aggarwal	RevisedEd., 2018	S. Chand

Reference Books:

1.	Data Structures Using C	Tenenbaum, Langsam & Augenstein	Low Price Ed., 2014	Pearson Education
2.	Data Structures with C (Schaum's Outline Series)	Seymour Lipschutz	2017	McGraw Hill Education
3.	Quantitative Aptitude	Arun Sharma	Latest Ed.	McGraw Hill Education

Web links and Video Lectures (e-resources)
1. Data Structures and Algorithms (NPTEL) – https://nptel.ac.in/courses/106102064 2. Data structures tutorials and practice – https://www.geeksforgeeks.org/data-structures/ 3. Algorithm visualisations – https://visualgo.net/en 4. DSA practice problems – https://www.hackerrank.com/domains/data-structures 5. Aptitude and reasoning practice – https://www.indiabix.com/

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. Algorithm visualisation lab using VisuAlgo (Learn by Doing) 2. Pair programming – linked list and stack implementations 3. Flip Class on recursion and complexity analysis 4. Timed aptitude drills simulating placement tests 5. Peer code review of data structure implementations

Semester: 4th Sem	**Scheme: P25**	
Course Title: National Service Scheme (NSS)		
Course Code: P25MAN4101	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks:**	**SEE Weightage:**
Teaching hours of Pedagogy: 24P	**Exam Hours: 1.5 Hours**	
Team work + Self-study Hrs: As per the self-study components indicated unit-wise		
Credits: 0		

Prerequisite:

Course learning Objectives:

CLO1: Understand the community in general in which they work.
CLO2: Identify the needs and problems of the community and involve them in problem - solving.
CLO3: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CLO4: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Unit 1:	**Hrs: 4**

RURAL ECONOMY, AGRICULTURE AND LIVELIHOODS

Rural economy and livelihood opportunities. Organic farming and sustainable agricultural practices. Indian agriculture – **Past, Present and Future**. Agricultural marketing and connectivity between farmers and markets. Role of cooperatives, self-help groups and farmer organizations. Waste management in rural areas – **5 R's: Refuse, Reduce, Reuse, Repurpose and Recycle**. Role of public, private and government organizations in rural development.

Unit 2:	**Hrs: 4**

WOMEN EMPOWERMENT AND COMMUNITY PARTICIPATION

Importance of women's participation in social and economic development. Formation and functioning of women's groups and Self-Help Groups (SHGs). Information and awareness campaigns for women. Role of women in household income generation and entrepreneurship. Social and economic issues affecting rural women. Identification of local resources and community strengths. Community participation, leadership and collective decision-making.

Unit 3:	**Hrs: 4**

WATER, WASTE AND ENVIRONMENTAL SUSTAINABILITY

Importance of water conservation in rural areas. Sources, utilization and challenges of rural water resources. Rainwater harvesting and groundwater recharge. Sustainable water management systems for rural areas. Role of different stakeholders in planning and implementation. Solid waste management and the 5 R's. Environmental protection, sanitation and community participation. Plantation and adoption of plants – **"Know Your Plants"**.

Unit 4:	**Hrs: 6**

RURAL DEVELOPMENT, EDUCATION AND GOVERNMENT INITIATIVES

Role of education in rural development. Identification of challenges faced by rural schools. Supporting schools to improve enrolment and continuation in higher/technical/vocational education. School infrastructure and rejuvenation initiatives. Major Government of India initiatives for socio-economic development: Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharat, Make in India, MUDRA Scheme, Skill Development and Entrepreneurship programmes. Role of government departments, NGOs and other stakeholders in

implementation.	
Unit 5:	**Hrs: 6**
SOCIAL RESPONSIBILITY, OUTREACH AND COMMUNITY DEVELOPMENT Social connect and responsibilities of students towards the community. Public awareness under rural outreach programmes. Planning and conducting awareness campaigns. National integration and social harmony. Community participation and social responsibility. Preparing an actionable business proposal for enhancing village income. Identification of local problems and preparation of community-based solutions. Documentation, presentation and evaluation of community engagement activities.	

