NUTAN MAHARASHTRA VIDYA PRASARAK MANDAL'S

NUTAN MAHARASHTRA INSTITUTE OF ENGINEERING AND TECHNOLOGY

AN AUTONOMOUS INSTITUTE | UNDER ADMINISTRATIVE SUPPORT OF PCET

Curriculum Structure and Syllabus of Second Year B.Tech Computer Science and Engineering (Artificial Intelligence) (2025 Pattern)

Nutan Maharashtra Vidya Prasarak Mandal's (NMVPM's)

NUTAN MAHARASHTRA INSTITUTE OF ENGINEERING AND TECHNOLOGY (NMIET)

An Autonomous Institute from 2025 - 26

Under Administrative Support - Pimpri Chinchwad Education Trust (PCET)

ESTD 1966

Course Approval Summary – Board of Studies CSE(AI)

Sl. No.	Approved By	Signature and Stamp of Authority
1	Chairman, Board of Studies, CSE(AI)	COMPUTER SCIENCE & ENGINEERING (AI) NMIET
2	Secretary, Academic Council, NMIET, Pune	
3	Chairman, Academic Council, NMIET, Pune	Director Nutan Maharashtra Institute of Engineering & Technology Talegaon Dabhade - 410507

VISION OF THE INSTITUTE

To be a notable institution for providing quality technical education and ensuring ethical, moral and holistic development of students.

MISSION OF THE INSTITUTE

To nurture engineering graduates with state of the art competence, professionalism and problem solving skills to serve needs of industry as well as society.

VISION OF COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE)

Excellence in the domain of Artificial Intelligence towards serving the greater cause of society and globally recognized for contributing professional engineers with a commitment to readiness of industry-oriented skill through potential research.

MISSION OF COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE)

- To develop skill-based education and ethical professionals for students that will enhance expertise in the field of AI through industry-institute interaction and research.
- To apply new optimized advanced methods in problem solutions for various challenges in society.
- To contribute towards innovation through interdisciplinary and analytical skills.

INDEX

COURSE-WISE CREDIT DISTRIBUTION

Sl. No.	Type of Course	No. of Courses	Total Credits	
			No.	%
1.	Basic Science Course (BSC)	8	14	8.14
2.	Engineering Core Course (ECC)	10	15	8.72
3.	Programme Core Course (PCC)	28	54	31.40
4.	Programme Elective Course (PEC)	9	20	11.63
5.	Multidisciplinary Minor (MDM)	7	13	7.56
6.	Open Elective Course (OEC)	3	8	4.65
7.	Vocational and Skill Enhancement Course (VSEC)	4	8	4.65
8.	Ability Enhancement Course (AEC)	2	4	2.33
9.	Entrepreneurship / Management Course(EMC)	2	4	2.33
10.	Value Education Course (VEC)	2	4	2.33
11.	Experiential Learning Courses	8	22	12.79
12.	Indian Knowledge System	1	2	1.16
13.	Co-curricular Courses	2	4	2.33
TOTAL		**86**	**172**	**100**

SEMESTER-WISE COURSE DISTRIBUTION

Course Distribution: Semester Wise										
Sl. No.	**Type Of Course**	**No. of Courses / Semester**								**Total**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1.	Basic Science Course (BSC)	4	4	-	-	-	-	-	-	8
2.	Engineering Science Course (ESC)	6	4	-	-	-	-	-	-	10
3.	Programme Core Course (PCC)	-	2	5	5	5	5	4	2	28
4.	Programme Elective Course (PEC)	-	2	-	-	2	3	2	2	11
5.	Multidisciplinary Minor (MDM)	-	-	1	1	2	1	-	2	7
6.	Open Elective Course (OEC)	-	-	1	1	1	-	-	-	3
7.	Vocational and Skill Enhancement Course (VSEC)	1	1	1	1	-	-	-	-	4
8.	Ability Enhancement Course (AEC)	1		-	1	-	-	-	-	3
9.	Entrepreneurship / Management Course(EMC)	-	-	1	1	-	-	-	-	2
10.	Value Education Course (VEC)	-	-	1	1	-	-	-	-	2
11.	Experiential Learning Courses	-	-	-	1	1	1	1	1	5
12.	Indian Knowledge System	-	1	-	-	-	-	-	-	1
13.	Co-curricular Courses	1	1	-	-	-	-	-	-	2
Total		**13**	**16**	**10**	**12**	**11**	**10**	**07**	**07**	**86**

SEMESTER-WISE CREDIT DISTRIBUTION

Course Distribution: Semester Wise										
1 Lecture hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit										
Sl. No.	**Type of Course**	**No. of Courses / Semester**								**Total**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1.	Basic Science Course (BSC)	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course (ESC)	9	6	-	-	-	-	-	-	15
3.	Programme Core Course (PCC)	-	3	10	10	10	8	8	4	53
4.	Programme Elective Course (PEC)	-	-	-	-	4	8	4	4	20
5.	Multidisciplinary Minor (MDM)	-	-	2	2	4	2	-	4	14
6.	Open Elective Course (OEC)	-	-	4	2	2	-	-	-	8
7.	Vocational and Skill Enhancement Course (VSEC)	2	2	2	2	-	2	-	-	10
8.	Ability Enhancement Course (AEC)	2	-	-	2	-	-	-	-	4
9.	Entrepreneurship / Management Course(EMC)	-	-	2	2	-	-	-	-	4
10.	Value Education Course (VEC)	-	-	2	-	-	-	-	-	2
11.	Experiential Learning Courses	-	-	-	2	2	2	8	8	22
12.	Indian Knowledge System	-	2	-	-	-	-	-	-	2
13.	Co-curricular Courses	2	2	-	-	-	-	-	-	4
Total		**22**	**22**	**22**	**22**	**22**	**22**	**20**	**20**	**172**

CURRICULUM STRUCTURE

Second Year B.Tech.

Computer Science and Engineering (Artificial Intelligence)

Semester – III

Level 5.0																	
Second Year B. Tech. Computer Science and Engineering (Artificial Intelligence)																	
Semester III																	
Sl. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**							
										CCE		**ESE**					
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**	**PR**	**OR**	**TW**	**TOTAL**	
										25	**25**	**50**					
1	CAI25PCC-201	Programme Core Course	Computer Organization and GPU Architecture	2			2			25	25	50				100	
2	CAI25PCC-202	Programme Core Course	Data Structures and Algorithm	2			2			25	25	50				100	
3	CAI25PCC-203	Programme Core Course	Data Structures and Algorithm Laboratory			2			4				50		25	75	
4	CAI25PCC-204	Programme Core Course	Object-Oriented Programming using Java	2			2			25	25	50				100	
5	CAI25PCC-205	Programme Core Course	Object-Oriented Programming Using Java – Laboratory			2			4				50		25	75	
6	CAI25MDM-206	Multi-disciplinary Minor Course	Microcontroller and Applications	2			2			25	25	50				100	
7	-	Open Elective Course	Open Elective Course-I	3	1		3	1		25	25	50				100	
8	-	Value Education Course	Value Education Course-I		1	1		1	2						25	25	
9	CAI25VSEC-209	Vocational and Skill Enhancement Course	Vocational and Skill Enhancement Course- I			2			4					25	25	50	
10	IL25EMC-210	Entrepreneurship / Management Course	Principles of Management and Entrepreneurship		1	1		1	2						25	25	
TOTAL				**11**	**3**	**8**	**11**	**3**	**16**	**125**	**125**	**250**	**100**	**25**	**125**	**750**	
				22			**30**										

CCE- Comprehensive Continuous Evaluation**, ESE-** End Semester Evaluation**, TW**-Term Work, **OR**-Oral, **PR**-Practical, **L**-Lecture, **P**-Practical, **T**-Tutorial, **FA**–Formative Assessment, **SA** – Summative Assessment

Basket: List of Open Elective Course - I

Course Code	Course Name	
CE25OEC-207	Computational Mathematics	Choose Any One
CAI25OEC-207	Probability Theory and Statistical Methods	
AIDS25OEC-207	Probability and Statistics	
IT25OEC-207	Numerical Statistical Analysis	
ETC25OEC-207	Vectors and Transforms	
ME25OEC-207	Applied Mathematics	

Basket: List of Value Education Course - I

Course Code	Course Name	
CSE25VEC-208	Universal Human Values	Choose Any One
ETC25VEC-208A	Professional Ethics for Engineers	
ETC25VEC-208B	Social Connect and Responsibility	

Basket: List of Vocational and Skill Enhancement Course - I

Course Code	Course Name	
CAI25VSEC-209A	Python Programming for AI	Choose Any One
CAI25VSEC-209B	R Programming Essentials	
CAI25VSEC-209C	Web Programming and Development	

CURRICULUM STRUCTURE

Second Year B.Tech.

Computer Science and Engineering (Artificial Intelligence)

Semester – IV

Level 5.0																
Second Year B. Tech. Computer Science and Engineering (Artificial Intelligence)																
Semester IV																
Sl. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						
										CCE		**ESE**				
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**	**PR**	**OR**	**TW**	**TOTAL**
										25	**25**	**50**				
1	CAI25PCC-251	Programme Core Course	Software Engineering	2			2			25	25	50				100
2	CAI25PCC-252	Programme Core Course	Artificial Intelligence	2			2			25	25	50				100
3	CAI25PCC-253	Programme Core Course	Artificial Intelligence Laboratory			2			4				50		25	75
4	CAI25PCC-254	Programme Core Course	Database Management Systems	2			2			25	25	50				100
5	CAI25PCC-255	Programme Core Course	Database Management Systems Laboratory			2			4				25		25	50
6	CAI25MDM-256	Multi-disciplinary Minor Course	IoT Fundamentals and Network Architecture	2			2			25	25	50				100
7	-	Open Elective Course	Open Elective Course-II	2			2			25	25	50				100
8	-	Value Education Course	Value Education Course-II	1	1		1	1							25	25
9	CAI25ELC-259	Experiential Learning Course	Community Engagement Project			2			4					50		50
10	IL25EMC-260	Entrepreneurship / Management Course	Entrepreneurship Skills Development		1	1		1	2						25	25
11	IL25AEC-261	Ability Enhancement Course	Modern Indian Languages (Marathi)	1		1	1		2						25	25
TOTAL				12	2	8	12	2	16	**125**	**125**	**250**	**75**	**50**	**125**	**750**
				22			**30**									

CCE-Comprehensive Continuous Evaluation**, ESE**-End Semester Evaluation**, TW**-TermWork,**OR**-Oral,**PR**-Practical,**L**-Lecture,**P**-Practical,**T**-Tutorial,**FA**–FormativeAssessment,**SA**-SummativeAssessment

Basket: List of Open Elective Course - II

Course Code	Course Name	
CE25OEC-257	Digital Marketing	Choose Any One
ETC25OEC-257	Engineering Economics	
ME25OEC-257	Digital Finance	

Basket: List of Value Education Course - II

Course Code	Course Name	
CE25VEC-258	Indian Constitution	Choose Any One
AIDS25VEC-258	Environmental Science	

Course Syllabus

Semester-III

Program	B.Tech. (Computer Science and Engineering - Artificial Intelligence)			Semester : III			
Course	Computer Organization and GPU Architecture			Code:		CAI25PCC-201	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Digital Electronics and Computer Fundamentals.

Course Objectives:

1. To explain the fundamental organization and architecture of computer systems.
2. To describe data representation techniques, instruction formats, and addressing modes used in computer systems.
3. To analyze the design and functioning of processor components, memory hierarchy, and I/O subsystems.
4. To evaluate the fundamental concepts of GPU architecture and distinguish them from traditional CPU-based systems.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Describe the basic structure, functions, and components of computer systems.

CO2: Apply concepts of data representation, instruction set architecture, and addressing modes to analyze instruction execution.

CO3: Analyze the design and functioning of the ALU, control unit, and memory hierarchy in modern computer systems.

CO4: Evaluate GPU architecture and execution models and contrast them with conventional CPU architectures.

Course Contents

Unit	Description	Duration [Hrs]
I	**Basic Structure of Computers** Computer organization vs. architecture, functional units, bus structure, instruction cycle, instruction formats, addressing modes, and data representation (integer and floating-point).	7
II	**Arithmetic and Logic Unit** Design of ALU, arithmetic operations (addition, subtraction, multiplication, division), logic operations, and hardware implementation of arithmetic algorithms.	7
III	**Control Unit and Processor Organization** Concepts of control unit; hardwired and microprogrammed control; control word and microinstruction sequencing; instruction pipelining – pipeline stages, hazards, and performance issues; superscalar architecture and instruction-level parallelism; RISC and CISC architectures – characteristics, comparison, and examples; overview of modern processor design – ARM and x86 architectures; introduction to parallel processing and multicore organization.	8

IV	**GPU Architecture** Basics of GPU architecture including evolution, CPU–GPU comparison, SIMT execution model, memory hierarchy, cores and multiprocessors, and an overview of programming and performance considerations.	**8**
	Total	**30**

Text Books:

1. M. Mano, "Computer System Architecture", Pearson Education, 3rd Edition.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", McGraw-Hill, 5th Edition.

Reference Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson, 10th Edition.
2. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 3rd Edition.
3. David A. Patterson and John L. Hennessy, "Computer Organization and Design", Morgan Kaufmann, 5th Edition.

e-sources:

- NPTEL: Computer Organization and Architecture – Prof. Indranil Sengupta (IIT Kharagpur) https://nptel.ac.in/courses/106105163
- https://www.geeksforgeeks.org/computer-organization-architecture/computer-organization-and-architecture-tutorials/

Program	B.Tech. (Computer Science and Engineering - Artificial Intelligence)			Semester : III			
Course	Data Structures and Algorithm			Code:		CAI25PCC-202	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of programming fundamentals, problem solving skills is essential.

Course Objectives:

1. To develop a strong foundation in the design, analysis, and implementation of data structures and algorithms.
2. To understand the role of data structures in solving computational problems effectively.
3. To explore advanced structures such as stacks, queues, linked lists, trees, and graphs for various applications.
4. To analyze algorithm performance using time and space complexity and apply efficient algorithms to solve practical problems such as searching, sorting, and graph traversal.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Analyze and implement searching and sorting algorithms, understanding their time and space complexity.

CO2: Design and apply stack and queue data structures for solving computational problems.

CO3: Implement and utilize linked lists for dynamic data manipulation.

CO4: Construct and manipulate tree and 4. graph structures to represent hierarchical and networked data, applying algorithms for traversal, shortest paths, and spanning trees.