Course Outcomes

CO1	Explain the major social, economic, agricultural and livelihood characteristics of rural communities.
CO2	Identify and propose sustainable practices related to organic farming, waste management, water conservation and environmental protection.
CO3	Demonstrate awareness of the role of women, community organizations, government agencies and other stakeholders in rural development.
CO4	Identify community needs and develop feasible solutions or proposals for improving education, livelihoods, infrastructure and village income.
CO5	Plan and participate effectively in community outreach, awareness, social harmony and environmental activities while demonstrating social responsibility, teamwork and leadership.

Suggested Learning Resources:

Textbooks:

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. **Government of Karnataka,** NSS cell, activities reports and its manual.
3. **Government of India, NSS cell, Activities reports and its manual.**

Reference Books:

1.	Rural Development: Principles, Policies and Management	Katar Singh		Sage Publications
2.	Agriculture and Rural Development	M. S. Swaminathan	2009	

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

At the end of every semester, activity report should be submitted for evaluation.

Pedagogy - Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

SI No	Topic	Group size	Location	Activity execution	Report	Evaluation
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	Individual /Team	Farmers land/Villages/ roadside / community area/ College campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	NSS officer /co ordinators as per rubrics
2.	Waste management Public, Private and Govt organization, 5 R's.	Individual /Team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.... .	Site selection /proper consultation/Continuous monitoring/ Information board		
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	Individual /Team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc.....	Group selection/pro per consultation/Continuous monitoring/ Information board		
4.	Water conservation techniques - Role of different stakeholders Implementation.	Individual /Team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.... .	site selection / proper consultation/Continuous monitoring/ Information board		
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	Individual /Team		Group selection/pro per consultation/Continuous monitoring/ Information board		

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	Individu al /Team	Local government / private/ aided schools/Govern men t Schemes officers/ etc.....	School selection/proper consultation/Conti nuo us monitoring/ Information board		
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	Individu al /Team	Villages/ City Areas / Grama panchayat/ public associations/Gov ern ment Schemes	site selection/proper c onsultation/Contin uo us monitoring/ Information board		
8.	Contribution to any national level initiative of Government of India. For Eg. Digital India, Skill India, Swachh Bharat, Atmanirbh ar Bharath, Make in India, Mudra scheme, Skill development progr ams etc.	Individu al /Team		Group selection/pro per consultation/Conti nuo us monitoring / Information board		
9.	Spreading public awareness under rural outreac h programs. (minimum5 programs). Social connect and responsibilities.	Individu al /Team		Group selection/pro per consultation/Conti nuo us monitoring / Information board		
10.	Plantation and adoption of plants. Know your plants.	Individu al /Team		Place selection/proper co nsultation/Continuo us monitoring / Information board		

Semester: 4th Sem	**Scheme: P25**	
Course Title: YOGA		
Course Code: P25MAN4102	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24P	**Exam Hours: 1.5 Hours**	
Team work + Self-study Hrs:		
Credits: 0		

Prerequisite:

Basic knowledge of human body and physical movements, willingness to participate in yogic practices, and awareness of basic health and safety practices. No prior knowledge of Yoga is required.

Course learning Objectives:

CLO1: Explain the origin, history, philosophy, objectives, and different schools of Yoga, along with its role in promoting holistic health and well-being.

CLO2: Understand and apply the rules, regulations, and ethical practices associated with Yogic exercises, including the significance of prayer and Suryanamaskara.

CLO3: Demonstrate the correct techniques of selected Yogasanas, such as sitting, standing, prone, and supine postures, while observing appropriate precautions.

CLO4: Analyse the physical, mental, and therapeutic benefits of Yogic practices and distinguish between authentic Yogic practices and common misconceptions about Yoga.

CLO5: Adopt Yoga as a regular lifestyle practice to enhance physical fitness, mental wellness, discipline, and overall quality of life.

Unit 1:	**Hrs: 4**

Introduction of Yoga

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga.