Course Contents

Unit	Description	Duration [Hrs]
I	**Searching and Sorting Algorithms** Common operations on data structures, Types of data structures, Data structures & Programming, Program Design, Complexities, Time Complexity, order of Growth, Asymptotic Notation, Searching and sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Fibonacci Series. Sorting methods: Bubble, insertion, Quick, Merge, shell and comparison of all sorting methods, Analyze Insertion sort, Quick Sort, binary search, hashing for Best, Worst and Average case.	8
II	**Stacks and Queues** Stack ADT: Definition, Array Implementation of stack, Operations on stack, Stack Applications-Conversion of expression, and Evaluation of postfix expression, QUEUES, The Queue ADT: Definition, Array Implementation of queue, Types of queues: Simple queue, Circular queue, Double ended queue (de -queue), Operations on all types of Queues, Priority Queues, Applications of Queues.	7
III	**Linked List** Linked List ADT: Singly linked list implementation, Double linked list	7

	implementation, insertion, deletion and searching operations on all List implementation, Concepts of Circular linked list, Array implementation of Lists, Implementation of stacks and queues using Single Linked List, Applications of linked list.	
IV	**Trees and Graphs** Concepts and terminologies of trees and graphs; Trees and binary trees – expression trees, binary trees as ADT, binary search trees (insertion, search, deletion, and level-wise display), recursive and non-recursive traversals; Threaded binary trees – inorder, preorder, and postorder concepts, traversals, and applications. Graphs as ADT – representations using adjacency matrix and adjacency list; graph traversal techniques such as Breadth-First Search (BFS) and Depth-First Search (DFS); minimum spanning tree algorithms.	**8**
	Total	**30**

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, ISBN: 978-8131720479.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition, ISBN: 978-8173716065.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 3rd Edition, ISBN: 978-0262033848.

Reference Books:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", CareerMonk Publications, 5th Edition, ISBN: 978-8192107554.
2. Robert Sedgewick, "Algorithms in C", Addison Wesley, 3rd Edition, ISBN: 978-0201514254.
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley, 1st Edition, ISBN: 978-1118290279.

e-sources:

- https://nptel.ac.in/courses/106102064
- https://www.geeksforgeeks.org/data-structures
- https://www.coursera.org/specializations/data-structures-algorithms

Program	B.Tech. (Computer Science and Engineering - Artificial Intelligence)				Semester : III		
Course	Data Structures and Algorithm Laboratory				Code	CAI25PCC-203	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	-	50	75

Pre-requisites: Prior knowledge of Programming language and Data structures is essential.

Course Objectives:

1. To implement fundamental data structures and algorithms for computational problem solving.
2. To analyze the efficiency and performance of algorithms using appropriate metrics.
3. To apply stack, queue, linked list, tree, and graph structures in programming.
4. To develop problem-solving and programming skills by implementing searching, sorting, and traversal algorithms using C or Python.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Implement searching and sorting algorithms with performance analysis.

CO2: Apply stack and queue structures for solving computational problems.

CO3: Develop programs using linked lists and dynamic memory management.

CO4: Implement tree and graph traversal algorithms and apply efficient data structures with complexity analysis for real-world problem-solving.

Course Contents

Guidelines for Laboratory Conduction

The instructor is expected to conduct **minimum 12 assignments.** The instructor may set multiple sets of assignments and distribute them among batches of students.

Suggested List of Experiments/Assignments

Sl. No	Problem Statement
1	Implementation of Linear Search and Binary Search with comparison count and real-world use-case discussion (e.g., searching in contacts).
2	Implementation of Bubble Sort, Selection Sort, and Insertion Sort with performance comparison for different input sizes.
3	Implementation of Quick Sort and Merge Sort with application discussion (e-commerce sorting and ranking).
4	Program to compute Fibonacci Series using recursion and iteration with time complexity analysis.
5	Implementation of Stack ADT using arrays and demonstration using an application (Undo/Redo simulation).
6	Application of Stack: Conversion of infix to postfix and evaluation of postfix expression.
7	Implementation of Queue ADT using arrays and simulation of a real-world scenario (task waiting line).
8	Implementation of Circular Queue and Double-Ended Queue (Deque) with use-cases

	(scheduling and caching).
9	Implementation of Singly Linked List with insertion, deletion, and search operations.
10	Implementation of Doubly Linked List with forward and backward traversal (browser forward/backward simulation).
11	Implementation of Circular Linked List with application explanation (round-robin scheduling).
12	Implementation of Stack and Queue using Linked Lists for flexible memory usage.
13	Implementation of Binary Tree with creation, insertion, and tree traversals (preorder, inorder and postorder).
14	Implementation of Binary Search Tree (BST) with insertion, search, delete, and display operations.
15	Creation and traversal of Expression Trees with evaluation (mathematical expression processing).
16	Graph representation using adjacency matrix and adjacency list, and implementation of BFS and DFS (network traversal application).

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, ISBN: 978-8131720479.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition, ISBN: 978-8173716065.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 3rd Edition, ISBN: 978-0262033848.

Reference Books :

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd Edition, ISBN: 978-8131720479.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition, ISBN: 978-8173716065.

e-sources:

- NPTEL: Programming and Data Structures – Prof. P. P. Chakrabarti (IIT Kharagpur) https://nptel.ac.in/courses/106105085
- NPTEL: Data Structures and Algorithms – Prof. Naveen Garg (IIT Delhi) https://nptel.ac.in/courses/106102064

Program	B.Tech. (Computer Science and Engineering - Artificial Intelligence)			Semester : III			
Course	Object-Oriented Programming using Java			Code:		CAI25PCC-204	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Programming and Problem Solving is essential.

Course Objectives:

1. To identify and explain Java language components and how they interact within applications.
2. To apply object-oriented programming principles in Java by defining classes, invoking methods, and using standard class libraries.
3. To analyze inheritance, polymorphism, and exception handling mechanisms in Java applications.
4. To understand and apply multithreading concepts for designing concurrent Java applications.
5. To use Java APIs effectively for application development.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Explain fundamental Java programming concepts and demonstrate their use in simple applications.
CO2: Apply Java control statements and standard Java API packages to develop modular programs.
CO3: Apply procedures for declaring, creating, and manipulating arrays in Java programs.
CO4: Analyze inheritance, polymorphism, and exception handling in Java.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Overview of Java and its features, Java program structure, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, Variables, Operators, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.	8
II	**Control Statements and Methods** Control structures if single-selection statement, if….else double-selection statement, while repetition statement, do….while repetition statement, switch multi-selection statement, break and continue statements, Methods :Introduction, Program modules in Java, static methods, static Fields and Class Math, declaring methods with multiple parameters, scope of declaration, method overloading and Java API packages.	7

III	**Arrays** Arrays, declaring and creating arrays in java, examples using arrays, passing arrays to methods, multidimensional arrays, variable-length argument lists, using command-line arguments.	**7**
IV	**Inheritance and Polymorphism** Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, constructors in subclasses, object class. Polymorphism: Abstract classes and methods, final methods and classes, polymorphism examples and Interfaces. Exception-handling: Exception-handling overview, handling Arithmetic Exceptions and Input Mismatch Exceptions.	**8**
	Total	**30**

Text Books:

1. Paul Deitel and Harvey Detail, "Java: How to Program", Pearson's Publication, 9thEdition.
2. The complete Reference Java, 8th edition, Herbert Schildt, TMH.

Reference Books:

1. P. Radha Krishna, Object Oriented Programming through Java, 2nd Edition – Universities Press.
2. Bruce Eckel, Thinking in Java, 4th Edition – Pearson Education.
3. S. Malhotra & S. Choudhary, Programming in Java, Revised 2nd Edition – Oxford University Press.
4. Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, 1st Edition – Addison-Wesley Professional.

e-sources:

- https://hostnezt.com/cssfiles/computerscience/Java%20How%20to%20Program%209th%20Edition%20(Deitel).pdf
- https://onlinecourses.swayam2.ac.in/aic20_sp13/preview
- https://onlinecourses.nptel.ac.in/noc25_cs110/preview

Program	B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : III			
Course	Object-Oriented Programming using Java - Laboratory			Code		CAI25PCC-205	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25		50	75

Pre-requisites: Prior knowledge of Object-Oriented Programming (OOP) concepts is essential.

Course Objectives:

1. To develop proficiency in programming using the Java programming language.
2. To gain knowledge of the object-oriented programming paradigm using Java.
3. To learn the use of Java across different platforms and application domains.
4. To develop problem-solving skills by designing and implementing small-scale Java applications using object-oriented and exception-handling concepts.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Apply fundamental Java programming concepts such as data types, variables, operators, control statements, methods, and arrays to develop basic programs.

CO2: Implement object-oriented features including inheritance, polymorphism, abstract classes, and interfaces to build modular and reusable Java applications.

CO3: Handle common runtime errors using Java exception-handling mechanisms to create robust programs.

CO4: Design small-scale Java applications by integrating arrays, methods, object-oriented concepts, and exception handling.

Course Contents

Guidelines for Laboratory Conduction

- The instructor is expected to conduct **minimum 12 assignments and mini application.**
- The instructor may set multiple sets of assignments and distribute them among batches of students.
- Assignments should be implemented in JAVA language.

Suggested List of Experiments/Assignments

Sl. No.	Problem Statement
1	Write simple Java programs demonstrating basic syntax, tokens, printing styles, and use of escape sequences.
2	Develop a program that accepts user input using Scanner/Command Line Arguments and displays formatted output.
3	Implement programs using data types, type casting, operators, and evaluate complex expressions using operator precedence.
4	Demonstrate the use of static variables, static methods, and the Math class through simple utility-based programs.

5	Write programs using decision-making statements (if, if–else, nested if, switch) for menu-driven applications.
6	Implement programs using iterative control structures (while, do–while, for loops) for real-life calculations.
7	Demonstrate break and continue statements through simple scenarios (search in list, skipping values, etc.).
8	Implement 1D arrays in Java for storing and processing lists such as marks, temperatures, or sales data.
9	Demonstrate 2D and multidimensional arrays for matrix operations, table storage, or seating layouts.
10	Write programs that pass arrays to methods and display statistics (min, max, average, frequency).
11	Implement variable-length argument methods (var-args) and demonstrate flexible summation/calculation tasks.
12	Implement inheritance concepts using superclasses and subclasses (e.g., Employee → Manager, Vehicle → Car).
13	Demonstrate polymorphism using method overriding, abstract classes, and dynamic method dispatch.
14	Implement interfaces in Java for functional components like payment processing, shape calculations, etc.
15	Develop programs to handle runtime errors using try–catch blocks (Arithmetic Exception, Input Mismatch Exception).
16	**Mini-Application:** Create a small Java program integrating arrays, methods, inheritance, and exception handling (e.g., student result processing, simple billing system).

Text Books:

1. Paul Deitel and Harvey Detail, "Java: How to Program", Pearson's Publication, 9thEdition.
2. The complete Reference Java, 8th edition, Herbert Schildt, TMH.

Reference Books:

1. Paul Deitel and Harvey Detail, "Java: How to Program", Pearson's Publication, 9th Edition.
2. Herbert Schildt, Java: "The Complete Reference", 8th Edition, Tata McGraw-Hill, ISBN-13: 978-0-07-160631-8.

e-sources:

- https://hostnezt.com/cssfiles/computerscience/Java%20How%20to%20Program%209th%20Edition%20(Deitel).pdf
- https://onlinecourses.swayam2.ac.in/aic20_sp13/preview
- https://onlinecourses.nptel.ac.in/noc25_cs110/preview

Program	B.Tech. (Computer Science and Engineering - Artificial Intelligence)			Semester : III			
Course	Microcontroller and Applications			Code:		CAI25MDM-206	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of fundamentals of Digital Logic and basics of C programming is essential.

Course Objectives:

1. To understand the architecture and functional blocks of the 8051 microcontroller.
2. To learn instruction sets, programming concepts, and interfacing methods.
3. To explore timers, interrupts, serial communication, and on-chip peripherals of 8051.
4. To apply microcontroller programming for simple embedded and IoT-oriented applications.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Explain the internal architecture, memory structure, and operational features of the 8051 microcontroller.

CO2: Develop and execute assembly/C programs using 8051 instructions, timers, and interrupts.

CO3: Interface sensors, actuators, and peripheral devices with the 8051 microcontroller.

CO4: Apply microcontroller programming concepts to build basic embedded/IoT prototype solutions.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Microcontrollers & 8051 Architecture** Evolution of microprocessors and microcontrollers, Microcontroller vs. Microprocessor: features and applications, Overview of the 8051 family (MCS-51), 8051 architecture including ALU, registers, program counter, data pointer, and PSW, Memory organization covering internal RAM, SFRs, external memory, and bit-addressable areas, Oscillator and clock circuits, reset circuit, and I/O port structure, Addressing modes and instruction format (overview).	7
II	**Instruction Set & Programming Fundamentals** Data transfer, arithmetic, logical, branching, and Boolean instructions, Assembly language programming concepts, 8051 programming using Keil µVision or equivalent simulators, Looping, decision-making, and delay generation, Stack operations and subroutines, Introduction to C programming for 8051 microcontrollers, Simple programs including LED blinking, switch reading, counters and arithmetic routines.	7
III	**Timers, Interrupts & Serial Communication** Timer/counter modes and configuration, Generating delays using timers, Interrupt structure including vector addresses, enabling/disabling options, and priority levels, ISR writing and applications, Serial communication in 8051 including SCON, SBUF, and baud rate generation, Simple serial communication programs for data transmission and reception, Concept of interfacing with UART-based sensors or communication modules.	8

IV	**Interfacing & Applications in Embedded/IoT Systems** Interfacing LEDs, switches, buzzers, and relays, Interfacing LCD and 7-segment displays, Sensor interfacing including temperature, IR, LDR, and others, Actuator interfacing such as motor drivers, DC motors, and servo motors, ADC/DAC interfacing concepts including the 0808/0809 ADC, 8051-based mini embedded applications such as smart home components and simple IoT gateway nodes, Design guidelines for low-cost microcontroller-based systems.	**8**
	Total	**30**

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi & Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, ISBN-13: 9788131710265.
2. Raj Kamal, Embedded Systems: Architecture, "Programming and Design", Tata McGraw-Hill Education, ISBN-13: 9780070667648.

Reference Books:

1. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Cengage Learning India, ISBN-13: 9788131502006.
2. Muhammad Ali Mazidi, "8051 Microcontroller Programming in C", 2nd Edition, Pearson Education, ISBN-13: 9788131716812.
3. Shibu K. V., "Introduction to Embedded Systems", 2nd Edition, McGraw Hill Education, ISBN-13: 9789339219680.

e-sources:

- https://nptel.ac.in/courses/117104072
- https://www.keil.com/support/man/docs/c51
- https://www.tutorialspoint.com/8051-microcontroller
- https://embedded.fm/episodes

Program	S.Y. B.Tech. (Open Elective Course-I)			Semester: III			
Course	Computational Mathematics			Code:		CE25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical		Lecture	Practical		Lecture
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of algebra, trigonometry, and calculus from First-Year Engineering Mathematics.

Course Objectives: This course aims at enabling students:

1. To develop foundational knowledge of logic, sets, functions, relations, and combinatory.
2. To model and analyze computational problems using discrete mathematical structures.
3. To understand conceptual clarity and knowledge of Statistical methods and probability.
4. To understand Numerical techniques to approximate solutions for interpolation, integration, and ordinary differential equations.
5. To understand different transform methods like Fourier/Z transforms.

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

CO1: Apply propositional/predicate logic and proof techniques for problem solving.

CO2: Solve counting problems using combinatory and recurrence relations.

CO3: Apply correlation and regression methods to analyze experimental data in reliability, probability, testing, and quality control.

CO4: Apply numerical methods for interpolation, differentiation, integration, and solving differential equations using single-step and multi-step methods.