Unit 2:	**Hrs: 4**

Prayer

Importance of prayer Brief introduction of yogic practices for Yogic practices for common man to promote positive health, Rules and regulations: Rules to be followed during yogic practices by practitioner

Unit 3:	**Hrs: 4**

Suryanamaskara

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds, Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices

Unit 4:	**Hrs: 6**

Asanas - Sitting

Different types of Asanas: Asana, Need, importance of Asana. Different types of asanas. Asana its meaning by name, technique, precautionary measures and benefits of each asana, Sitting 1. Padmasana, 2. Vajrasana, Standing 1. Vrikshana, 2. Trikonasana.

Unit 5:	Hrs: 6
Asanas – Prone Line Different types of Asanas: Asana, Need, importance of Asana. Different types of asanas. Asana its meaning by name, technique, precautionary measures and benefits of each asana. Prone line 1. Bhujangasana, 2. Shalabhasana, Supine line 1. Utthitadvipadasana, 2. Ardhahalasana	

Course Outcomes

CO1	
CO2	
CO3	
CO4	
CO5	

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	The Yoga Tradition: Its History, Literature, Philosophy, and Practice	Georg Feuerstein	2001	Hohm Press
2.	The Complete Book of Yoga: Harmony of Body and Mind	Sri Ananda	2017	Orient Paperbacks
3.	Light on the Yoga Sutras of Patanjali	B. K. S. Iyengar	2012	HarperCollins
4.	Science of Divinity and Realization of Self	Vethathiri Maharishi	---	Vethathiri Maharishi Store, Erode

Reference Books:

1.	Principles and Practice of Yoga in Health Care	Sat Bir Singh Khalsa, Lorenzo Cohen, Timothy McCall, Shirley Telles & Holger Cramer	2024	Jessica Kingsley Publishers / Handspring Publishing
2.	Yoga in School Health	I. V. Basavaraddi	2009	Morarji Desai National Institute of Yoga (MDNIY), New Delhi
3.	Yoga Research and Application	H. R. Nagendra	---	Vivekananda endra Yoga Prakashana, \Bengaluru
4.	A Glimpses of the Human Body	Shirley Telles	1999	Vivekananda Kendra Yoga Prakashana, Bengaluru

Web links and Video Lectures (e-resources)
1. Ministry of AYUSH – Common Yoga Protocol 2. Morarji Desai National Institute of Yoga (MDNIY) 3. MDNIY – Video Gallery

Active Based Learning (Suggested Activity in Class)/ Practical Based Learning (Example)
1. **Flip Class:** Yoga history, origin, development and misconceptions. . 2. **Seminar/Poster Presentation:** Schools, meanings, definitions and importance of Yoga and prayer 3. **Role Play/Team Demonstration:** Rules, Suryanamaskara and selected Asanas. 4. **Case Study:** Application of Yoga for positive health and common misconceptions. 5. **Learn by Doing:** Suryanamaskara (12 counts, 2 rounds) and prescribed Asanas with technique, precautions and benefits.

Semester: 3rd Sem	**Scheme: P25**	
Course Title: Physical Education		
Course Code: P25MAN4103	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24P	**Exam Hours: 1.5 Hours**	
Team work + Self-study Hrs:		
Credits: 0		

Prerequisite:

Basic awareness of physical fitness, health, wellness, and willingness to participate in sports and physical activities.

Course learning Objectives:

CLO1: Develop awareness of the importance of a healthy lifestyle, physical fitness, wellness, and regular physical activity.

CLO2: Assess and improve physical fitness through pre-fitness testing and structured activities focusing on strength, speed, flexibility, endurance, and general fitness.

CLO3: Develop fundamental physical skills through appropriate warm-up, free-hand exercises, and fitness activities.

CLO4: Acquire basic skills and techniques in selected traditional and team games such as Kabaddi and Kho-Kho.

CLO5: Promote teamwork, discipline, sportsmanship, coordination, leadership, and healthy competitive spirit through participation in physical and sporting activities.