CO5: Apply transforms to engineering systems related to signals, circuits, and control applications.

Course Contents

Unit	Description	Duration [Hrs]
I	**Logic, Proof Techniques & Sets** Propositional logic, truth tables, Predicate logic, quantifiers Logical implications, inference rules Proof techniques: direct, contradiction, contrapositive, Mathematical induction. Sets: Set operations, algebra of sets Functions: injective, surjective, bijective.	9
II	**Relations, Recurrence & Combinatory** Recurrence relations (basic introduction) Relations: definition, properties, equivalence relations, partial orders Combinatory: Permutations & combinations, Pigeonhole principle Inclusion–exclusion principle.	9
III	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test.	9

IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Fourier and Z-Transforms** Fourier Transform: Introduction to time-domain and frequency-domain representation of signals. Complex exponential form of Fourier series. Fourier integral representation. Fourier Transform and inverse Fourier Transform. Properties of Fourier Transform such as linearity, time shifting, frequency shifting, and scaling. Fourier sine and cosine transforms with inverses. Z-Transform: Discrete-time signals and systems. Definition of Z-transform and region of convergence (ROC). Z-transform of basic sequences. Properties of Z-transform. Inverse Z-transform using standard pairs and partial fraction method. Applications of Z-Transform: Application of Z-transform in solving linear difference equations, analysis of discrete-time systems, stability analysis, and modeling of simple digital filters, Fourier sine and cosine transforms and their inverses.	**9**
	Total	**45**

Text Books:

1. Rosen, K. H., Discrete Mathematics and Its Applications, 8th Edition, McGraw-Hill Education, 2019. ISBN: 978-1-259-67651-2.
2. Kolman, B., Busby, R. C., & Ross, S., Discrete Mathematical Structures, 6th Edition, Pearson/Prentice Hall, 2009/2010. ISBN: 978-0-13-229751-6.
3. Lipschutz, S., & Lipson, M., Schaum's Outline of Discrete Mathematics, Revised 3rd Edition, McGraw-Hill Education, 2009. ISBN: 978-0-07-161586-0.
4. Grimaldi, R. P., Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson/Addison-Wesley, 2004 (reprints 2013). ISBN: 978-0-321-21103-3.
5. Ramana, B. V., Higher Engineering Mathematics, Tata McGraw-Hill, 2006. ISBN: 978-0-07-063419-0.

Reference Books:

1. Kenney, J. F. and Rosen, K. H., Discrete Mathematics, 1st Edition, McGraw-Hill Education, 2012. ISBN: 978-0-07-338309-5.
2. Biggs, N. L., Discrete Mathematics, 2nd Edition, Oxford University Press, 2003.ISBN: 978-0-19-850717-8.
3. Graham, R. L., Knuth, D. E. and Patashnik, O., Concrete Mathematics: A Foundation for Computer Science, 2nd Edition, Addison-Wesley, 1994. ISBN: 978-0-201-55802-9.
4. Deo, N., Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1974. ISBN: 978-0-13-363473-0.
5. Epp, S. S., Discrete Mathematics with Applications, 4th Edition, Cengage Learning, 2011. ISBN: 978-0-495-39132-6.
6. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern Ltd., New Delhi (Indian

Edition), 1999 (Reprinted). ISBN: 978-81-224-0883-6.
7. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., Numerical Methods for Scientific and Engineering Computation, 7th Edition, Khanna Publishers, 2013. ISBN: 978-81-7409-205-9.

e-sources:

- https://onlinecourses.nptel.ac.in/noc20_cs82/preview
- https://onlinecourses.nptel.ac.in/noc25_cs27/preview

Program	S.Y. B.Tech. (Open Elective Course-I)			Semester: III			
Course	Probability Theory and Statistical Methods			Code:		CAI25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations is essential.

Course Objectives:

1. To introduce the fundamental concepts of probability, random variables, and distributions required to model real-world uncertainty.
2. To develop the ability to analyze discrete and continuous probability models and interpret their applications.
3. To provide understanding of statistical measures, sampling techniques, and the behaviour of sample data.
4. To explain estimation methods, hypothesis testing, and inference techniques used for data-driven decision making.
5. To enable students to apply probability and statistical tools for solving practical engineering and computational problems.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain random variables, probability distributions, and their properties.
CO2: Apply standard discrete and continuous distributions to solve problems.
CO3: Analyze statistical measures and perform hypothesis testing for decision-making.
CO4: Apply point estimates, interval estimates, and MLE for parameter estimation.
CO5: Evaluate stochastic processes and Markov chain behaviors in AI-related scenarios.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Probability & Random Variables** Sets, events, sample space, mutually exclusive events, independent events, conditional probability, Bayes' theorem, random variables (discrete and continuous), PMF, PDF, CDF, expectation, variance, moments, joint distributions, marginal distributions, conditional distributions, independence of random variables, Markov's inequality, Chebyshev's inequality, Chernoff bounds, Weak Law of Large Numbers, Strong Law of Large Numbers, Central Limit Theorem. **Case Studies (Select any one):** Spam classification using Bayes' theorem, weather prediction using conditional probability, joint probability in manufacturing defect analysis, network traffic modelling using Central Limit Theorem.	10
II	**Probability Distributions** Bernoulli distribution, Binomial distribution, Geometric distribution, Poisson distribution, Poisson process, Uniform distribution, Exponential distribution, Normal distribution, mean and variance of distributions,	8

	Introduction of moment generation, applications in AI/ML and queuing systems. **Case Studies (Select any one):** Call center arrival modelling using Poisson distribution, defect detection in manufacturing using binomial distribution, waiting time analysis using exponential distribution, sensor reading variations modeled using normal distribution.	
III	**Hypothesis Testing** Parameter and statistic, null hypothesis, alternative hypothesis, Type I error, Type II error, significance level, p-value, power of a test, large sample tests (mean, difference of means, proportion, difference of proportions), small sample tests (t-test for mean, t-test for difference of means), chi-square test, F-test for variances, hypothesis testing for real-world decision making. **Case Studies (Select any one):** A/B testing for e-commerce click-through rate improvement, medical data testing for treatment effectiveness, comparison of accuracy between two ML models, evaluating impact of teaching method using student score data.	**10**
IV	**Estimation – Point, Interval & MLE** Point estimation, interval estimation, confidence intervals for mean, confidence intervals for proportion, confidence intervals for binomial, Poisson and normal parameters, properties of estimators (unbiasedness, consistency, efficiency), Maximum Likelihood Estimation, MLE for binomial parameters, MLE for Poisson parameters, MLE for exponential distribution, MLE for normal distribution parameters. **Case Studies (Select any one):** MLE-based click-through rate estimation, estimation of failure rate of electronic components using exponential distribution, estimation of customer arrival rate in retail using Poisson distribution, confidence interval estimation for OTT movie rating averages.	**9**
V	**Stochastic Processes & Markov Chains** Introduction to stochastic processes, branching processes, Markov chains, transition probability matrix, state classification, recurrent states, transient states, absorbing states, stationary distributions, applications of Markov chains in AI, introduction to martingales and stopping times. **Case Studies (Select any one):** Google PageRank using Markov chains, customer loyalty state transition modelling, weather forecasting using Markov model, reinforcement learning grid-world transition modelling.	**8**
	Total	**45**

Text Books:

1. R. A. Johnson, Miller and Freund's "Probability and Statistics for Engineers", Pearson Publishers, 9 th Edition, 2017.
2. John E. Freund, Benjamin M. Perles, "Modern Elementary Statistics", 12th Edition, Pearson, 2013. 3. Hamdy A. Taha, "Operations Research: An Introduction", Pearson, 2017, Tenth Edition.
3. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition,

S.Chand & Co, 2020.
4. Kanti Swarup, P. K. Gupta, and Man Mohan, "Operations Research", 20th Revised Edition, Sultan Chand & Sons, 2022, ISBN-13: 978-93-5161-183-7.

Reference Books*:*

1. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition, Academic Press (Elsevier), 2021, ISBN-13: 978-0128243466.
2. A. Papoulis and S. U. Pillai, "Probability, Random Variables, and Stochastic Processes", 4th Edition, McGraw-Hill Education, 2002, ISBN-13: 978-0073660113.
3. J. S. Milton and J. C. Arnold, "Probability and Statistics in the Engineering and Computer Sciences", 4th Edition, McGraw-Hill Education, 2003, ISBN-13: 978-0071238123.

e-sources:

- **NPTEL –** Stochastic Processes (IIT Bombay)
  https://nptel.ac.in/courses/111102014
- **University of Cambridge –** Stochastic Processes Notes
  https://www.statslab.cam.ac.uk/~rrw1/markov/M.pdf

Program	S.Y. B.Tech. (Open Elective Course-I)			Semester: III			
Course	Probability and Statistics			Code:		AIDS25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations, Fundamental concepts of probability (events, sample space, basic rules) is essential.

Course Objectives:

1. To introduce the basic concepts of random variables and probability distributions.
2. To develop the ability to apply standard discrete and continuous distributions to real-world problems.
3. To analyze fundamental statistical measures and distribution properties.
4. To provide knowledge of hypothesis testing methods for decision-making.
5. To enable students to analyze real-life situations using statistical reasoning and case studies.

Course Outcomes:

After completing this course, students will be able to:

CO1: Demonstrate understanding of Set Theory concepts and their relevance to probability.

CO2: Interpret random variables, probability distribution functions, and basic probability concepts.

CO3: Apply standard discrete and continuous probability distributions (Binomial, Poisson, Uniform, Exponential, and Normal) to solve simple engineering problems.

CO4: Analyze statistical measures such as mean, quantiles, and inequalities (Markov and Chebyshev) to study distribution properties.

CO5: Evaluate hypotheses for population parameters and interpret results using real-life case studies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Set Theory** Basics of set Theory: Introduction to sets and algebra of sets, Random Experiment, Sample Space, Events, Complementary Events, Union and Intersection of Two Events, Difference Events, Exhaustive Events, Mutually Exclusive Events, Equally Likely Events, Independent Events.	8
II	**Introduction to Probability** Probability Theory: Mathematical & Statistical definition of Probability, Need of probability theory in Data science, Axiomatic definition of probability, Addition Theorem, Multiplication Theorem, Theorems of Probability, Conditional Probability, Inverse Probability, Joint Probability, Total Probability and Bayes Theorem. **Case Study**: Use of probability in real-life situations, like weather forecasting, sports betting, sales forecasting etc.	7
III	**Introduction to Statistics** Introduction, Origin and Development and scope of Statistics, Population and Sample, Sampling –Introduction, Types of Sampling, Purposive Sampling, Random Sampling, Simple Sampling, Stratified Sampling,	10

	Parameter and Statistic, Sampling Distribution 54 Sampling with and Without Replacement, Population Parameters, Sample Statistics. Introduction, Arithmetic Mean, Simple and weighted mean for raw data, Discrete frequency distribution, Continuous frequency distribution, Properties of A. M. Merits & Demerits of A.M. Median, Mode for raw data, Merits and demerits of Median and Mode. **Case Study**: Create measures of central tendency for a real-life example dataset, such as the payroll dataset or titanic dataset. Case study of sampling for any real-world problem like exit poll statistics	
IV	**Descriptive Statistics** Measures of Dispersion, Skewness and Kurtosis: Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis. Correlation and Regression: Bivariate Distribution, Scatter diagrams, Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Regression Coefficients, Lines of Regression. **Case study**: Create measures of dispersion for a real-life example dataset like students dataset, iris detection etc.	**10**
V	**Probability Distributions & Hypothesis Testing** Random Variables: Distribution function, PMF, PDF, basic properties; mean, median, quantiles, Markov and Chebyshev inequalities. Standard Distributions: Bernoulli, Binomial, Poisson, Uniform, Exponential, Normal – definitions and simple applications. Moment concepts (introduction) and basic characteristics of the above distributions. Hypothesis Testing: Statistical hypothesis, null and alternative hypotheses, level of significance, Type I & II errors, tests for mean and proportion. **Case Study**: Case studies based on binomial distribution and hypothesis testing for real-life decision problems.	**10**
	Total	**45**

Text Books:

1. A. M. Mood, F. A. Graybill, D. C. Boes, Introduction to the Theory of Statistics, McGraw-Hill. 3rd Edition
2. Robert V. Hogg, Joseph McKean, Allen T. Craig, Introduction to Mathematical Statistics, Pearson, 8th Edition
3. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 11th Edition

Reference Books*:*

1. Sheldon Ross, A First Course in Probability, Pearson, 9th Edition
2. William Mendenhall, Statistics for Engineering and the Sciences, CRC Press, 13th Edition
3. J.E. Freund, Mathematical Statistics, Pearson, 7th Edition

e-sources:

1. NPTEL Courses (IIT Bombay / IIT Kanpur)
   https://nptel.ac.in/courses/111105090
2. Probability and Statistics for Engineers
   https://nptel.ac.in/courses/111102160

Program	S.Y. B.Tech. (Open Elective Course-I)			Semester: III			
Course	Numerical Statistical Analysis			Code:	IT25OEC-207		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of Engineering Mathematics, Algebra, Calculus, and Programming Concepts is essential.

Course Objectives: This course aims at enabling students:

1. To solve algebraic and transcendental equations using numerical methods.
2. To apply interpolation, curve fitting, numerical differentiation, and numerical integration techniques.
3. To analyze probability theory, random variables, and standard probability distributions.
4. To utilize statistical tools for sampling, correlation, regression, and hypothesis testing.
5. To develop analytical skills for engineering problems using numerical and statistical techniques.

Course Outcomes:

After completion of the course, the students will be able to:

CO1: Apply numerical techniques to solve algebraic and transcendental equations with convergence analysis.

CO2: Use interpolation, curve fitting, numerical differentiation, and numerical integration effectively.

CO3: Apply probability concepts and apply standard probability distributions to engineering problems.

CO4: Perform sampling, regression analysis, correlation and statistical data interpretation.

CO5: Conduct hypothesis testing such as t-test, z-test, chi-square, ANOVA & construct confidence intervals.

Course Contents

Unit	Description	Duration [Hrs]
I	**Numerical Solution of Equations** Types of Errors: Absolute, Relative, Percentage error Roots of algebraic & transcendental equations, Bisection Method, Regula Falsi Method, Newton–Raphson Method, Secant Method and Convergence of iterative methods.	9
II	**Interpolation & Curve Fitting** Finite differences**,** Interpolation: Newton Forward & Backward Interpolation, Lagrange's Interpolation**,** Newton's Divided Difference Formula, Curve fitting: Least Squares Method, Fitting Straight Line, Parabola, and Exponential Curves.	9
III	**Numerical Differentiation & Integration** Numerical differentiation using Newton's formulas, Maxima & minima using numerical differentiation, Numerical Integration: Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Error analysis for numerical differentiation & integration.	9
IV	**Probability & Statistical Distributions** Basic Probability Theory, Bayes' Theorem, Random Variables, Discrete & Continuous Probability Distributions: Binomial Distribution, Poisson	9

	Distribution, Normal Distribution, Moments, Skewness & Kurtosis.	
V	**Sampling, Regression & Hypothesis Testing** Sampling Techniques & Sampling Distribution, Correlation: Karl Pearson coefficient, Regression Analysis: Linear regression & multiple regression, Hypothesis Testing: t-test, z-test, Chi-square test, ANOVA (One-way) and Confidence intervals.	**9**
	Total	**45**

Text Books:

1. S.S. Sastry – Introductory Methods of Numerical Analysis, PHI, 5th edition
2. Erwin Kreyszig – Advanced Engineering Mathematics, Wiley, 10th edition
3. Gupta & Kapoor – Fundamentals of Mathematical Statistics, Sultan Chand, , 11th edition

Reference Books:

1. Jain, Iyengar, Jain – Numerical Methods for Scientific and Engineering Computation, New Age, 6th edition
2. William Navidi – Engineering Statistics, McGraw Hill, 2nd edition
3. Richard Johnson – Statistics & Data Analysis, Pearson, 6th edition

e-sources:

1. NPTEL: Numerical Methods (IIT Bombay / IIT Kharagpur) https://nptel.ac.in/courses/111/102/111102128/

e-Books:

1. https://www.aerostudents.com/courses/applied-numerical analysis/IntroductoryMethodsOfNumericalAnalysis.pdf

Program	S.Y. B.Tech. (Open Elective Course-I)				Semester : III		
Course	Vectors and Transforms				Code:	ETC25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of Univariate Calculus, Multivariate Calculus is essential.

Course Objectives:

1. To develop a strong foundational understanding of transform techniques to analyze and solve engineering and communication-related problems.
2. To provide conceptual clarity in formulating and solving differential equations arising in various engineering applications.
3. To equip students with numerical methods for interpolation, numerical integration, and solving ordinary differential equations with practical computational approaches.
4. To enable students to understand, differentiate, and integrate vector fields, and apply these concepts to engineering and physical systems.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Apply transforms such as Laplace transform, to solve problems related to signal processing and control systems.

CO2: Apply Integral transforms such as, Fourier transform to solve problems related to signal processing and control systems.

CO3: Apply transforms such as Z-Transform to solve problems related to signal processing and control systems.

CO4: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.

CO5: Perform vector differentiation and integration, analyze the vector fields and apply to electromagnetic fields.

Course Contents

Unit	Description	Duration [Hrs]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n , scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	9
II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.	9

III	**Fourier and Z-Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their inverses. Z-Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations.	**9**
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.	**9**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill), 1st Edition.
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning), 2nd Edition.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 1st Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication), 2nd Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York, 2nd Edition.
4. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw Hill Editions, 2002, ISBN 0-07-047437-0
5. Dr. B. S. Garewal, Numerical Methods in Engineering and Science, 7/e, Khanna Publishers, ISBN 81-74009-205-6
6. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson), 1st Edition.

e-sources:

- https://onlinecourses.nptel.ac.in/noc23_ma54/
- https://nptel.ac.in/courses/111106111

Program	S.Y. B.Tech. (Open Elective Course-I)				Semester: III		
Course	Applied Mathematics				Code	ME25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior Knowledge of Univariate Calculus**,** Multivariate Calculus**,** Fourier series, Collection, classification, and representation of data is essential.

Course Objectives: This course aims at enabling students:

1. To develop conceptual understanding of Laplace Transform techniques and their applications in engineering problems.
2. To impart knowledge of Inverse Laplace Transform methods for solving differential equations and system analysis problems.
3. To introduce Fourier Transform techniques for analysis of signals and systems in the frequency domain.
4. To familiarize students with statistical methods and probability theory for modeling and analysis of engineering data.
5. To provide foundations of vector calculus, including vector fields and their differentiation and integration, for engineering applications.

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

CO1: Apply transforms such as the Laplace transform to solve problems related to mechanical systems.

CO2: Apply transforms such as the Inverse Laplace transform to solve problems related to mechanical systems, such as Differential Equations, mass, and spring systems.

CO3: Apply Integral transforms, such as the Fourier transform to solve problems related to mechanical systems

CO4: Apply Statistical methods like correlation and regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.

CO5: Perform vector differentiation and integration, analyze the vector fields and apply to magnetic fields

Course Contents

Unit	Description	Duration [Hrs.]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	9
II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of	9

	linear differential equations.	
III	**Fourier Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, and their inverse Fourier transform, inverse Fourier sine transform, inverse Fourier cosine transform.	**9**
IV	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test and t- test.	**9**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stokes' theorem. Applications to problems in Electro-magnetic fields.	**9**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill),1st Edition.
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning), 2nd edition.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 1st Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication), 1st Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill , New York, 2nd edition.
4. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson), 1st Edition.
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross.
6. Jason Brownlee, 'Statistical Methods for Machine Learning', Machine learning Mastery, 1st Edition.

e-sources:

- https://nptel.ac.in/courses/111107098
- https://nptel.ac.in/courses/111105041

Program	S.Y. B.Tech. (Value Education Course-I)			Semester : III			
Course	Universal Human Values			Code		CSE25VEC-208	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	-	2	1			25	25

Pre-requisites: Basic knowledge of Social Values, Communication is essential.

Course Objectives:

1. To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity.
2. To elaborate on 'Self-exploration' as the process for Value Education.
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1. Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.

CO2. Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.

CO3. Explain relationship between one self and the other self as the essential part of relationship and harmony in the family.

CO4. Interpret the interconnectedness, harmony and mutual fulfillment inherent in the nature and the entire existence and draw ethical conclusions in the light of Right understanding.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Value Education** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations.	4
II	**Harmony in the Human Being** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.	4
III	**Harmony in the Family and Society** Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Values	4

	in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.	
IV	**Harmony in the Nature (Existence)** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Professional Ethics in the light of Right Understanding, Strategies for Transition towards Value-based Life and Profession.	**3**
	Total	**15**

The subject instructor supposed conduct the activities based on the topic covered during the tutorial sessions. The few activities should be individual or in group. The students supposed to submit the properly written documents.

Suggested list of Experiments/Assignments

Sl. No.	**Experiments/Assignments**
1	Introduce yourself in detail. What are your life goals? How do you make goals for your life? How do you distinguish between right and wrong? What are your major accomplishments and faults in life? Observe and study them.
2	Man-made issues such as energy and material resource depletion, pollution, global warming, ozone depletion, deforestation, and soil degradation pose a threat to the survival of life on Earth. What is the source of these ailments and what is the solution, in your opinion?
3	There is rapidly growing danger due to nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression, and suicidal attempts. What do you think is the root cause of these threats to human happiness and peace? What is the solution in your opinion?
4	Our "Natural Acceptance" ability allows us to choose what is right or wrong for ourselves. We are not educated to listen to our "Natural Acceptance," which can be confused by perceptual biases and sensory stimuli. Explore the following: (i) What is your natural level of respect for yourself and others? (ii) What is "naturally acceptable" to you: nurturing or exploiting others? Is your lifestyle consistent with your natural acceptance or divergent from it?
5	Share a personal experience when you demonstrated deliberate devotion to values in a challenging scenario.
6	Identify any two major problems confronting society now and investigate the underlying causes. Can these be handled based on natural acceptance of human values? If so, how should one move in this approach given the current situation?
7	Having awareness about nature, its four orders and their mutual fulfilment. Activities to be performed- written assignment, chart making.
8	List down all your desires, Observe whether the desire is related to Self (I) or Body. If it

	appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.
9	Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are: 1a. Do I want to make myself happy? 2a. Do I want to make the other happy? 3a. Is the other want to make him happy? 4a. Is the other want to make me happy? Intention (Natural Acceptance) 1b. Am I able to make myself always happy? 2b. Am I able to make the other always happy? 3b. Is the other able to make him always happy? 4b. Is the other able to make me always happy? What is the answer? Competence Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others' intention & competence.
10	1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under- evaluation, over-evaluation or otherwise evaluation. 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.
11	Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group. Develop three chapters to introduce social science-its need, scope and content in the primary education of children.
12	List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders. List what do you take from nature; and what do you give back to nature? Are you a source of harmony in Nature?

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed

Copy), 978-81- 957703-6-6 (e-book)

2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

Reference Books:

1. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak
2. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
3. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

e-Sources:

- Jeevan Vidya: Ek Parichaya — A. Nagaraj (1999)
  https://uhvparivar.org/publications/otherbooks/Jeevan-Vidya-ek-Parichay.pdf

E-Books:

1. A Foundation Course in Human Values and Professional Ethics.
   https://uhvparivar.org/publications/uhvbooks/UHV-FCV-3E-Textbook.pdf

MOOC / NPTEL/YouTube Links:

1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav
   Link- https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof. A. K. Sharma IIT Kanpur
   Link- https://nptel.ac.in/courses/109104068
3. UHV Lecture Series – Prof. R. R. Gaur
   Link- https://www.youtube.com/playlist?list=PLz0n_SjOttT0LlwM1zVfPVTz3wGM5seXm

Program	S.Y. B.Tech. (Value Education Course-I)			Semester : III			
Course	Professional Ethics for Engineers			Code		ETC25VEC-208A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
1	-	2	1			25	25

Pre-requisites: Prior knowledge of business management is essential

Course Objectives:

1. To provide the students an understanding of the meaning of ethics in engineering profession.
2. To introduce an awareness of ethical duties and responsibilities of engineers in the practice of them Careers.
3. To provide a sociological understanding of the social impact of technology and engineering.
4. To examine some of the classical cases as well as contemporary ethical issues in engineering Profession.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Practice the moral values that ought to guide the Engineering profession.

CO2: Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations.

CO3: Know the definitions of risk and safety also discover different factors that affect the perception of risk.

CO4: Appreciate the Ethical issues and Know the code of ethics adopted in various professional bodies and industries.

Course Contents

Unit	Description	Duration [Hrs]
I	**Ethics in Engineering** Understanding basic concepts Ethics- Engineering Ethics- Engineering as Profession – Difference between occupation and professions- Professional Ethics - Codes of Ethics in Engineering profession- Moral dilemmas and moral autonomy in Engineering profession.	4
II	**Engineering as Social Experimentation** Engineering as Experimentation-Engineers as responsible Experimenters-A balanced outlook on law.	3
III	**Social Impact of Technology and Engineering** Ethics of science and engineering- Ethical leadership in engineering and society, social responsibility of scientist/ researchers, Intellectual property and society, Cross cultural issues in engineering research.	4
IV	**Major Issues in Engineering Ethics and Environment** Ethics and sustainable engineering- Computer ethics- Analyzing ethical problems in research- Ethics in collaborative research- Engineers as expert consultants and advisors- Corporate Social Responsibility (CSR).	4

	Total	**15**

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	Study of basic ethical concepts including values, morals, rights, duties, and ethical reasoning frameworks relevant to engineering practice.
2	Study of engineering as a profession with emphasis on professional roles, responsibilities, accountability, and distinction between occupation and profession.
3	Study of professional ethics and codes of ethics as prescribed by recognized professional engineering bodies, highlighting ethical conduct and compliance.
4	Study of moral dilemmas in engineering practice through case studies to develop ethical reasoning and decision-making skills.
5	Study of engineering as social experimentation focusing on risk, safety, uncertainty, and the responsibility of engineers as responsible experimenters.
6	Study of law and ethics in engineering practice to understand regulatory compliance and the need for a balanced ethical and legal outlook.
7	Study of social, environmental, and sustainability impacts of technology and engineering in the context of societal well-being..
8	Study of research ethics and intellectual property rights including issues related to plagiarism, authorship, innovation, and societal benefit.
9	Study of computer ethics and ethics in collaborative engineering work covering data privacy, cybersecurity, and professional integrity.
10	Study of corporate social responsibility (CSR), ethical leadership, and sustainable practices in engineering organizations.

Text Books:

1. Naagarazan, R.S. , "Professional Ethics and Human Values " New age International, 3rd Edition.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall 4th edition.

Reference Books:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice all of India, New Delhi, 2004, 1st Edition.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Wadsworth Thompson Learning, United States, 2000, 2nd Edition.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003, 4th Edition.

e-Sources:

1. https://youtu.be/ag1fHF7aL0A?si=vlNPA0Ea7ZjKAT3S
2. https://youtu.be/ag1fHF7aL0A?si=_T2VV3q_iYG4rj8L

Program	S.Y. B.Tech. (Value Education Course-I)				Semester : III		
Course	Social Connect and Responsibility				Code:	ETC25VEC-208B	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	1	25	-	-	25

Pre-requisites: Prior knowledge of basic awareness of societal issues and community needs

Course Objectives:

1. To enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. To provide a formal platform for students to communicate and connect with their surroundings.
3. To enable to create of a responsible connection with society.

Course Outcomes: After successful completion of the course, learner will be able to:

CO1: Perform tree plantation, adoption activities, document plant characteristics, relevance and cultural significance.

CO2: Demonstrate understanding of local heritage and crafts through field visits and digital documentation.

CO3: Explain principles of organic farming and wet waste management and relate them to sustainable campus practices.

CO4: Analyze water conservation practices in community settings and prepare evidence-based documentation.

CO5: Explore and document local culinary heritage, indigenous materials, and food lore through field-based interactions.

Course Contents:

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage student's interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed:

Unit	Description	Duration [Hrs]
I	**Plantation and adoption of a tree** Plantation of a tree that will be adopted for four years by a group of B. Tech. students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature carried out by the project groups.	3
II	**Heritage walk and crafts corner** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.	3

III	**Organic farming and waste management** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.	**3**
IV	**Water Conservation** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	**3**
V	**Food Walk** City's culinary practices, food lore, and indigenous materials of the region used in cooking.	**3**
	Total	**15**

Course Contents	
Sl. No.	**Suggested List of Assignment/Experiments**
1	**Tree Plantation & Adoption Activity** Students will plant a sapling on campus or a designated location and adopt it for four years. They must record initial environmental conditions, plant type, and growth indicators.
2	**Documentary/Photo Blog on Adopted Plant** Each group will prepare a short documentary or a photo blog about the adopted tree covering: • Plant origin • Botanical features • Usage in daily life • Cultural, folklore, and literary significance
3	**Heritage Walk Documentation** Students will participate in a heritage walk within the city to study historical sites, traditional architecture, and community spaces. They will document observations with photographs and short descriptions.
4	**Crafts Corner Study & Documentation** Visit a local crafts workshop (e.g., pottery, weaving, metalwork) to interact with craftsmen and understand techniques, tools, and cultural relevance. Prepare a photo blog or documentary on evolution and practice of the craft.
5	**Organic Farming Exposure Visit** Students will visit an organic farm or agricultural field to learn about: • Organic farming techniques • Soil preparation • Bio fertilizers • Crop rotation • Pest control methods A reflective report will be prepared based on observations.
	Wet Waste & Compost Management Practical Study wet waste collection, segregation, and composting processes in nearby villages or campus. Students will carry out small-scale composting using daily biodegradable

6	waste.
7	**Water Conservation Practices Survey** Survey nearby villages/campus to document traditional and modern water conservation practices such as: • Rainwater harvesting • Check dams • Greywater reuse • Percolation pits Prepare a photo blog or documentary presenting current practices and recommendations.
8	**Food Walk & Culinary Culture Mapping** Conduct a food walk to explore local dishes, ingredients, indigenous cooking materials, and culinary traditions. Students will document: • History behind specific dishes • Food lore • Traditional preparation methods

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE) After completion of, the social connect, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing.