Unit 1:	**Hrs: 4**

Orientation

A. Lifestyle

B. Health & Wellness

C. Pre - Fitness test.

Unit 2:	**Hrs: 4**

General Fitness & Components of Fitness

A. Warming up (Free-Hand exercises)

B. Strength – Push-up / Pull-ups

C. Speed – 30 Mtr Dash

Unit 3:	**Hrs: 16**

Games

Specific games (Any one game to be selected by the student)

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Course Outcomes

CO1	**(Bloom's Level 1 – Remember):** Recall the fundamental concepts of lifestyle, health, wellness, physical fitness, and components of fitness.
CO2	**(Bloom's Level 2 – Understand):** Explain the importance of warm-up, strength, speed, fitness exercises, and regular physical activity in maintaining health and overall well-being.
CO3	**(Bloom's Level 3 – Apply):** Demonstrate and apply the basic skills, techniques, and rules of Kabaddi or Kho-Kho and participate effectively in physical fitness and sports activities.

Suggested Learning Resources:				
Textbooks:				
Sl. No	**Title**	**Author**	**Year & Edition**	**Publisher**
1.	A Textbook on Physical Education & Health Education: Fitness, Wellness and Nutrition	A. K. Uppal & P. P. Ranganathan	2018, 1st Edition	Friends Publications (India)
2.	Science of Sports Training	Dr. Hardayal Singh	2023, 1stEdition	Friends Publications (India)
3.	Kabaddi: Skills, Drills, Tactics and Strategies	Dr. Sudhakara G. & Dr. Ravindra Gouda S. M.	2020, 1stEdition	Sports Publication, New Delhi
4.	How to Play Kho-Kho	Naval Kishore	2016, 1stEdition	Sports Publications, New Delhi
Reference Books:				
1.	Corbin's Concepts of Fitness and Wellness: A Comprehensive Lifestyle Approach	Welk, G. J., Corbin, C. B., Corbin, W. R. & Welk, K. A.	2026, 13th Edition	McGraw Hill
2.	Measurement and Evaluation in Human Performance	James R. Morrow Jr., Dale P. Mood, Weimo Zhu & Minsoo Kang	2023, 6th Edition,	Human Kinetics
3.	A Text Book on Kabaddi: Kabaddi, Skills Techniques and Strategies	S. Muniraju	2015, 6th Edition	LAP Lambert Academic Publishing
4.	Manual of Kabaddi	Biswajit Sardar & Kavita Verma	2014, 1st Edition	International E Publication
5.	Kho-Kho	Sanjay Khalatkar	2016, 2nd Edition	Nachiket Prakashan

Web links and Video Lectures (e-resources)
1 World Health Organization (WHO), Physical Activity and Health: https://www.who.int/health topics/physical-activity
2. Khelo India Fitness Assessment, Sports Authority of India: https://schoolfitness.kheloindia.gov.in/
3. NPTEL–IIT Madras, Introduction to Exercise Physiology & Sports Performance: https://nptel.ac.in/courses/109106406
4. NPTEL–IIT Madras, Strength & Conditioning for the Indian Population: https://nptel.ac.in/courses/109106404
5. Amateur Kabaddi Federation of India (AKFI), Rules and Resources: https://www.indiankabaddi.org/
6. Kho Kho Federation of India (KKFI), Rules & Regulations: https://khokhofederation.in/rules regulations/
7. Kho Kho Federation of India (KKFI), Video Resources: https://khokhofederation.in/videos/

Semester:4th Sem	**Scheme: P25**	
Course Title: Creative Arts and Culture		
Course Code: P25MAN4104	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P) 0:0:1	**SEE Marks: 50**	**SEE Weightage: 50%**
Teaching hours of Pedagogy: 24P	**Exam Hours:**	
Team work + Self-study Hrs:		
Credits: 0		

Prerequisite:

Basic awareness of physical fitness, health, wellness, and willingness to participate in sports and physical activities.

Course learning Objectives:

CLO1: Develop awareness of the importance of a healthy lifestyle, physical fitness, wellness, and regular physical activity..

CLO2: Assess and improve physical fitness through pre-fitness testing and structured activities focusing on strength, speed, flexibility, endurance, and general fitness.

CLO3: Develop fundamental physical skills through appropriate warm-up, free-hand exercises, and fitness activities.

CLO4: Acquire basic skills and techniques in selected traditional and team games such as Kabaddi and Kho-Kho.

CLO5: Promote teamwork, discipline, sportsmanship, coordination, leadership, and healthy competitive spirit through participation in physical and sporting activities.

Unit 1:	**Hrs: 4**

Introduction to Performing Arts

Performing arts as a form of cultural expression. Introduction to: Music, Dance, Drama/Theatre. Relationship between music, dance, drama. Role of performing arts in festivals, celebrations and social life. Introduction to classical, folk and contemporary forms.

Unit 2:	**Hrs: 6**

Fundamentals of Indian Music

Origin and evolution of Indian music. Overview of Indian classical music. Introduction to Carnatic and Hindustani music. Basic concepts: Nada, Shruti, Swara, Raga, Tala, Laya. Relationship between music, language, emotion and culture. Introduction to major forms: Geethe, Swarajathi, Varna, Kriti, Tillana. Introduction to notation, Eminent composers: Purandara Dasa, Tyagaraja, Mysore Vasudevacharya.

Unit 3:	**Hrs: 4**

DANCE: TRADITION, EXPRESSION

Introduction to Indian Dance: Meaning, origin and significance of dance. Dance as a medium of cultural expression. Classical and folk-dance traditions of India. Major Indian classical dance forms: Bharatanatyam, Kathak, Kathakali, Kuchipudi, Major folk and regional dance traditions. Traditional dance forms of Karnataka. **Elements of Dance:** Basic concepts of: Movement, Rhythm, Gesture, Expression, Posture, Coordination.

Unit 4:	**Hrs: 4**

DANCE PERFORMANCE

Introduction to **Abhinaya** and expression. Relationship between music, rhythm and movement. Dance as storytelling. **Practical Dance Activities,** Basic movement and rhythm exercises. Hand gestures and simple expressions. Group choreography. Folk/classical dance demonstration. Preparation of a short cultural dance presentation.

Unit 5:	Hrs: 6
DRAMA, THEATRE AND CREATIVE COMMUNICATION Introduction, meaning and significance of drama. Development of Indian theatre traditions, Classical, folk and modern theatre, regional theatre traditions. Drama as a medium of communication and social awareness. Characterization, Dialogue and Voice modulation. Body language and stage presence. Direction and stagecraft. Basic concepts of costume, props, lighting and sound. Public speaking. Anchoring and event hosting, mime and improvisation. Script writing. Short skit development, Drama for social awareness.	

Course Outcomes

CO1	**Describe and appreciate** Indian cultural heritage and the major traditions of music, dance and drama.
CO2	**Interpret and respond to** artistic expressions by recognizing their cultural, emotional and social dimensions.
CO3	**Communicate and collaborate effectively** in cultural performances, creative activities and group projects.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	Theory of Music	Vasantha Madhavi	*2007*	Prism Publication
2.	Indian Classical Dance	Kapila Vatsyayan		Publications Division, Government of India.
3.	The Natyasastra: English Translation with Critical Notes	Adya Rangacharya		Karnataka University
4.	Indian Theatre: Tradition and Modernity	Suresh A. Goel,		

Web links and Video Lectures (e-resources)

1. https://ignca.gov.in/online-digital-resources/
2. https://digital.nios.ac.in/topic.php?id=243en&

Semester:4th Sem	**Scheme: P25**	
Course Title: Basic Engineering Mathematics – II		
Course Code: P25MADIP401	**CIE Marks: 50**	**CIE Weightage: 50%**
Teaching hours/week (L:T:P:S) 2:2:0:0		
No of lecture hours per week: 04	**Exam Hours:**	
Credits: 0		

Prerequisite:

Course learning Objectives:

To provide essential concepts of linear algebra, introductory concepts of second & higher order differential equations along with various techniques/methods to solve them, Laplace & inverse Laplace transforms and elementary probability theory.

Unit 1:	**Hrs: 8**

Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations – Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and Eigen vectors of a square matrix.
Self-study Components: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.

Textbook Mapping:	**Textbook 1:** Chapter 2.1, 2.7, 2.10, 2.13.

Unit 2:	**Hrs: 8**

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators and variation of parameters. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation.
Self-study Components: Method of undetermined coefficients

Textbook Mapping:	**Textbook 1:** Chapter 13.1, 13.4, 13.6, 13.8, 13.9.