Textbooks:

1. Agricultural Sustainability: Strategies for Organic, Climate-Smart, and Resource-Conserving Farming, Shravanthi et al., First edition, 2025.
2. Hydrological Measurements for Watershed Research – Wasi Ullah et al., First Edition.
3. Perspectives in Environmental Studies – Kaushik & Kaushik, First Edition,2018.

e-sources:

- https://www.youtube.com/watch?v=iaQjEDYyWKw
- https://onlinecourses.nptel.ac.in/noc23_hs155/preview

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : III			
Course	Python Programming for AI			Code			CAI25VSEC-209A
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior knowledge of Basics of Computer and Basics of Mathematics is essential.

Course Objectives:

1. To develop foundational programming skills in Python applied to AI-related problem solving.
2. To introduce data handling, numerical computation, and visualization using NumPy, Pandas, and Matplotlib.
3. To enable students to implement basic AI-related tasks using Python libraries.
4. To develop mini-project skills for solving real-world problems using Python.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Apply core Python programming concepts to solve computational problems.
CO2: Use NumPy for numerical operations and array-based computation.
CO3: Perform data manipulation and analysis using Pandas.
CO4: Visualize datasets using Matplotlib for AI-based interpretations.
CO5: Develop and present mini-projects using Python and associated libraries.

Course Contents

Sl. No.	Suggested List of Assignment/Experiments
1	Implement basic Python programs using variables, operators, and I/O functions.
2	Apply & Test control structures (loops and conditionals) to solve computational problems.
3	Design and Develop user-defined functions and modules for modular programming.
4	Implement and Analyze Python data structures such as lists, tuples, sets, and dictionaries.
5	Perform & Demonstrate data file handling operations using text and CSV files.
6	Compute numerical operations using NumPy arrays, indexing, slicing, and vectorized operations.
7	Analyze advanced NumPy operations including broadcasting and linear algebra functions.
8	Manipulate & Process datasets using Pandas Series and DataFrames.
9	Analyze & Clean real-world datasets using Pandas (handling missing values, grouping, summarizing).
10	Visualize & Interpret datasets using Matplotlib charts (line, bar, histogram, scatter plots).
11	Perform data analysis on a real-world dataset to extract insights using Python, NumPy, and Pandas.

12	Develop & Present a complete mini-project using Python, NumPy, Pandas, and Matplotlib.

Text Books:

1. John M. Zelle, Python Programming: An Introduction to Computer Science, 3rd Edition, Franklin, Beedle & Associates, 2016, ISBN-13: 978-1590282755.
2. Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly Media, 2017, ISBN-13: 978-1491957660.

Reference Books:

1. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media, 2013, ISBN-13: 978-0596158064.
2. Ivan Idris, NumPy Cookbook, 2nd Edition, Packt Publishing, 2015, ISBN-13: 978- 784390945.
3. Benjamin Bengfort, Tiffany Timbers, and Darren Japkowicz, Matplotlib Plotting Cookbook, 1st Edition, Packt Publishing, 2014, ISBN-13: 978-1849513272.

e-source:

- Python Official Documentation – https://docs.python.org
- NumPy Official Documentation – https://numpy.org/doc
- Pandas Official Documentation – https://pandas.pydata.org/docs
- Matplotlib Documentation – https://matplotlib.org/stable/contents.html
- Kaggle Datasets & Tutorials – https://www.kaggle.com

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : III			
Course	R Programming Essentials			Code			CAI25VSEC-209B
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior basic knowledge of understanding of programming concepts and familiarity with mathematics and statistics.

Course Objectives:

1. To introduce students to the R programming environment and its basic features.
2. To develop fundamental programming skills using R, including data types, operators, loops, and functions.
3. To enable students to manipulate, process, and analyze data using R data structures and data frames.
4. To provide hands-on experience in data visualization and statistical analysis using R.
5. To prepare students to apply R programming skills to real-world data analysis problems.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Install and configure the R programming environment and manage packages.

CO2: Implement basic programming constructs in R, including loops, functions, and conditional statements.

CO3: Manipulate and analyze data using R data structures, data frames, and file handling operations.

CO4: Perform data visualization using R plotting functions and libraries.

CO5: Apply statistical analysis and simple predictive modeling techniques to real-world datasets.

Course Contents

Sl. No.	Suggested List of Assignment/Experiments
1	Download and install the R programming environment and install basic packages using the install.packages() command.
2	Learn and practice the basics of R programming: data types, variables, operators, and expressions.
3	Implement loops in R (for, while, repeat) with different examples.
4	Learn the basics of functions in R and implement user-defined functions with examples.
5	Implement data frames in R. Write programs to join columns and rows using cbind() and rbind().
6	Implement and apply string manipulation functions in R.
7	Implement and analyze different data structures in R: vectors, lists, and data frames.
8	Read a CSV file into R and perform data analysis on the dataset.
9	Create visualizations including pie charts, bar charts, and basic plots using R.
10	Use a dataset and perform statistical analysis (mean, median, variance, correlation) using R.

11	Perform data aggregation and summary operations using R functions such as aggregate(), summary(), and table().
12	Perform basic linear regression and correlation analysis using built-in R functions on a dataset.

Text Books:

1. Hadley Wickham, Mine Çetinkaya-Rundel, and Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, 2nd Edition, O'Reilly Media, 2023, ISBN-13: 978-1492097402.
2. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, 1st Edition, No Starch Press, 2011, ISBN-13: 978-1593273842.

Reference Books:

1. Robert I. Kabacoff, R in Action: Data Analysis and Graphics with R, 2nd Edition, Manning Publications, 2015, ISBN-13: 978-1617291388.
2. Paul Teetor and J. D. Long, R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics, 2nd Edition, O'Reilly Media, 2019, ISBN-13: 978-1492040682.
3. John Verzani, Using R for Introductory Statistics, 2nd Edition, Chapman & Hall/CRC, 2014, ISBN-13: 978-1584884507.

e-source:

- https://cran.r-project.org/ – Official R Project website
- https://r4ds.had.co.nz/ – R for Data Science online book
- https://www.tutorialspoint.com/r/index.htm – Tutorials Point R Programming tutorials

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : III			
Course	Web Programming and Development			Code			CAI25VSEC-209C
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites : Prior basic understanding of programming and fundamentals of HTML and basic computer networking concepts.

Course Objectives:

1. To introduce students to web technologies, including front-end and back-end development.
2. To develop practical skills in HTML, CSS, JavaScript, and basic server-side programming.
3. To provide hands-on experience in building interactive, responsive, and dynamic web pages.
4. To familiarize students with web development tools, libraries, and frameworks.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Design and implement static web pages using HTML and CSS.
CO2: Develop dynamic and interactive web pages using JavaScript.
CO3: Integrate front-end and back-end functionalities in a simple web application.
CO4: Apply web development frameworks and libraries for responsive design.

Course Contents

Sl. No.	Suggested List of Assignment/Experiments
1	**Basic HTML & CSS:** Design a multi-page website for a personal portfolio or college event using HTML5 semantic elements and CSS styling. Include headings, paragraphs, lists, links, images, and basic CSS properties.
2	**Advanced CSS & Responsive Design:** Convert the static website into a fully responsive design using CSS Flexbox/Grid and media queries. Ensure proper layout and readability across mobile, tablet, and desktop screens.
3	**HTML Forms & JavaScript Validation:** Create a complex user registration form with multiple input types and implement client-side validation using JavaScript. Ensure invalid input triggers appropriate error messages.
4	**DOM Manipulation & Events:** Build an interactive web page with dynamic content updates such as accordion menus, tabs, modals, and dynamic tables using JavaScript or jQuery.
5	**JavaScript Functions & Local Storage:** Implement a to-do list or shopping cart where tasks/items can be added, edited, and removed. Persist the data using Local Storage and Session Storage.
6	**AJAX & API Integration:** Create a web page that fetches real-time data from a public REST API (e.g., weather, movies, COVID-19 stats) using AJAX/Fetch and displays it dynamically with proper formatting.
7	**Front-End Framework (React.js / Angular / Vue.js):** Develop a single-page application (SPA) for a task manager, blog, or portfolio using a modern front-end framework. Implement component-based architecture, routing, and state management.

8	**Server-Side Programming (Node.js / Express):** Create a RESTful API to manage a collection of items (e.g., books, products, students). Implement routes to perform CRUD operations and proper error handling.
9	**Database Integration (MySQL / PostgreSQL / MongoDB):** Connect the RESTful API backend to a database and implement CRUD operations on real data. Ensure that changes in the database reflect dynamically on the front-end.
10	**Authentication & Authorization:** Implement a user login/signup system with password hashing and session management using JWT or cookies. Add role-based access to restrict certain features to authorized users only.
11	**Interactive Data Visualization:** Build an interactive dashboard that visualizes data from the database or API using Chart.js or D3.js. Include dynamic charts, tooltips, legends, and responsive updates.
12	**Mini Project – Full-Stack Web Application:** Design and develop a complete web application integrating front-end, back-end, database, and API functionalities. Example projects: e-commerce store, online quiz system, blog engine, or task management application.

Text Books:

1. Jon Duckett, HTML & CSS: Design and Build Websites, 1st Edition, Wiley, 2011, ISBN-13: 978-1118008188.
2. Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development, 1st Edition, Wiley, 2014, ISBN-13: 978-1118531648.

Reference Books:

1. Thomas A. Powell, HTML, CSS, and JavaScript All in One, 3rd Edition, Sams Publishing (Pearson), 2018, ISBN-13: 978-0134772457.
2. Robin Nixon, Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5, 5th Edition, O'Reilly Media, 2018, ISBN-13: 978-1491978917.
3. Jennifer Niederst Robbins, Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, 5th Edition, O'Reilly Media, 2018, ISBN-13: 978-1491960200.

e-source:

- https://www.w3schools.com/ – Tutorials for HTML, CSS, JS, PHP, SQL.
- https://www.tutorialspoint.com/html/index.htm – Tutorials point Web Development tutorials.

Program	S.Y. B.Tech. (Entrepreneurship Management Course)			Semester: III			
Course	Principles of Management and Entrepreneurship			Code:	IL25EMC-210		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives:

1. To introduce the fundamental concepts, functions, and principles of management.
2. To develop the ability to plan, organize, lead, and control organizational activities.
3. To familiarize with the concept of entrepreneurship.
4. To develop skills for identifying business opportunities.
5. To create awareness about MSME policies, institutional support systems, startup ecosystem.

Course Outcomes:

CO1: Explain fundamental principles, functions of management with the role and responsibilities of manager.
CO2: Design and develop the plan, strategies, organizational structure and HR processes.
CO3: Apply motivational theories for leadership in organizational situations
CO4: Identify entrepreneurial traits and competencies
CO5: Create the opportunities to Utilize government and financial support systems through business plans.

Course Contents

Unit	Description	Duration [Hrs]
I	**Theory of Management** Meaning, Nature, Scope and Importance of Management, Functions of Management – Planning, Organizing, Staffing, Directing, Controlling, Levels of Management – Top, Middle and Lower, Roles of a Manager (Mintzberg's Managerial Roles), Evolution of Management Thought: Classical Theory (Fayol, Taylor), Behavioral Approach, Modern Approaches (System, Contingency), Social and Ethical Responsibilities of Managers.	3
II	**Planning and Techniques in Management** Planning – Nature, Process, Types of Plans, MBO (Management by Objectives), Decision Making – Types, Steps, Techniques, Organizing – Concept, Types of Organization Structures (Functional, Divisional, Matrix), Span of Control, Delegation of Authority, Centralization vs Decentralization, Staffing – Manpower Planning, Recruitment, Selection and Training.	3
III	**Leadership and Control** Leadership – Meaning, Importance, Qualities of a Leader, Leadership Styles – Autocratic, Democratic, Laissez-faire, Transformational, Motivation – Meaning, Importance, Motivation Theories – Maslow,	3

	Herzberg, McGregor Theory X & Y, Communication – Process, Types, Barriers, Effective Communication Techniques, Controlling – Concept, Steps, Techniques of Control, Budgetary and Non-Budgetary Controls.	
IV	**Introduction to Entrepreneurship and Business Plan** Concept and Meaning of Entrepreneurship**,** Characteristics and Competencies of Successful Entrepreneurs**,** Types of Entrepreneurs – Innovative, Imitative, Serial, Social, Women Entrepreneurs**,** Entrepreneurial Process – Idea Generation to Enterprise Launch**,** Creativity and Innovation – Techniques and Tools**,** Barriers to Entrepreneurship – Personal, Social, Situational. Micro, Small & Medium Enterprises (MSMEs) – Definition, Importance, Opportunities, Business Environment – Internal & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. Institutional Support for Entrepreneurship: MSME-DI, DIC, NSIC, SIDBI, NABARD, KVIC, NIESBUD, EDII, Start-up India, Make in India, Atal Innovation Mission. Financial Support: Seed Funding, Angel Investors, Venture Capital and Bank Loans**.**	**6**
	Total	**15**

Sl. No.	**Suggested List of Experiments/Assignments**
1.	Case Study on Functions of Management in a Real-World Organization
2.	Preparation of Vision, Mission, and Objectives for a Startup Idea
3.	Case Study on Evolution of Management Thought – Classical to Modern Approaches
4.	Case Study on Motivation Strategy Development for Employee Productivity Improvement
5.	Business Communication Activity – Drafting Official Letters, Memos, and Emails
6.	Decision-Making Exercise Using Decision Tree or SWOT Analysis
7.	Preparation of a Basic Business Plan for a Startup
8.	Market Survey and Opportunity Identification for New Ventures
9.	Preparation of Project Report for an Entrepreneurial Idea
10.	Group Activity: Role Play on Leadership and Team Management

Text Books:

1. Stephen Robins, Mary Coulter , David Decenzo. Fundamental of Management, 11th Edition, Pearson, 2020, ISBN 13: 978-0-13-517515-6.
2. Richard L. Hughes, Robert C. Ginnett, Gordon J. Curphy. Leadership, 09th Edition, Mc Graw Hill, 2022, ISBN-13. 978-9355320704.

3. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.

Reference Books:

1. Jennifer M. George. Contemporary Management, 1st Edition, Mc Graw Hill, 2024, ISBN13: 9781264948390.
2. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

e-sources:

MOOC / NPTEL/YouTube Links: -

- https://www.coursera.org/learn/entrepreneur-guide-beginners
- https://onlinecourses.nptel.ac.in/noc21_mg70/preview
- https://onlinecourses.nptel.ac.in/noc20_ge08/preview

Course Syllabus
Semester-IV

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : IV			
Course	Software Engineering			Code:		CAI25PCC-251	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Programming Language.