Unit 3:	**Hrs: 8**

Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration.
Vector Integration: Vector Integration: Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems.
Self-study Components: Orthogonal curvilinear coordinates.

Textbook Mapping:	**Textbook 1:** Chapter 7.1 – 7.2, 8.11 – 8.13.

Unit 4:	**Hrs: 8**

Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function- Problems only. Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods.
Self-study Components: Application to solutions of linear differential equations and simultaneous differential equations.

Textbook Mapping:	**Textbook 1:** Chapter 21.1 – 21.13

Unit 5:	Hrs: 8
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. **Self-study Components:** State and prove Bayes's theorem.	
Textbook Mapping:	**Textbook 1:** Chapter 26.1 – 26.6.

Course Outcomes

CO1	Apply matrix theory for solving systems of linear equations in the different areas of linear algebra.
CO2	Solve second and higher order differential equations occurring in electrical circuits, damped/un-damped vibrations.
CO3	Identify-the technique of integration evaluates double and triple integrals by change of variables, and vector integration technique to compute line integral
CO4	Explore the basic concepts of elementary probability theory and apply the same to the problems of decision theory,

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	Higher Engineering Mathematics	B. S. Grewal	43rd Ed.,2015.	Khanna Publishers, New Delhi

Reference books:

1.	Advanced Engineering Mathematics,	E. Kreyszig	10th Ed., 2015.	John Wiley & Sons
2.	Engineering Mathematics	N. P. Bali and Manish Goyal	7th Ed., 2007.	Laxmi Publishers

Semester: 4th Sem	**Scheme: P25**	
Course Title: Additional Communicative English – II		
Course Code: P25HDIP409	**CIE Marks: 100**	**CIE Weightage: 100%**
Teaching hours/week (L:T:P) 0:2:0	**SEE Marks: -**	**SEE Marks: -**
Total number of Teaching Hrs:	**Exam Hours: 3Hrs**	
Teaching hours of Pedagogy: 30 Hours		
Credits: 0		
Prerequisite:		
Course learning Objectives:		

Unit 1:	**Hrs: 6**
Introduction to Communication Skills Introduction to communication, Meaning and process, Channels of communication, Elements of communication, Barriers to effective communication. Activities - Making introductions, Sharing personal information, Describing feelings and opinions.	
Unit 2:	**Hrs: 4**
Listening Skills I Hearing vs. Listening, Types of listening, Determinants of good listening, Active listening process, Barriers to listening, Activities - Listening for pronunciation practice, Listening for personal communication, Listening for communication - language functions	
Unit 3:	**Hrs: 6**
Speaking Skills I Basics of speaking, Elements and Functions of speaking, Structuring your speech, Focusing on fluency, Homographs and Signpost words. Activities – Free Speech and Pick and Speak	
Unit 4:	**Hrs: 4**
Reading Skills I Developing reading as a habit, Building confidence in reading, improving reading skills, Techniques of reading - skimming and scanning. Activities - understanding students' attitudes towards reading, countering common errors in reading, developing efficiency in reading. **Writing Skills I** Improving writing skills, Spellings and punctuation, Letter and Paragraph writing. Activity – Writing your personal story	
Unit 5:	**Hrs: 4**
Body Language and Presentation Skills Elements of body language, Types, Adapting positive body language, Cultural differences in body language. 4 Ps in presentations, Overcoming the fear of public speaking, Effective use of verbal and nonverbal presentation techniques. Activity – Group presentations	

Course Outcomes

CO1	Understand the role of communication in personal and professional success
CO2	Comprehend the types of technical literature to develop the competency of students to Apprehend the nature of formal communication requirements.
CO3	Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence
CO4	Demonstrate effective individual and teamwork to accomplish communication goals.

Suggested Learning Resources:

Textbooks:

Sl. No	Title	Author	Year & Edition	Publisher
1.	Communication Skills	Sanjay Kumar and Pushpa Lata	2015	Oxford University Press
2.	Everyday Dialogues in English	Robert J.	2006	Dixson, Prentice-Hall of India Ltd.,
3.	Developing Communication Skills	Krishna Mohan& Meera Banerjee (Macmillan)		
4.	The Oxford Guide to Writing and Speaking	John Seely		Oxford.