Course Objectives:

1. To understand the principles of professional software development.
2. To learn software process models, engineering methods, and best practices.
3. To understand requirements engineering and system modelling techniques.
4. To gain knowledge of software testing, dependability, and quality assurance.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Understand and explain basic concepts of software engineering, development processes, and ethics.
CO2: Analyse and apply agile and plan-driven models in software development.
CO3: Model system requirements using different modeling approaches.
CO4: Evaluate software using testing strategies and understand dependability properties.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Professional software development, Software engineering ethics, Case studies. Software processes: Software process models, Process activities, Coping with change, The Rational Unified Process.	7
II	**Agile Software Development** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. Requirements Engineering: Functional and non-functional requirements, Software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.	7
III	**System Modeling** Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering. Architectural Design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures.	8
IV	**Design and Implementation & Software Testing** Object-oriented design using UML, Design patterns, Implementation issues, Open source development. Development testing, Test-driven development, Release testing, User testing. Dependability and Security: Dependability properties, Availability and reliability, Safety, Security.	8
	Total	30

Text Books:

1. Ian Sommerville, Software Engineering, 9th Edition, Addison-Wesley Publishing Company, USA, 2011, ISBN-13: 978-0137035151.
2. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 6th Edition, Tata McGraw-Hill Education, 2006, ISBN-13: 978-0070634176.

Reference Books:

1. S. A. Kelkar, Software Engineering, 2nd Edition, Prentice Hall of India (PHI Learning), 2016.
2. Pankaj Jalote, Software Engineering, Narosa Publishers, 3rd Edition, 2006.

e-sources:

MOOC / NPTEL/YouTube Links:

- https://onlinecourses.nptel.ac.in/noc25_cs108/preview
- https://www.youtube.com/playlist?list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : IV			
Course	Artificial Intelligence			Code:		CAI25PCC-252	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Data Structures, basics of Programming Language.

Course Objectives:

1. Understand the fundamentals of Artificial Intelligence, including intelligent agents, environments, and rational decision-making.
2. Apply problem-solving and search techniques, including heuristic, local, and optimization strategies.
3. Analyze adversarial problems and constraint satisfaction techniques for games and complex scenarios.
4. Develop skills in knowledge representation and reasoning while exploring advanced AI trends such as generative models, large language models, explainable AI and Edge AI.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Understand basics of AI, its applications, and intelligent agents.
CO2: Use search techniques and heuristics to solve AI problems.
CO3: Apply game search methods and solve constraint satisfaction problems.
CO4: Represent knowledge using logic and understand recent AI trends.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Artificial Intelligence and Intelligent Agents** Introduction to Artificial Intelligence, Applications of AI , Risks and Benefits of AI, Intelligent Agents, Agents and Environments, Concept of Rationality, Nature of Environments and Structure of Agents.	7
II	**Problem Solving and Search Techniques in AI** Solving Problems by Searching, Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions, Search in Complex Environments, Local Search and Optimization Problems.	8
III	**Adversarial Search** Game Theory, Optimal Decisions in Games, Heuristic Alpha–Beta Tree Search, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs and Backtracking Search for CSPs.	7
IV	**Knowledge Representation, Reasoning, and Advanced AI Trends** Covers propositional and first-order logic, inference methods, and knowledge-based reasoning. Introduces generative models, LLMs, and	8

	transformer architectures with applications in AI. Includes Explainable AI techniques and emerging trends like Edge AI for efficient deployment.	
	Total	**30**

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education, 2009, ISBN-13: 978-0136042594.
2. Deepak Khemani, A First Course in Artificial Intelligence, 1st Edition, McGraw Hill Education (India), 2013, ISBN-13: 978-1259029981.
3. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, Artificial Intelligence, 3rd Edition, Tata McGraw-Hill Education, 2009, ISBN-13: 978-0070087705.

Reference Books:

1. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, 1st Edition, Morgan Kaufmann Publishers Inc., San Francisco, CA, 1998, ISBN-13: 978-1558604674.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Addison-Wesley Publishing Company, 1992, ISBN-13: 978-0201533774.
3. Andries P. Engelbrecht, Computational Intelligence: An Introduction, 2nd Edition, Wiley India, 2007, ISBN-13: 978-0470512500.
4. Dr. Lavika Goel, Artificial Intelligence: Concepts and Applications, 1st Edition, Wiley India, 2017, ISBN-13: 978-8126519934.
5. Dr. Nilakshi Jain, Artificial Intelligence: As per AICTE – Making a System Intelligent, 1st Edition, Wiley India, 2018, ISBN-13: 978-8126579945.

e-sources:

e-Books:

- https://people.engr.tamu.edu/guni/csce625/slides/AI.pdf

MOOC / NPTEL/YouTube Links:

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

Program	S.Y. B.Tech. (Computer Science and Engineering-Artificial Intelligence)				Semester : IV		
Course	Artificial Intelligence Laboratory				Code	CAI25PCC-253	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	-	50	75

Pre-requisites: Prior knowledge of Data Structures, basics of Programming Language.

Course Objectives:

1. To introduce fundamental concepts and techniques in Artificial Intelligence.
2. To enable students to implement key AI algorithms for search, reasoning, and learning.
3. To develop practical skills in solving real-world problems using AI.
4. To provide foundational knowledge in neural networks and decision-making systems.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Apply rule-based systems and search algorithms (BFS, DFS, A*) to solve structured problem-solving tasks.

CO2: Design and implement solutions for constraint satisfaction problems using backtracking and constraint propagation.

CO3: Develop intelligent agents for decision-making in games using Minimax and Alpha-Beta Pruning techniques.

CO4: Analyze basic neural network models for classification tasks, including the use of activation functions.

Course Contents

Guidelines for Laboratory Conduction

- The instructor is expected to conduct **minimum 12 assignments.**
- Each student must perform Mini Project.
- The instructor may set multiple sets of assignments and distribute them among batches of students.

Sl. No.	Suggested List of Assignment/Experiments
1	Study the concept of Intelligent Agents and implement a simple reflex agent for a given environment.
2	Simulate a model of agent–environment interaction (vacuum cleaner, taxi agent, or grid world).
3	Implement a Problem-Solving Agent using state-space representation for a simple puzzle/problem.
4	Implement Breadth-First Search (BFS) and Depth-First Search (DFS) for a given graph/tree.
5	Implement Uniform-Cost Search and compare it with BFS/DFS for pathfinding problems.
6	Implement Informed Search using Best-First Search and A Search with heuristic functions.
7	Develop local search methods such as Hill Climbing and Simulated Annealing for

	optimization tasks.
8	Implement Adversarial Search using Minimax Algorithm for simple games like Tic-Tac-Toe.
9	Enhance Minimax with Alpha–Beta Pruning and analyze reduction in explored nodes.
10	Implement Monte Carlo Tree Search (MCTS) for a small game environment.
11	Model a Constraint Satisfaction Problem (CSP) such as Map Coloring or Sudoku using Backtracking Search.
12	Implement Constraint Propagation techniques like Forward Checking or Arc Consistency (AC-3).
13	Write programs for knowledge representation using Propositional Logic (truth tables, inference rules).
14	Represent knowledge using First-Order Logic and perform simple inference manually or through code.
15	Perform basic NLP/AI tasks using a pre-trained Transformer/LLM API (text classification, Q&A, summarization).
16	Mini Project: Design a small AI system integrating search, logic, or LLM-based reasoning (chatbot, game solver, recommender).

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 4th Edition, 2021.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw-Hill Education, 2nd Edition, 2023.
3. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, McGraw-Hill Education, 4th Edition, 2022.

Reference Books:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, Indian Reprint Edition, 2022.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, Reprint Edition, 2023.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 3rd Edition, 2023.
4. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, 2nd Edition, 2024.

e-sources:

e-Books:

- https://people.engr.tamu.edu/guni/csce625/slides/AI.pdf
- https://nptel.ac.in/courses/106102220

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : IV			
Course	Database Management Systems			Code:		CAI25PCC-254	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites : Basic knowledge of data structures and algorithms of programming fundamentals is essential

Course Objectives: This course aims at enabling students:

1. To provide fundamental knowledge of database concepts, architectures, and data models.
2. To make students familiar with building database design.
3. To develop the ability to write efficient SQL queries for data definition, manipulation, and control.
4. To introduce the fundamental concepts of transactions, ACID properties, and their importance in database reliability.

Course Outcomes: After completing the course, the learner will be able to:

CO1: Design E-R Model for given requirements and convert the same into database tables.
CO2: Implement normalization techniques, to construct optimized relational database designs.
CO3: Use SQL to write queries for given requirements.
CO4: Implement transaction management strategies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Foundations of Databases and ER Model** Introduction of Data, Information, Database and DBMS, Characteristics and applications of DBMS, key, Database architecture, levels of Abstraction ER model and ER diagrams, Extended ER Features: Specialization, Generalization, Aggregation.	7
II	**Relational Database design** Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, 2NF, 3NF, BCNF.	8
III	**SQL** SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Updating, SQL DML Queries: SELECT Query and clauses, Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries.	7
IV	**Database Transaction Management** Transaction concept, Transaction states, ACID properties, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Lock-based, Time-stamp based Deadlock handling, Recovery methods: Shadow- Paging and Log-Based Recovery	8

	Total	30

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.
4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626.

Reference Books:

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674.Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O‟Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.
2. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011, ISBN 1743045743, 9781743045749.

e-Books:

1. SQL and Relational Theory
   (How to Write Accurate SQL code), C.J. Date, O'REILLY Publication
2. SQL A Beginner's Guide, Andy Oppel, Robert Sheldon, McGraw Hill Publication

MOOC / NPTEL/YouTube Links:

1. NPTEL–Database Management System (IIT Madras) https://nptel.ac.in/courses/106105175
2. NPTEL–Database Systems (IISc Bangalore) https://nptel.ac.in/courses/106104135
3. Coursera–Database Systems Concepts & Design (ASU)
   https://www.coursera.org/specializations/database-systems

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : IV			
Course	Database Management System Laboratory			Code:		CAI25PCC-255	
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
02	-	04	-	25	-	25	50

Pre-requisites: Basic knowledge of computer operation and programming logic, data structures and algorithms.

Course Objectives: This course aims at enabling students:

1. To develop Database programming skills.
2. To develop basic Database administration skills.
3. To learn, understand and execute process of software application development.

Course Outcomes: After completing this course, students will be able to
CO1: Implement SQL queries for given requirements, using different SQL concepts
CO2: Implement a complete software application by applying database concepts and Software Engineering practices.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus. Operating System recommended :- 64-bit Open source Linux or its derivative Programming tools recommended: - MYSQL/Oracle, MongoDB, ERD plus, ER Win

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of the student. Each Laboratory assignment assessment of the student should be based on predefined rubrics finalized during course meetings.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Course Contents

Suggested List of Experiments/Assignments

Sl. No.	Group A: SQL
1	Decide a case study related to real time application in group of 2-3 students and formulate a problem statement for application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER diagram into relational tables and normalize Relational data model
2	Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym, different constraints etc.
3	Implement SQL queries to familiarize students with essential SQL commands in

	MySQL - to create a new user, create a table considering different data types, Insert, Select, Update, Delete, Drop, Alter, distinct, describe, Truncate command.
4	Implement sql queries to provide students with hands-on experience in implementing various data constraints using SQL commands in MySQL. (NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, and DEFAULT)
5	Implement sql queries for different SQL concepts for SQL computation (arithmetic operators, logical operators, pattern matching, IN and NOT IN predicates, and MySQL built-in functions).
6	Implement SQL queries for different SQL concepts such as grouping data, using the GROUP BY clause, employing the HAVING clause, applying the EXISTS/NOT EXISTS operators, Creating and using Database Views.
7	Write SQL queries to demonstrate the different SQL concepts like subqueries, performing various join operations, and using set operators in MySQL.
8	Implement SQL queries to demonstrate the nested queries in SQL using MySql.
	Group B:- Mini Project
9	Using the database concepts covered in Group A, develop an application with following details: 1. Follow the same problem statement decided in Assignment -1 of Group A. 2. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation. 3. Develop application considering: • Front End : Java/Perl/PHP/Python/Ruby/.net/any other language • Backend : MySQL/Oracle 4. Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle: • Title of the Project, Abstract, Introduction • Software Requirement Specification • Conceptual Design using ER features, Relational Model in appropriate Normalize form • Graphical User Interface, Source Code • Testing document • Conclusion. **Note:** • Instructor should maintain progress report of mini project throughout the semester from project group • Practical examination will be on assignments given above in Group only • Mini Project in this course should facilitate the Project Based Learning among students

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
3. Connally T, Begg C., "Database Systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.
4. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626.

Reference Books:

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674.Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O‟Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.
2. Kevin Roebuck, "Storing and Managing Big Data - NoSQL, HADOOP and More", Emereo Pty Limited, 2011, ISBN 1743045743, 9781743045749.

Program	S.Y. B.Tech. (Computer Science and Engineering- Artificial Intelligence)			Semester : IV			
Course	IoT Fundamentals and Network Architecture			Code:		CAI25MDM-256	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites Prior knowledge of fundamentals of Computer Networks is essential.

Course Objectives:

1. Understand the foundational concepts, evolution, and characteristics of the Internet of Things.
2. Learn IoT reference architectures, communication models, and essential system components.
3. Study device-level, network-level, and cloud-level architecture for IoT solutions.
4. Explore real-world IoT applications, design challenges, interoperability, and standards.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Explain key IoT concepts, enabling technologies, and interaction between physical and digital ecosystems.

CO2: Illustrate IoT system architecture including devices, gateways, connectivity layers and cloud integration.

CO3: Compare IoT communication models, protocols, and design principles across various domains.

CO4: Analyze real-world IoT applications, challenges, standards and interoperability requirements.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of IoT & Ecosystem Components** Evolution of IoT from M2M to cyber–physical systems, characteristics of IoT systems including scalability, heterogeneity, and interoperability, elements of IoT such as sensors, actuators, embedded devices, gateways, and cloud services, IoT functional blocks including sensing, communication, data processing, and application layers, enabling trends such as ubiquitous connectivity, edge computing, and AI integration, and an overview of IoT application domains including smart cities, healthcare, retail, agriculture, and industrial automation.	7
II	**IoT Reference Models & Architecture Layers** IoT architecture basics including device, network, service, and application layers, three-layer and five-layer architectures covering perception, network, middleware, application, and business layers, IoT Reference Model (ARM) and IoT-A concepts, functions of IoT middleware such as device management, data routing, security, and interoperability, the edge–fog–cloud architectural hierarchy, and IoT platform architecture components including device registry, data ingestion, storage, analytics, and dashboards.	7
III	**IoT Communication Models & Protocols** IoT communication patterns including device-to-device, device-to-cloud, and gateway-mediated models, communication models such as publish–	8

	subscribe, request–response, event-driven, and streaming, wireless communication technologies including Wi-Fi, BLE, ZigBee, LoRaWAN, NB-IoT, and RFID, IoT application protocols such as MQTT, CoAP, AMQP, and HTTP/HTTPS, addressing and identification methods including IPv6, 6LoWPAN, and device addressing strategies, and interoperability challenges with guidelines for protocol selection.	
IV	**IoT System Design Considerations & Real-World Applications** Functional requirements including scalability, latency, reliability, and energy efficiency, hardware design considerations such as sensor selection, low-power design, and gateway functions, IoT data flow architecture from acquisition to processing, analytics, actuation, and feedback, integration with the cloud ecosystem, industry-specific case studies such as smart energy and AMI systems, smart mobility and intelligent transport, smart homes and building automation, and environmental and agricultural monitoring, and key IoT challenges including privacy, data management, regulatory concerns, ethics, and lifecycle management.	**8**
	Total	**30**

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 2nd Edition, Universities Press, 2017.
2. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, 1st Edition, Morgan Kaufmann, 2016.

Reference Books:

1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, 1st Edition, Wiley, 2014, ISBN-13: 978-1118430620.
2. Ovidiu Vermesan and Peter Friess (Editors), Internet of Things: From Research and Innovation to Market Deployment, 1st Edition, River Publishers, 2014, ISBN-13: 978-8793102941.
3. Pethuru Raj and Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, 1st Edition, CRC Press (Taylor & Francis), 2017, ISBN-13: 978-1498737593.

e-sources:

- https://www.iotone.com
- https://www.postscapes.com
- https://developer.ibm.com/technologies/iot
- https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Program	S.Y. B.Tech. (Open Elective Course - II)			Semester : IV			
Course	Digital Marketing			Code:		CE25OEC-257	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of marketing terms such as target audience, branding, product, pricing, etc. is essential.

Course Objectives:

1. To provide the basic Concepts of Digital Marketing and the road map for successful Digital marketing strategies.
2. To know the importance of Social Media Platforms importance in Digital Marketing.
3. To understand the technological importance of Search Engine Optimization (SEO).
4. To develop skills for creating, managing, and optimizing digital marketing campaigns across various channels.
5. To enable students to analyze digital consumer behavior and create effective online strategies.

Course Outcomes:

After completion of the course, the students will be able to:

CO1: Explain the basic Concepts of Digital marketing.

CO2: Apply digital marketing tools for suitable applications.

CO3: Examine the various social media and design Advertising campaigns.

CO4: Apply SEO, SEM, and content creation techniques to improve online visibility.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Digital Marketing** Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, The Digital users in India, Digital marketing Strategy- Consumer Decision journey Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan. **Case study**: Launching a Tech Startup's Mobile App - "SmartBudget".	7
II	**Digital Marketing strategy** **strategy** used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Google web-master and analytics overview, Email Marketing, Mobile Marketing Display adverting, Buying Models, different type of ad tools, Display advertising terminology, types of display ads, different ad formats. **Case study:** Social Media Marketing	8
III	**Social Media Marketing** Fundamentals of Social Media Marketing& its significance, Necessity of Social media Marketing Facebook Marketing: Facebook for Business, Facebook Insight, Different types of Ad formats, setting up Facebook Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags.	8

	Case study: App Store Optimization (ASO).	
IV	**Search Engine Optimization (SEO)** Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, Googlebot (Google Crawler), Types of SEO technique, Keyword Planner tools Social media Reach- Video Creation & Submission, Maintenance- SEO tactics, Google search Engine. **Case study: Provide REAL outputs like a mini-project** Marketing plan, Keyword research sheet Google Ads mock screenshot FB Ads audience design Social media creative poster 1 reel script.	**7**
	Total	**30**

Text Books:

1. Dave Chaffey and Fiona Ellis-Chadwick, Digital Marketing, 8th Edition, Pearson Education, 2022, ISBN-13: 978-1292738086.
2. Rajan Gupta and Supriya Madan, Digital Marketing, 1st Edition, Dreamtech Press, 2023, ISBN-13: 978-9355511522.

Reference Books:

1. Klaus Solberg Søilen, "Digital Marketing", Springer, 2024, ISBN: 9783031695186.
2. Dionne Solomons et al., "eMarketing: The Essential Guide to Marketing in a Digital World", 6th Edition, 2020, ISBN: 9780639707808.

e-sources:

- NPTEL Course, By Dr. Tejinderpal Singh, Panjab University Chandigarh https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview

Program	S.Y. B.Tech. (Open Elective Course - II)			Semester : IV			
Course	Engineering Economics			Code:		ETC25OEC-257	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of economics & mathematics is essential.

Course Objectives: This course aims at enabling students:

1. To enable the students to understand the economic theories which may be applied to maximize return and the economic environment in which they have to operate.
2. To introduce fundamental economic principles relevant to engineering analysis and decision-making.
3. To develop the ability to apply time-value-of-money concepts for evaluating engineering alternatives.
4. To learn cost estimation, depreciation, and break-even analysis for effective financial planning in engineering projects.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Identify the core concepts of economics and recognize its potential in addressing modern day socio- economic challenges.

CO2: Compare and analyze alternatives based on present, annual, rate of return, benefit over cost analyses, time value of money in evaluation of investments and projects in real life and the impact of economic factors on feasibility of real life projects.

CO3: Analyze and predict the economic impact of engineering solutions to make financially prudent decisions in everyday life.

CO4: Evaluate the role of economics to give knowledge to the students about various costs for determining the manufacturing of a product.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market - Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts and E-commerce.	8
II	**Money- its evaluation and function, Bank** Commercial Bank and Central Bank and brief idea about function of banking system. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, IPR & WTO, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping and Balance of Payment.	8
III	**Role of Science, Engineering and Technology in economic**	7

	Development Some of the burning problems of rural and slum areas in India and how engineering and technology may be used to alleviate them, example of Green Revolution and White revolution. Reasons for their success and can we replicate them and Sustainable Development.	
IV	**Elementary Economic Analysis; Interest formulas and their Applications:** Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of return; Evaluating Production Operations and Business Risk Management.	**7**
	Total	**30**

Text Books:

1. A Textbook of Engineering Economics: The Principles and Applications, D. R. Kiran, BS Publications, 2021, 1st Edition.
2. Engineering Economics Test & Cases, D N Dwivedi, Dr. H L Bhatia & Dr. S N Maheshwari, Vikas Publishing House Pvt. Ltd. Revised / Latest Edition (2024).

Reference Books:

1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi, 2nd Edition, Cambridge University.
2. Practical Applications of Engineering Economics, Kal R. Sharma, Momentum Press. Engineering Economics, R. Panneerselvam, PHI Learning Private Ltd, 1st Edition.

e-sources:

- https://youtu.be/-5q7RB1GWEA

Program	S.Y. B.Tech. (Open Elective Course - II)			Semester: IV			
Course	Digital Finance			Code:		ME25OEC-257	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Finance and Economics**,** Cyber Security & Digital Payments is essential.

Course Objectives: This course aims at enabling students

1. To understand the evolution of digital finance and the role of big data in modern financial systems.
2. To gain insight into digital payment ecosystems and ongoing transformations in digital banking.
3. To acquire foundational knowledge of blockchain technology, cryptocurrencies, and decentralized finance.
4. To explore applications of artificial intelligence, machine learning, and data analytics in financial services

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the basics of digital finance, big data, and regulatory frameworks.
CO2: Analyze digital payments, FinTech trends, and neo-banking models.
CO3: Illustrate blockchain, cryptocurrencies, and DeFi systems.
CO4: Discuss the role of AI/ML for financial analytics.
CO5: Apply cybersecurity and compliance strategies for digital finance.

Course Contents

Unit	Description	Duration [Hrs]
I	**Digital Finance Fundamentals & Big Data** **Evolution & Fundamentals of Digital Finance:** Evolution of digital finance and the shift from traditional to digital systems. Introduction to FinTech and technological transformations in financial services. Overview of regulatory frameworks and compliance in the digital era. **The Rise of Big Data in Finance:** Role of big data in shaping financial decision-making and risk management. Leveraging data science for personalization and modern financial services **Case Study:** DBS Bank's Digital Transformation	7
II	**Digital Payment Systems & Digital Banking Transformation** **Digital Payment Ecosystems:** Historical evolution and digitalization of payment systems (ECS, RTGS, NEFT, IMPS, UPI, mobile wallets, contactless payments), Attributes of a well-functioning payment system and the role of banks. **Fintech Innovations & Disruption:** FinTech startups, challenger banks, and peer-to-peer lending models, FinTech applications across banking, NBFCs, insurance, lending, audit, and compliance, Regulatory guidelines (e.g., RBI guidelines) and risks associated with new payment models. The Future of Digital Banking: How traditional banks are adapting and the rise of neo-banks, Digital banking trends and evolving customer	7

	expectations **Case Study:** Unified Payments Interface (UPI) in India Case Study: Unified Payments Interface (UPI) in India.	
III	**Blockchain, Cryptocurrencies & Decentralized Finance** **Blockchain Technology:** Fundamentals of blockchain and underlying cryptographic techniques, Smart contracts and decentralized finance (DeFi) applications. Cryptocurrencies & Digital Assets: Overview and evolution of cryptocurrencies (Bitcoin, Ethereum, etc.), Central Bank Digital Currencies (CBDCs) and other emerging digital assets. **Advanced Applications & Case Studies:** Impact of blockchain on payments, lending, and financial settlements, Real-world case studies and disruptive potential in global finance **Case study:** The Sand Dollar (Bahamas' CBDC)	**8**
IV	**Artificial Intelligence, Machine Learning in Financial Analytics** **AI & Machine Learning in Finance:** Predictive analytics in stock markets, trading, and algorithmic/high frequency trading, Credit risk analysis and automated decision-making using AI. Data Analytics & Financial Applications: Data sourcing, cleaning, processing, and visualization for financial data, Sentiment analysis and AI-driven portfolio management. **Practical Projects & Case Studies:** Hands-on projects: building stock price prediction models, fraud detection systems, and credit score prediction models, Real-world applications in digital lending and wealth management **Case study:** Thread programming Using Pthreads, POSIX	**8**
	Total	**30**

Text Books:

1. C. Skinner, Digital Finance: Big Data, Startups, and the Future of Financial Services, 1st edition. Hoboken, NJ, USA: Wiley, 2016.
2. J. H. M. T. Jeffry, Introduction to FinTech, 1st edition. Noida, India: Pearson Publications, 2018
3. D. Tapscott and A. Tapscott, The Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World, 1st edition. New York, NY, USA: Penguin Random House, 2016.
4. M. López de Prado, Machine Learning for Asset Managers, 1st edition. Cambridge, UK: Cambridge University Press, 2020.
5. "FinTech: The Impact and Role of Financial Technology" by Parag K. Patel, Wiley publications, 1st edition

Reference Books:

1. R. Ghose, Future Money: Fintech, AI and Web3. London, UK: Kogan Page, 2024.
2. Y. Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, 1st edition. Sebastopol, CA, USA: O'Reilly Media, 2020.
3. M. López de Prado, Advances in Financial Machine Learning, 1st edition. Hoboken, NJ, USA: Wiley, 2018.
4. S. Chishti and J. Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs, and Visionaries, 1st edition. Hoboken, NJ, USA: Wiley, 2016.

5. D. Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st edition. Berkeley, CA, USA: Apress, 2017.
6. B. Hines, Digital Finance: Security Tokens and Unlocking the Real Potential of Blockchain, 1st edition. Hoboken, NJ, USA: Wiley, 2020

e-sources:

E- Books:

1. P. H. Beaumont, Digital Finance: Big Data, Start-ups, and the Future of Financial Services, 1st edition. London, U.K.: Routledge, 2019.
   Link: https://download.e-bookshelf.de/download/0015/1963/23/L G-0015196323-0047264745.pdf.
2. N. Urbach and M. Roglinger, Big Data and Artificial Intelligence in Digital Finance, 1st edition. Cham, Switzerland: Springer, 2022
3. L. Perlman, An Introduction to Digital Financial Services, 1st edition., 2018.
   Link: https://www.academia.edu

MOOC/NPTEL/YouTube Links:

1. https://www.my-mooc.com/en/mooc/introduction-to-fintech/
2. https://mooc.besideproject.eu/courses/blockchain-use-cases-in-digital-finance/
3. 3. https://www.coursera.org/specializations/digital-transformation-financial-services

Program	S.Y. B.Tech. (Value Education Course - II)			Semester : IV			
Course	Indian Constitution			Code:		CE25VEC-258	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	TW	Total
2	1	-	1	-	-	25	25

Pre-requisites: Prior knowledge of and Indian history, civics, and societal structure to comprehend constitutional principles and governance frameworks is essential.

Course Objectives: This course aims at enabling students:

1. To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. To channelize students' thinking towards basic understanding of the constitutional principles and statutory institutions.
4. To enable students to critically evaluate constitutional provisions and apply them to contemporary social, political, and administrative contexts.

Course Outcomes:

After completion of the course, the students will be able to:

CO1: Identify and explore the basic features and modalities about Indian constitution.

CO2: Differentiate and relate the functioning of Indian Parliamentary System at the center and state level.

CO3: Analyze the administrative structure of various branches of government.

CO4: Examine different aspects of Indian Legal System and its related bodies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Constitution** Meaning & Constitutionalism, Introduction to Constitution: Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and itslegal status, Citizenship. **Case Study:** The Kesavananda Bharati Case (1973) – Basic Structure & Constitutionalism.	4
II	**System of Government- Center & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure, and distribution of legislative and financial powers between the Union and the States, local self-government. **Case Study:** S.R. Bommai v. Union of India (1994) – Misuse of President's Rule.	4
III	**Government: Union & State** Executive & Legislature, composition, powers and functions, Local Self	4

	Governments – Panchayat Raj Institutions & Urban Local Bodies (Municipalities). Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women. **Case Study:** Indira Gandhi v. Raj Narain (1975) – Executive Accountability(Powers of Election Commission, Executive accountability, Free & fair elections).	
IV	**Constitution Functions** Indian Federal System and its characteristics, Federal structure & distribution of legislative and financial powers between the Union and the States. Centre & State Relations, President's Rule, Constitutional Amendments and powers, Constitutional Functionaries, Emergency Provisions, Assessment of working of the Parliamentary System in India. **Case Study:** GST & Federal Structure (2017–2023).	**3**
	Total	**15**

Text Books:

1. E 1. Durga Das Basu, ―Introduction to the Constitution of India ―, Prentice Hall of India, New Delhi,24th edition,2020, ISBN-109388548868.
2. Clarendon Press, Subhash C, Kashyap, ― Our Constitution: An Introduction to India's Constitution andconstitutional Law‖, NBT, 5th edition, 2014, ISBN-9781107034624.

Reference Books:

1. Maciver and Page, ―Society: An Introduction Analysis ― Laxmi Publications, 4th edition, 2007, ISBN-100333916166
2. PM Bhakshi, ―The constitution of India‖, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition,2017, ISBN-108131262375
3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi.
4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.

e-sources:

e-Books:

1. The full text of the Constitution of India (latest version) — available for download in English (and other Indian languages). Legislative Dashboard+2legislative.gov.in+2
2. Updated 2024 edition (English + Hindi Diglot) — PDF version. S3WaaS
3. Official publication with all amendments (as on May 2022) — PDF version. S3WaaS
4. A simple introductory book: The Constitution of India — An Introduction (by NCERT) — which gives a good basic overview. NCERT

MOOC / NPTEL/YouTube Links:

1. **Constitution Law and Public Administration in India** (NPTEL-NOC, IIT Madras) — comprehensive course covering constitutional law + public administration. https://onlinecourses.nptel.ac.in/noc20_lw03/preview
2. Playlist on YouTube: **"Constitutional Studies" (NPTEL)** lectures by law professors covering fundamentals, history, structure, rights etc. https://www.youtube.com/playlist?app=desktop&list=PLyqSpQzTE6M-Zj2GBVpJ3c7cfvMTcKrPL&utm_source=chatgpt.com

Program	S.Y. B.Tech. (Value Education Course - II)			Semester : IV			
Course	Environmental Science			Code:			AIDS25VEC-258
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	TW	Total
2	1	-	1	-	-	25	25

Pre-requisites: Prior **k**nowledge of Multidisciplinary nature of environmental studies; components of environment — atmosphere, hydrosphere, lithosphere and biosphere.is essential.

Course Objectives: This course aims at enabling students:

1. To gain an understanding of the Environment where we live.
2. To comprehend the importance of water.
3. To educate about Air and Noise pollution.
4. To explain the concepts of E- waste and Green Computing.

Course Outcomes: After successful completion of the course, learner will be able to:

CO1: Analyze the impacts of different types of environmental pollution on ecosystems and physical resources.

CO2: Describe the sources and effects of water, air, and noise pollution on human health and the environment.

CO3: Identify sources and types of e-waste and analyze basic e-waste management practices.

CO4: Apply green computing principles to promote environmental sustainability and reduce ecological impact.

Course Contents

Unit	Description	Duration [Hrs]
I	**Environmental pollution** Environment and its importance, Definition, Types. Effect of environmental pollution on Plants, Non-living things.	3
II	**Water Pollution** Definition, Sources of water Pollution, Types of waste water-Domestic and industrial waste.	4
III	**Air pollution** Definition, Sources/causes of air pollution. Atmospheric layers, Effects on human. **Noise Pollution:** Definition of Noise Pollution, Types of Noise Pollution.	4
IV	**E-waste management** Definition of E-waste, Sources of E-waste, Types of E-waste, **Green computing:** Definition, Objectives of Green Computing, Necessity, Environmental benefits.	4
	Total	15

Tutorial Conduction and Term Work Guidelines (Set of Suggested Activities)

1	Report/Presentation on the effect of Environmental Pollution on any world famous Structure/ monument.
2	Report/Presentation on importance of different sources of water available nearby them.
3	Report/Presentation based on the data collected from the local authorities on air pollution and noise pollution.
4	Report/Presentation on the E-Waste generated in the campus.
5	Time-series analysis of natural resource consumption of a given country using publicly available data

Text Books:

1. 'Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. 5th edition (1 July 1998) WCB, McGraw Hill
2. "The text book of Environmental studies", Dr. P. D. Raut, Shivaji University, 2013.
3. "A Text Book of Environmental Studies", Dr. D. K. Asthana, S. Chand.
4. "Environmental Pollution, monitoring and control", S. M. Khopkar, New Age Publication.

Reference Books:

1. Bharucha, E., ―Textbook of Environmental Studies‖, Universities Press (2005), ISBN-10:8173715408 ,1st Edition.
2. Mahua Basu, ―Environmental Studies‖, Cambridge University Press, ISBN-978-1-107-5317-3, 1st Edition.

e-sources:

- https://onlineethics.org/cases/life-and-environmental-science-ethics-case-studies

Program	S.Y. B.Tech. (Computer Science and Engineering - Artificial Intelligence)			Semester : IV			
Course	Community Engagement Project			Code:		CAI25ELC-259	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	50	-	50

Pre-requisites: Prior knowledge of social and ethical responsibilities, Teamwork and communication skills is essential.

Course Objectives:

1. To establish a mutually beneficial relationship between the college and the community.
2. To engage with their local community, fostering empathy, teamwork, and problem
3. To understand challenges faced by the local community and the role of engineering in addressing those challenges.
4. To evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

Course Outcomes:

After completion of the course, the students will be able to:

CO1: Identify local community needs and challenges by engaging with stake holders and evaluating real-world problems.

CO2: Implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3: Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

CO4: To apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.

Course Contents:

Guidelines for Laboratory Conduction

- A group of 3 to 4 students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
- Each group /practical batch is allotted to a faculty member of the department as a mentor.
- A division of 60 students can have 3 batches of minimum 20 students. Practical load of 4 hours to be allocated to each batch.
- The group of students will be associated with a government official / village authority /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
- The Community Engagement Project should be different from the regular programmes of NSS/NCC /Green Club/Hobby Clubs, Special Interests Groups etc.
- An activity book has to be maintained by each of the students to record the activities under taken/involved and will be countersigned by the concerned mentor/HoD.
- Project report shall be submitted by each student/group of students.
- Students groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e waste management or any other activity in an area of their studies and as per his/her aptitude.

Guidelines for Oral Examination

- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.

Suggestive list of topics under Community Engagement Project

- The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall.
- Use/ miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture
- Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits
- Air /Sound /Water pollution
- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Organic farming
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustain ability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community.

Proposal Submission

- CEP Group should submit a two-page project proposal, preferably prior to the term commencement outlining the following:
- Title of the project

- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).
- Get approval from the designated faculty mentor.

Learning Resources

Text Books:

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.

e-sources:

MOOC/NPTEL/YouTube Links:

- NPTEL course: Ecology and Society, https://onlinecourses.nptel.ac.in/noc20_hs77/preview

Program	S.Y. B.Tech. (Entrepreneurship Management Course)				Semester : IV		
Course	Entrepreneurship Skills Development				Code	ILI25EMC-260	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	1	25	-	-	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives:

1. Introduce the fundamental principles of entrepreneurship, forms of business organizations, and the start-up ecosystem.
2. Enable students to identify, evaluate, and select viable business opportunities using structured techniques.
3. Familiarize students with business models, financial planning, and market validation strategies.
4. Expose students to key marketing strategies, customer acquisition techniques, and branding essentials for start-ups.
5. Develop students' entrepreneurial mind-set and their ability to communicate and pitch business ideas effectively using structured storytelling techniques.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Describe the role of entrepreneurship in economic growth and the start-up ecosystem.

CO2: Apply creative techniques to viable business ideas based on customer needs.

CO3: Develop a basic business model using tools like the Business Model Canvas through market research.

CO4: Implement basic marketing strategies for start-ups.

CO5: Deliver a concise business pitch using storytelling and effective communication techniques.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Entrepreneurship** Entrepreneurship**:** Definition and evolution, Role of entrepreneurship in economic development, Role in job creation, GDP, and innovation. Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience. Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (corporate entrepreneurship), Lifestyle and small business entrepreneurship, Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited. Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking. Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.) and Global vs. Indian startup ecosystems.	3

II	**Idea Generation & Opportunity Recognition** Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneur- ship. Brainstorming: Rules of effective brainstorming. Individual vs. group brainstorming. Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping. Understanding Customer Needs and Pain Points: Customer pain points and their identification, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user inter- views, and empathy mapping. Evaluating Opportunities: Difference between an "idea" and an "opportunity." Basic filters: Desir- ability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends and market gaps.	**3**
III	**Business Model Development** Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining what unique value the product/service of- fers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, freemium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business de- velopment. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops.	**3**
IV	**Customer Acquisition , Pitching & Funding Sources** Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools. Customer Acquisition Strategies: Understanding the Customer Journey – Awareness, interest, de- cision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer mar- keting (micro-influencers), Email marketing basics, building a landing page and collecting lead. Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value propo- sition, target audience, Delivery tips: Clarity, brevity, confidence Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators, government schemes and crowdfunding.	**6**
	Total	**15**

Suggested List of Experiments/Assignments

Sl. No.	Title	Objective	Description
1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a	**Write a reflective essay** (500–600 words) based on the following: • Explain what entrepreneurship means to you personally. • Identify an entrepreneur (Indian or

		real-world entrepreneur.	global) whom you admire and explain the reasons for your admiration. • Highlight specific mindset traits (e.g., risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur's success. • Reflect on how these traits align with your own strengths or indicate areas you wish to develop.
2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	**Generate 10 Business Ideas** Use any structured brainstorming technique Ideas can be tech-based, social impact, service-based, or product-based 2. Select One Idea- Choose the most promising idea from your list 3. Write a 1-page Concept Summary, include the following: • Problem Identified: Describe the specific problem or pain point your idea addresses. • Solution Overview: Briefly describe your business idea. • Target Audience: Identify the group of people or organizations that would benefit. • Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer conversations. The goal is to learn how to validate ideas through	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas with all 9 key blocks:

		real-world feedback and refine the business concept accordingly.	o Customer Segments o Value Propositions o Channels o Customer Relationships o Revenue Streams o Key Resources o Key Activities o Key Partnerships o Cost Structure 3. Present the BMC in visual or tabular format. **Part B: Customer Interviews & Insights** 1. Identify 2–3 potential customers from your target segment. 2. Conduct brief interviews (5–10 minutes each) to gather insights on: o Their pain points o Their reaction to your proposed solution o Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: o Key customer quotes or paraphrased insights o A revised Value Proposition or Customer Segment block (if needed) 4. A short reflection: key learnings and potential changes to your idea.
4	Business Launch Plan – Marketing & Financial Snapshot	To develop a practical understanding of how marketing stratey and financial planning go hand-in-hand in launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and	You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following **Part A: Marketing Campaign Plan** • Define your target market by identifying

		projected revenue	primary customers. • Design a mini-campaign using one or more of the following channels: Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing • Describe the campaign content, including the message or offer to be promoted. Optionally, create 1–2 sample marketing materials. Write a 300-word explanation outlining your marketing strategy and expected impact. **Part B: Financial Snapshot** 1. Startup Costs – Estimate your initial costs (fixed + variable) 2. Pricing Strategy – State your pricing model and justification Break-even Analysis – Basic cost vs. sales estimate 4. 6-Month Revenue Projection – Expected sales and income Format: Use a simple table or spreadsheet (optional)
5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	**Prepare a 90-second elevator pitch for your business idea** (the same or refined idea used in earlier assignments). Your pitch should cover the following elements: The Problem – Problem Identification The Solution – Description of your product/service. Value Proposition – The unique value proposition.

			Target Audience – Audience for your idea. o Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** o Record a video and submit it with written version of your pitch. o Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** o Share what you learned about communicating your idea Describe challenges or rewards you experienced in the process.

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.
2. Drucker, Peter F. Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionar- ies, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

Reference Books:

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 9781591847847.

e-sources:

1. https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_mg35
4. https://www.coursera.org/learn/entrepreneur-guide-beginners
5. https://wadhwanifoundation.org/
6. https://www.youtube.com/@wadhwani-foundation/videos

Program	S.Y. B.Tech. (Ability Enhancement Course)			Semester : IV			
Course	Modern Indian Language (Marathi)			Code:		IL25AEC-261	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	2	-	-	-	25	25

Pre-requisites : --

अभ्यासक्रमाची उद्दिष्टे :

१. प्रात भौषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमांतिल संज्ञापनातिल स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्व विकास आणि भाषा यांतील सहसंबंध स्पष्ट करणे.
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

अभ्यासक्रम परिणाम (COs)

अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील परिणाम साध्य करू शकतील:

CO1: शैक्षणिक व व्यावसायिक वातावरणात प्रातभाषिक संवाद कौशल्ये प्रभावीपणे प्रदर्शित करणे.
CO2: प्रसारमाध्यमांच्या संज्ञापनातील रचना, भूमिका आणि महत्त्व स्पष्टपणे समजावून सांगणे.
CO3: व्यक्तिमत्व विकास आणि भाषाज्ञान यांतील परस्पर संबंधांचे विश्लेषण करणे.
CO4: लोकशाहीतील जीवनशैली व प्रसारमाध्यमे यांच्यातील परस्पर संबंधांचे मूल्यांकन करणे.
CO5: विविध प्रसारमाध्यमांसाठी अचूक, संरचित आणि प्रभावी लेखन तयार करणे.

Course Contents

Unit	Description	Duration [Hrs]
१.	भाषा आणि व्यक्तिमत्व विकास : सहसंबंध लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे	७
२.	**प्रसारमाध्यमांसाठी लेखन** वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितसंपादन नभोवाणीासाठी भाषणाची संहितालेखन दूरचित्रवाणीासाठी माहितीपटासाठी संहितालेखन	७
३.	भाषा, जीवन व्यवहार आणि नवमाध्यमे, सामाजिक माध्यमे नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम	७
४.	वेबसाइट आणि ब्लॉग, ट्विटरासाठी लेखन व्यावसायिक पत्रव्यवहार	७
	Total	२८

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे
२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई
३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी
४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई
५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई

६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर
७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	Read a specific column (Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal. "दैनिक मराठी वर्तमानपत्रांमध्ये विशिष्ट कॉलम (क्रीडा, राजकीय, वित्त, संपादकीय, शिक्षण, आंतरराष्ट्रीय बातम्या इ.) वाचा, सारांश द्या आणि व सादरीकरण करा. त्या संदर्भातील सगळा सारांश जर्नल मध्ये जमा करावा."
2	Write blogs and posts on social media up to 200 words on recent development in their field of study. "सोशल मीडियावर त्यांच्या अभ्यासाच्या क्षेत्रातील अलीकडील विकासावर 200 शब्दांपर्यंत ब्लॉग लिहा, आणि पोस्ट करावा"
3	Professional letter / report writing. a. Write letter to the principal for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University "जवळच्या गावात एनएसएस शिबिर आयोजित करण्यासाठी मुख्याध्यापकांना पत्र लिहा. विद्यापीठात बजेट, परवानगी पत्रे आणि अहवाल सादर करणे." b.Write a letter for internship sponsorship to any organization. कोणत्याही संस्थेला इंटर्नशिप प्रायोजकत्वासाठी पत्र लिहा."
4	Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice. "पुस्तक पुनरावलोकन - विद्यार्थ्यांनी त्यांच्या आवडीचे कोणतेही कादंबरी, काल्पनिक कथा किंवा साहित्य पुस्तक वाचावे आणि त्यावर पुनरावलोकन लिहून ते त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावे अशी अपेक्षा आहे."
5	Participation in Competitions (in college/outside the college) debate, declamation, elocution – A Report should be submitted स्पर्धेमध्ये (महाविद्यालयात/महाविद्यालयाबाहेर) सहभाग वादविवाद, भाषण, वक्तृत्व – अहवाल सादर करावा.
6	Group Activity: Road show, skit play, one-act play गट क्रियाकलाप : रोड शो, स्किट प्ले, एकांकिका
7	Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak. पुष्कोतम करंडक, फिरोदिया करंडक, दाजीकाका गाडगीळ करंडक आणि श्रीतेज करंडक या स्पर्धेमध्ये सहभाग नोंदवावा.
8	Marathi film Review – Social Marathi movie available and write a review on post it on social media of their choice. मराठी चित्रपट पुनरावलोकन – सामाजिक आशयावर आधारित मराठी चित्रपट उपलब्ध आहे आणि त्या

	चित्रपटाची समीक्षा करून त्यावर सारांश लिहावा व तो वर्तमानपत्रे किंवा सोशल मीडियावर पोस्ट करावा पसंतीच्या सोशल मीडियावर पोस्ट करा.

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे
२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई
३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी
४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई
५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई
६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर
७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे