AC –

Item No. –

As Per NEP 2020

Anjuman-I-Islam's
Kalsekar Technical Campus
School of Engineering & Technology
(An Autonomous Institute Affiliated to University of Mumbai)

Syllabus for Major Vertical – 1, 4 & 6		
Name of the Programme – B.Tech. (Computer Science & Engineering (Artificial Intelligence & Machine Learning))		
Faulty of Engineering		
Board of Studies in Computer Science & Engineering (Artificial Intelligence & Machine Learning)		
U.G. Second Year Programme	Exit Degree	Two Year U.G. Diploma in Computer Science & Engineering (Artificial Intelligence & Machine Learning).
Semester		III & IV
From the Academic Year		2025-26

AIKTC – School of Engineering & Technology **University of Mumbai**

(As per NEP 2020)

Sr. No.	Heading	Particulars
1	**Title of program** **O: _____**	**B.Tech. (Computer Science & Engineering (Artificial Intelligence & Machine Learning))**
2	**Exit Degree**	**Two Year U.G. Diploma in Computer Science & Engineering (Artificial Intelligence & Machine Learning).**
3	**Scheme of Examination** **R: _____**	NEP 40% Internal 60% External, Semester End Examination Individual Passing in Internal and External Examination
4	**Standards of Passing** **R: _____**	**40%**
5	**Credit Structure** **R: _____**	**Attached herewith**
6	**Semesters**	**Sem. III & IV**
7	**Program Academic Level**	**5.00**
8	**Pattern**	**Semester**
9	**Status**	**New**
10	**To be implemented from Academic Year**	**2025-26**

Dr. Salim Shaikh **BoS-Chairman – CSE(AIML)** **SoET-AIKTC**	**Dr. Rajendra Magar** **Principal, SoET-AIKTC**	**Dr. Ramjan Khatik** **Director, AIKTC**

Preamble

In alignment with the **National Education Policy (NEP) 2020**, the Department of Computer Science & Engineering (Artificial Intelligence & Machine Learning) is committed to ensuring academic excellence through a structured and outcome-based approach to teaching and learning. Accreditation remains the key mechanism for assuring quality in higher education, with a primary focus on evaluating program outcomes. Reflecting this philosophy, the **Faculty of Science and Technology, University of Mumbai**, has pioneered the integration of NEP 2020 principles into curriculum design and implementation.

The **Second-Year Engineering Program** serves as a foundation for developing scientific reasoning, analytical thinking, and problem-solving skills among learners. Students are offered a flexible choice of subjects from **Program Core Courses, Multidisciplinary Minors, and Vocational Skill-Enhanced Courses**, ensuring holistic development. In line with NEP 2020, the curriculum emphasizes the essential knowledge and skills required in modern engineering, while also providing exposure to emerging technologies and industry practices.

To support a **stress-free and learner-centric pedagogy**, a **choice-based subject pool** has been introduced for the 3rd and 4th semesters. These include **Core Courses, Open Electives, and Multidisciplinary Minors**, designed to nurture creativity and align with current industry trends. Vocational and skill-enhancement modules further provide hands-on experience in contemporary industrial practices, ensuring learners acquire both academic knowledge and practical expertise.

The program structure ensures learners have the **freedom to pursue courses of their interest**, enabling a personalized and interdisciplinary learning experience. Alongside core engineering courses, emphasis is placed on **Design Thinking** introduced in the First Semester to encourage innovation and transition learners from rote learning to becoming creative professionals. Additionally, the NEP 2020 framework provides for **multiple exit options** with Certificates and Diplomas, supported by vocational skill pools aligned with industry demands.

The faculty has resolved that **clear Course Objectives and Course Outcomes** be defined for every subject to ensure consistency and depth across affiliated institutes. The **NEP 2020 grading system** brings a paradigm shift from teacher-centric to learner-centric education, focusing on time invested in learning rather than teaching. It emphasizes **continuous internal assessment**, integrating revision sessions, tutorials, guest lectures, and advanced content delivery within the 15-week teaching framework (12–13 weeks for teaching and 2–3 weeks for reinforcement).

Importantly, the second-year syllabus is designed to be **balanced and stress-free**, ensuring that learners can smoothly transition into college life and build strong bonds with faculty mentors. The revised curriculum will be implemented for the **First Year and Second Year of Engineering from the academic year 2025–26**, followed by Third Year in 2026–27 and Final Year in 2027–28.

Dr. Salim Shaikh **BoS-Chairman – CSE(AIML)** **AIKTC-SoET**	**Dr. Rajendra Magar** **Principal, AIKTC - SoET**	**Dr. Ramjan Khatik** **Director, AIKTC**

Two Year Under Graduate Diploma in Engineering- Computer Science & Engineering (Artificial Intelligence & Machine Learning).

Credit Structure (Sem. III & IV)

		R: _____C								
Level	**Semester**	**Major**		**Minor**	**OE**	**BSEC**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr./ Sem.**	**Degree/ Cum. Cr.**
		Mandatory	**Electives**								
5.0	III	PCC301:2 PCC302:2 PCC303:2 PCL301: 2 PCL302:1 PCL303:1 PCL304:1	--	MDM:2	--	BSEC:5	--	AEC: 2 ED: 2	--	22	**Two Year UG Diploma 86**
		R: _____D									
	IV	PCC401:2 PCC402:2 PCC403:2 PCL401:1 PCL402:1 PCL403:1 PCL404:1	--	MDM: 4	OE:2	BSEC:4	--	--	CEP:2	22	
	Cum Cr.	21	--	6	2	9		**4**	2	44	
	Exit option: Award of Two Year UG Diploma in Major with 86 credits and additional 8 credits, out of which 4 credits in work based vocational courses or internship/apprenticeship during summer vacation and 4 credits from skill-based courses to be earned during third and/or fourth semester.										

[Abbreviation - OE – Open Electives, VSC – Vocation Skill Course, BSEC- Basic Science & Engineering Course, SEC – Skill Enhancement Course, (VSEC), AEC – Ability Enhancement Course, VEC – Value Education Course, IKS – Indian Knowledge System, OJT – on Job Training, FP – Field Project, CEP – Continuing Education Program, CC – Co-Curricular, RP – Research Project]

Letter Grades and Grade Points:

U.G and P.G Program				
Sr. No.	**Letter Grade**	**Percentage of Marks**	**Grade Points**	**Performance**
1	0	80 and above	10	Outstanding
2	A	75:00 – 79.99	9	Excellent
3	B	70:00 – 74.99	8	Very Good
4	C	60:00 – 69.99	7	Good
5	D	50:00 – 59.99	6	Fair
6	E	45:00 – 45.99	5	Average
7	P	40:00 – 44.99	4	Pass
8	F	< 40.00	0	Fail

Semester-III

Semester - III									
Course Code	Course Name	Course Abbr	Teaching Contact Hours			Credits			
			Theory	Tutorial	Practical	Theory	Tutorial	Practical	Total
25CAIPCC301	Artificial Intelligence	AI	2	-	-	2	-	-	2
25CAIPCC302	Data Structures	DS	2	-	-	2	-	-	2
25CAIPCC303	Database Management System	DBMS	2	-	-	2	-	-	2
25CAISEC301	Statistical Maths	SM	3	-	-	3	-	-	3
25CAISEC302	Problem Solving & Aptitude Building I	PSAB-I	2	-	-	2	-	-	2
25CAIMDC301	Multidisciplinary Course I	MDC-I	2	-	-	2	-	-	2
25AE302X	Modern Language	ML	2	-	-	2	-	-	2
25AE303	Entrepreneurship Development	ED	2	-	-	2	-	-	2
25CAIPCL301	Artificial Intelligence Lab	AI-L	-	-	2	-	-	1	1
25CAIPCL302	Data Structures Lab	DS-L	-	-	4	-	-	2	2
25CAIPCL303	Database Management System Lab	DBMS-L	-	-	2	-	-	1	1
25CAIPCL304	Modern Programming Lab	MP-L	-	-	2	-	-	1	1
TOTAL			**27 hrs**			**22 Credits**			

Semester - III							
Course Code	Course Name	Course Abbr	Internal Assessment		External Assessment		TOTAL
			CIA	MSE	ESE	Prac / Pres / Oral	
25CAIPCC301	Artificial Intelligence	AI	20	20	40	-	80
25CAIPCC302	Data Structures	DS	20	20	40	-	80
25CAIPCC303	Database Management System	DBMS	20	20	40	-	80
25CAISEC301	Statistical Maths	SM	20	30	50	-	100
25CAISEC302	Problem Solving & Aptitude Building I	PSAB-I	50		-	-	50
25CAIMDC301	Multidisciplinary Minor I	MDM-I	20	20	40	-	80
25AE302X	Modern Language	ML	50			-	50
25AE303	Entrepreneurship Development	ED	50	-	-	-	50
25CAIPCL301	Artificial Intelligence Lab	AI-L	25	-	-	25	50
25CAIPCL302	Data Structures Lab	DS-L	50	-	-	25	75
25CAIPCL303	Database Management System Lab	DBMS-L	25	-	-	25	50
25CAIPCL304	Modern Programming Lab	MP-L	25	-	-	25	50
TOTAL			**485 (61%)**		**310 (39%)**		**795**

Artificial Intelligence

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCC301	Artificial Intelligence	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: C Programming

Course Objectives:

1	Describe the fundamental characteristics of intelligent environments and compare various agent architectures
2	Understand different search algorithms to solve problems
3	Discuss knowledge representation techniques and reasoning methods to evaluate and solve

	problems.
4	Analyze and evaluate different decision-making approaches used in uncertain situations.
5	Explain and differentiate between various machine learning techniques
Course Outcomes (COs): At the End of the course students will be able to	
CO1	**Understand** the characteristics of the environment and differentiate between various agent architectures. (BL4)
CO2	**Apply** and **analyze** search algorithms to solve problems using various search techniques (BL3)
CO3	Use knowledge and reasoning to **analyze** problems and **evaluate** solutions (BL3)
CO4	**Evaluate** and reason through uncertain situations to make informed decisions. (BL5)
CO5	**Comprehend** various learning techniques (BL2)

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Introduction to Artificial Intelligence**	**CO1**	**BL2**	**3**
	1.1	Artificial Intelligence (AI): History of AI, Applications of AI, The present state of AI, Ethics in AI	**CO1**	**BL2**	**1**
	1.2	Intelligent Agents and Environment the structure of an agent, Types of Agents, Environments and Its Properties, PEAS Representation for an Agent	**CO1**	**BL2**	**2**
		Self Learning: Applications of AI			**1**
2	**Title**	**Problem-Solving using Searching**	**CO2**	**BL3, BL4**	**7**
	2.1	Solving Problems by Searching, Performance evaluation of search strategies, Time Complexity, Space Complexity, Completeness, Optimality	**CO2**	**BL4**	**4**
	2.2	Uninformed Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bidirectional Search	**CO2**	**BL3**	
	2.3	Informed Search: Heuristic Function, Admissible Heuristic,	**CO2**	**BL4**	**3**

		Informed Search Technique, Greedy Best First Search, A* Search, Local Search: Hill Climbing Search, Simulated Annealing Search, Optimization: Genetic Algorithm			
	2.4	Game Playing, Adversarial Search Techniques, Mini-max Search, Alpha-Beta Pruning	**CO2**	**BL4**	
		Self Learning: Solving Problems by Searching Techniques			**1**
3	**Title**	**Knowledge and Reasoning**	**CO3**	**BL2, BL3**	**8**
	3.1	Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems	**CO3**	**BL2**	**2**
	3.2	Propositional Logic (PL): Syntax, Semantics, Formal logic-connectives, truth tables, tautology, validity, well-formed-formula, Introduction to logic programming (PROLOG)	**CO3**	**BL3**	**2**
	3.3	Predicate Logic: FOPL, Syntax, Semantics, Quantification, Inference rules in FOPL	**CO3**	**BL3**	**2**
	3.4	Forward Chaining, Backward Chaining and Resolution in FOPL	**CO3**	**BL4**	**2**
		Self Learning: Case study on Knowledge and Reasoning in AI			**1**
4	**Title**	**Reasoning Under Uncertainty**	**CO4**	**BL3, BL4**	**4**
	4.1	Handling Uncertain Knowledge, Random Variables, Prior and Posterior Probability, Inference using Full Joint Distribution	**CO4**	**BL4**	**2**
	4.2	Bayes' Rule and its use, Bayesian Belief Networks	**CO4**	**BL3**	**2**
		Self Learning: Case study and Applications on Healthcare Systems			**1**
5	**Title**	**Planning and Learning**	**CO5**	**BL2, BL3,**	**6**

				BL4	
	5.1	The planning problem, Partial order planning, total order planning	**CO5**	**BL4**	**1**
	5.2	Learning in AI, Learning Agent, Concepts of Supervised, Unsupervised, Semi -Supervised Learning, Reinforcement Learning, Ensemble Learning	**CO5**	**BL2**	**2**
	5.3	Expert Systems, Components of Expert System: Knowledge base, Inference engine, user interface, working memory, Development of Expert Systems	**CO5**	**BL3**	**3**
		Self Learning: Types of Learning			**1**
				Total	**28***

*Total Hours 28 Excluding Self Learning Session

Text Books :	
1	Stuart J. Russell and Peter Norvig, "Artificial Intelligence, A Modern Approach —Second Edition" Pearson Education.
2	Elaine Rich and Kevin Knight —Artificial Intelligence‖ Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
3	George F Luger —Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition.
Reference Books :	
1	Ivan Bratko —PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition
2	D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall
3	Saroj Kaushik —Artificial Intelligence‖, Cengage Learning.

Data Structures

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCC302	Data Structures	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: C Programming	
Course Objectives:	Understand the significance of data structures in the field of computer science and their role in efficient problem-solving.
	Explore various linear and nonlinear data structures and searching techniques.
	Select appropriate data structures based on the nature of a given real-world problem.
Course Outcomes (COs): At the end of the course students will be able to	
CO1	Differentiate between linear and non-linear data structures and apply basic operations such as

	searching, insertion, deletion, and traversal on stacks and queues. (BL3)
CO2	Perform various operations like searching, insertion, deletion and traversals on Linked List. (BL3)
CO3	Apply tree data structure to solve hierarchical and real-world problems. (BL4)
CO4	Utilize the graph data structure to solve problems in various domains. (BL3)
CO5	Select and apply suitable searching techniques to solve computational problems. (BL4)

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Introduction, Stack and Queues**	**CO1**	**BL3**	**9**
	1.1	Introduction to Data Structures, Concept of ADT, Classification of Data Structures, Array Revision, Recursion			
	1.2	**Stack**: ADT, Representation, Operations, Applications of Stack: Infix to postfix conversion, postfix expression evaluation, balanced parentheses			
	1.3	**Queue:** ADT**,** Representation, Operations on Queue, Circular Queue, Priority Queue, Double Ended Queue, Applications of Queue			
	1.4	Self Learning: Need of data structure for AI and ML,Infix to prefix conversion			
2	**Title**	**Linked List**	**CO2**	**BL3**	**6**
	2.1	ADT, Representation, Array vs Linked list, Types of Linked list			
	2.2	Singly linked list: Representation, Operations			
	2.3	Doubly linked list: Representation, Operations			
	2.4	Circular linked list: Representation, Operations			
	2.5	Stack using linked list, Queue using linked list, Applications of Linked list			
	2.6	Self Learning: Real-World Applications			

3	**Title**	**Trees**	**CO3**	**BL4**	**10**
	3.1	ADT, Tree Terminology, Binary Tree, Traversal of Binary Tree			
	3.2	Binary Search Tree, Operations: Insertion, Deletion, Traversal			
	3.3	Self-balancing trees: AVL trees, Operations: Rotations, Insertion			
	3.4	Applications: Expression Tree, Huffman Encoding			
	3.5	B/B+ Tree, B tree- Insertion, Deletion			
	3.6	Self Learning: Splay Tree, Tries, K-D tree, Applications in data science			
4	**Title**	**Graph**	**CO4**	**BL3**	**4**
	4.1	ADT, Graph Terminologies, Representation of Graph			
	4.2	Graph Traversal Technique: BFS, DFS			
	4.3	Applications: Topological Sorting			
	4.4	Self Learning: Real-World Applications Social networks, Road maps and GPS, Web page ranking (Google PageRank), Network security and packet routing, Knowledge graphs in AI			
5	**Title**	**Searching**	**CO5**	**BL4**	**4**
	5.1	Linear Search, Binary Search			
	5.2	Hashing – Hash Tables, Hash Functions. Collision Resolution Techniques: Linear Probing, Quadratic Probing, Double Hashing			
	5.3	Self Learning: Significance of Searching Techniques in Real world applications			
				Total	**28***

*Total Hours 28 Excluding Self Learning Session

Text Books :	
1	Data Structures using C, ReemaThareja, Oxford, June 2014
2	Data Structures using C, ISRD Group
3	Data Structures Using C, Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, Pearson
4	Data Structures: A Pseudocode Approach with C, Richard F. Gilberg and Behrouz A. Forouzan, 2ndEdition, CENGAGE Learning.
Reference Books :	
1	Data Structure Using C, E. Balagurusamy, Tata McGraw-Hill Education India.
2	Data Structures and Program Design in C, Robert Kruse, C. L. Tondo, Bruce Leung, Pearson Edition

Database Management System

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCC303	Database Management System	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)

As per the rubric provided by the Attendance committee.

Prerequisite: Programming Fundamentals

Course Objectives:

1	Understand the need for databases and how DBMS solves data-related problems.
2	Study the architecture of DBMS and its key components.
3	Model real-world systems using Entity-Relationship diagrams.
4	Perform operations using relational algebra and SQL.

5	Apply normalization to reduce redundancy and improve consistency.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	Define DBMS concepts, architecture, and the role of a DBA. (BL2)
CO2	Model data using ER diagrams and relational schemas. (BL3)
CO3	Apply relational algebra and SQL for querying databases. (BL3, BL4)
CO4	Write complex SQL queries for data manipulation. (BL3, BL4)
CO5	Apply normalization and manage transactions for database consistency. (BL4)

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Introduction to DBMS**	CO1	BL2	**2**
	1.1	Differences between DBMS and File Systems, Advantages and disadvantages	CO1	BL2	
	1.2	DBMS architecture (1-tier to 3-tier), Data abstraction: physical, logical, and view levels, Role of DBA	CO1	BL2	
		Self-Learning:Explore real-world applications of DBMS in industries like banking, healthcare, and education.	CO1	BL2	**1**
2	**Title**	**Entity-Relationship (ER) Model**	**CO2**		**5**
	2.1	Entities, attributes, relationships, Entity types: strong & weak	CO2	BL3	
	2.2	Primary keys, composite & derived attributes, Generalization, specialization, aggregation	CO2	BL3	
	2.3	ER to Relational mapping	CO2	BL3	
		Self-Learning:Design an ER diagram for a small company’s database system and convert it into a relational schema.			
3	**Title**	**Relational Model & Relational Algebra**	**CO3**		**7**

	3.1	Concepts: relation, schema, instance, Relational constraints: keys, integrity	CO3	BL2	
	3.2	Relational algebra: select, project, rename, union, intersection, set difference, Cartesian product, join	CO3	BL3	
	3.3	Algebraic query examples in AI/ML, Basics of query optimization	CO3	BL4	
		Self-Learning:Solve advanced relational algebra problems and optimize queries for performance.			
4	**Title**	**Structured Query Language (SQL)**	**CO4**		**6**
	4.1	SQL basics: SELECT, INSERT, UPDATE, DELETE, Clauses: WHERE, ORDER BY, GROUP BY, HAVING	CO4	BL3	
	4.2	Advanced SQL: Joins (INNER, OUTER), Nested Queries, Views and Subqueries	CO4	BL3	
	4.3	SQL use in AI/ML (data preprocessing)	CO4	BL3	
		Self-Learning:Write SQL queries for a database with multiple relations, focusing on joins and subqueries.			
5	**Title**	**Relational Database Design & Transactions**	**CO5**		**8**
	5.1	Functional dependencies and their significance, 1NF, 2NF, 3NF, BCNF, Schema refinement and anomalies	CO5	BL4	
	5.2	Avoiding redundancy and inconsistency for ML-ready data	CO5	BL4	
	5.3	Transaction states and properties (ACID), Schedule types: serial, serializable, Concurrency control: locking, timestamp ordering	CO5	BL4	
		Self-Learning:Apply normalization techniques to a given unnormalized database and explore best practices for transaction management.			
				Total	**28***

*Total Hours 28 Excluding Self Learning Session

Text Books :	
1	Silberschatz, Korth & Sudarshan, *Database System Concepts*, 7th Edition, McGraw Hill
2	Elmasri & Navathe, *Fundamentals of Database Systems*, 7th Edition, Pearson
3	Ramakrishnan & Gehrke, *Database Management Systems*, 3rd Edition, McGraw Hill
Reference Books :	
1	Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, *Database Systems: The Complete Book*, 1st Edition, Prentice Hall
2	C. J. Date, *An Introduction to Database Systems*, 8th Edition, Addison-Wesley
3	C. J. Date, *SQL and Relational Theory: How to Write Accurate SQL Code*, 1st Edition, O'Reilly Media

Statistical Mathematics

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAISEC301	Statistical Mathematics	3	0	0	3	0	0	3

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	30	50

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Engineering Mathematics I & II

Course Objectives: To build a strong mathematics foundation to support advanced engineering studies

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Apply the concept of eigen values and eigen vectors to solve engineering problems.
CO2	Apply the concept of Correlation and Regression to solve engineering problems.

CO3	Apply the concepts of Probability and expectations for getting the spread of the data and use standard distribution functions.
CO4	Apply the concept of hypothesis testing and parametric and non parametric test to solve engineering problems

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	1.1	**Linear Algebra: Matrix Theory** Characteristic equation, Eigenvalues and Eigen vectors	**CO1**	**BL3**	**07**
	1.2	Example based on properties of Eigen values (Without Proof).			
	1.3	Cayley-Hamilton theorem (Without proof), Examples based on verification of Cayley-Hamilton theorem and compute inverse of Matrix.			
	1.4	Diagonalization of matrices. **Self-learning Topics: Application of Matrix Theory in machine learning and google page rank algorithms, derogatory and non-derogatory matrices. (1hr)**			
2	2.1	**Statistical Techniques** Karl Pearson's Coefficient of correlation (r)	**CO2**	**BL 3**	**07**
	2.2	Spearman's Rank correlation coefficient (R) (repeated and non-repeated ranks			
	2.3	Lines of regression.			
	2.4	Fitting of first and second degree curve **Self-learning Topics: Covariance, fitting of exponential curve.(1 hr)**			
	3.1	**Probability**	**CO3**	**BL3**	**07**

3		Definition and basics of probability			
	3.2	Discrete and continuous random variable with probability distribution and Probability density function			
	3.3	Expectation, Variance			
	3.4	Moment generating function, Raw and central moments up to 4th order. **Self-learning Topics: Conditional probability, Baye's theorem (1hr)**			
4	4.1	**Probability distributions** Introduction	**CO3**	**BL3**	**07**
	4.2	Binomial distribution			
	4.3	Poisson distribution			
	4.4	Normal distribution **Self-learning Topic: Applications of Probability Distributions in Engineering (1hr)**			
5	5.1	**Sampling Theory I** Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degrees of freedom. Errors in testing of hypothesis	**CO4**	**BL3**	**08**
	5.2	Large Sample: Testing the hypothesis that the population mean is μ			
	5.3	Small sample test: Students' t-distribution			
	5.4	Test the significance for the difference between means of two samples **Self-learning topics: Test significance of difference between the means for Large samples, Estimate parameters of a population (2hrs)**			

6	6.1	Chi square test: Test of goodness of fit and independence of attributes.	**CO4**	**BL3**	**06**
	6.2	Contingency table			
	6.3	Analysis of Variance(F-Test): One way Classification **Self-learning topic: Yate's Correction (1hr)**			
			Total	**42***	

*Total Hours 42 Excluding Self Learning Session

Text Book:	
1	Dr B.S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4nd Edition
Reference Books:	
1	H. K. Das, "*Advanced Engineering Mathematics*", S. Chand, 28th Edition
2	Erwin Kreysizg, "*Advanced Engineering Mathematics*", John Wiley & Sons, 10th Edition.
3	Matrices, Shanti Narayan, S. Chand publication
4	T. Veerarajan, "Probability, Statistics and Random Processes", McGraw-Hill Education.

Problem Solving and Aptitude Building -I

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAISEC302	Problem Solving and Aptitude Building-I	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
30	10	10	50	-	-

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (30)

Minimum Two (02) of the above mentioned activities each of 30 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (10)

Minimum Two (02) of the above mentioned tests each of 10 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (10)
As per the rubric provided by the Attendance committee.

Prerequisite: Basic knowledge of arithmetic and logical thinking.

Course Objectives:

1	To develop fundamental quantitative aptitude and problem-solving skills.
2	To strengthen logical reasoning and data interpretation abilities.
3	To prepare students for competitive exams and placement aptitude tests.

Course Outcomes (COs): At the End of the course students will be able to

1	Apply arithmetic concepts for solving real-life and placement problems.
2	Solve questions related to ratios, percentages, and time-based problems.
3	Apply algebraic concepts to solve equations and inequalities.
4	Demonstrate logical reasoning ability in pattern-based problems.
5	Analyze and interpret basic reasoning scenarios with structured techniques.

Module No.	Detailed Contents		CO Mapped	BL	Hrs
1	1.1	**Module 1: Number Systems & Arithmetic Basics**: Divisibility, LCM/HCF	CO1	BL2	05
	1.2	Remainders, Simplifications			
	1.3	Fractions and Decimals			
2	2.1	**Module 2: Percentages, Profit & Loss**: Percentage Calculations and Applications, Profit, Loss, and Discount	CO2	BL2	05
	2.2	Simple and Compound Interest,Ratio and Proportion			
	2.3	Mixtures and Alligations			
3	3.1	**Module 3: Time & Work, Speed & Distance**: Averages and Weighted Averages, Time, Speed, and Distance	CO2	BL3	06
	3.2	Relative Speed and Trains, Boats and Streams			
	3.3	Time and Work, Pipes and Cisterns			
4	4.1	**Module 4: Algebra and Linear Equations**: Basic Algebraic Identities, Linear and Quadratic Equations	CO3	BL3	06
	4.2	Inequalities Problems on Ages			
	4.3	Surds and Indices, Simplification Using Algebra			
5	5.1	**Module 5: Introduction to Logical Reasoning**: Number and Letter Series, Coding-Decoding	CO4, CO5	BL2, BL3	06
	5.2	Blood Relations, Direction Sense			
	5.3	Ranking and Order, Syllogisms and Venn Diagrams			

Text Book:	
1	Quantitative Aptitude for Competitive Examinations, R.S. Aggarwal, S. Chand
2	A Modern Approach to Verbal and Non-Verbal Reasoning, R.S. Aggarwal, S. Chand
3	Quantitative Aptitude Quantum CAT, Sarvesh K. Verma, Arihant Publications
4	Fast Track Objective Arithmetic, Rajesh Verma, Arihant Publications
Reference Books:	
1	How to Prepare for Quantitative Aptitude for CAT, Arun Sharma, McGraw Hill
2	Logical Reasoning and Data Interpretation for the CAT, Nishit K. Sinha, Pearson Education
3	Analytical Reasoning, M.K. Pandey, BSC Publishing
4	Arihant's Master Resource Book – Logical Reasoning & Data Interpretation, Ajay Singh, Arihant Publications

MDM-1-Design Thinking

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIMDC301	Design Thinking	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Nil	
Course Objectives:	
CO1	Introduces the fundamental principles and process of design thinking.
CO2	Explore human-centered problem-solving approaches.
CO3	Understand the stages of empathy, ideation, prototyping, and testing

CO4	Analyze design thinking frameworks and real-world applications
CO5	Examine visualization and storytelling as tools for innovation.
Course Outcomes (COs): At the End of the course students will be able to	
CO 1	**Explain** the philosophy, mindset, and stages of design thinking. **(BL2)**
CO 2	**Describe** frameworks used for customer empathy and defining problems. **(BL2)**
CO 3	**Use** ideation tools and creativity methods for generating solutions. **(BL4)**
CO 4	**Evaluate** different approaches to prototyping and solution testing. **(BL5)**
CO 5	**Analyze** how storytelling and visualization aid design thinking. **(BL4)**

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Introduction to Design Thinking**		**CO 1**	**2**	**6**
	1.1	Definition and origin of design thinking			
	1.2	Design thinking vs Traditional problem-solving approaches			
	1.3	Importance of design thinking in modern innovation			
	1.4	Design thinking mindsets: empathy, experimentation, optimism			
	1.5	Overview of models: Stanford d.school 5-step process, Double Diamond model			
	1.6	Principles of human-centered design			
	Case Studies: IDEO, Apple, Airbnb **Activities:** ❖ Group exercise: Identify real-world challenges ❖ Comparative discussion: Engineering Design vs. Design Thinking				

2	**Empathy and Problem Framing**		**CO 2**	**2**	**6**
	2.1	User empathy in design thinking			
	2.2	Techniques: Observation, interviews, shadowing			
	2.3	Empathy tools: Empathy maps, journey maps			
	2.4	Framing problems: POV statements, HMW questions			
	2.5	Design thinking for social impact			
	Theoretical Focus: Cognitive bias, User perspective, Systems thinking **Activities:** ❖ Field Observation (Virtual/Physical) ❖ Create Empathy Map and User Persona ❖ Develop a Problem Statement				
3	**Ideation and Creative Thinking**		**CO 3**	**4**	**6**
	3.1	The psychology of creativity in problem solving			
	3.2	Ideation methods: Brainstorming, Mind Mapping, SCAMPER, Lateral Thinking			
	3.3	Innovation heuristics and analogies			
	3.4	Overcoming fixed mindsets and cognitive blocks			
	3.5	Convergent vs divergent thinking			
	3.6	Idea selection: Feasibility vs impact			

<table>
<tr><td></td><td colspan="5">Case Analysis: Creative ideation at Google, IDEO

Activities:

❖ Ideation Sprint in Teams
❖ Affinity Diagramming
❖ Concept Selection</td></tr>
<tr><td rowspan="7">4</td><td colspan="2">Prototyping and Testing Strategies</td><td rowspan="7">CO 4</td><td rowspan="7">5</td><td rowspan="7">6</td></tr>
<tr><td>4.1</td><td>Concept of prototyping and its purpose in design thinking</td></tr>
<tr><td>4.2</td><td>Types of prototypes: Low fidelity, high fidelity, MVP (theory only)</td></tr>
<tr><td>4.3</td><td>Prototyping strategies for products and services</td></tr>
<tr><td>4.4</td><td>Testing concepts: A/B testing, feedback loops, usability testing</td></tr>
<tr><td>4.5</td><td>Role of experimentation and failure</td></tr>
<tr><td>4.6</td><td>Metrics: Desirability, viability, feasibility</td></tr>
<tr><td></td><td colspan="5">Discussion: Design validation through user feedback / Experimentation and learning from failure

Activities:

❖ Build Low-Fi Prototypes (Paper, LEGO, Sketch)
❖ Test with Peers and Refine Based on Feedback</td></tr>
<tr><td rowspan="4">5</td><td colspan="2">Visualization, Storytelling and Application</td><td rowspan="4">CO 5</td><td rowspan="4">4</td><td rowspan="4">6</td></tr>
<tr><td>5.1</td><td>Role of storytelling in communicating ideas</td></tr>
<tr><td>5.2</td><td>Storytelling structures: Pixar framework, Hero’s journey</td></tr>
<tr><td>5.3</td><td>Visualization tools: Mind maps, affinity diagrams, journey</td></tr>
</table>

		maps			
	5.4	Scenario planning and role-based narratives			
	5.5	Strategic application of design thinking in business, education, and healthcare			
	5.6	Challenges and limitations of design thinking			
	Readings: Industry application cases from IBM, SAP, and educational settings **Activities:** ❖ Prepare Final Storyboard and Pitch ❖ Present Team Prototypes + Roadmap ❖ Reflective Group Discussion				
				Total	**30Hrs**

Text Books :	
1	Tim Brown – Change by Design: How Design Thinking Creates New Alternatives for Business and Society, Harper Business
2	Idris Mootee – Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, John Wiley & Sons
3	Jeanne Liedtka, Andrew King, Kevin Bennett – Solving Problems with Design Thinking, Columbia Business School Publishing
Reference Books :	
1	Roger Martin – The Design of Business: Why Design Thinking is the Next Competitive Advantage, Harvard Business Review Press
2	Tom Kelley & David Kelley – Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Publishing
3	Tom Kelley – The Art of Innovation, Currency
4	Maurício Vianna et al. – Design Thinking: Business Innovation, MJV Press

5	L.T.M. Blessing & A. Chakrabarti – DRM, A Design Research Methodology, Springer
6	Karl T. Ulrich, Design: Creation of Artifacts in Society, University of Pennsylvania
7	Pavan Soni, Design Your Thinking, Penguin India, 2020

MODERN LANGUAGE (SELECT ANY ONE)

MARATHI LANGUAGE

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AE3021	Modern Language MARATHI	2	0	0	2	0	0	2

Evaluation Scheme				
Component	CIA	MSE	ESE	Total
Theory	50	-	-	50

Prerequisite: • शालेय मराठी शिक्षण (इयत्ता 10 पर्यंत)
• देवनागरी लिपी वाचता व लिहिता येणे आवश्यक

Course Objectives:

- भाषिक कौशल्य वाढवणे – विद्यार्थींचे वाचन, लेखन, ऐकणे व बोलणे या चारही भाषा कौशल्यांचा विकास करणे.
- औपचारिक व तांत्रिक मराठी लेखनाची ओळख – कार्यालयीन पत्र, अहवाल, अर्ज इत्यादींच्या माध्यमातून.
- मराठी साहित्याची मूलभूत समज विकसित करणे – कथा, कविता व लघुनाट्य वाचनातून.
- भाषांतर कौशल्ये विकसित करणे – इंग्रजी ते मराठी आणि मराठी ते इंग्रजी या दोन्ही दिशेने.
- तांत्रिक शब्दसंपत्तीची ओळख – अभियंता क्षेत्रातील तांत्रिक मराठी शब्दसंपत्ती समजून घेणे.

Course Outcomes (COs): कोर्सच्या शेवटी विद्यार्थी :

CO1	शुद्ध व सुसंगत मराठी वाचन आणि लेखन करता येईल
CO2	कार्यालयीन व तांत्रिक मराठीत पत्र व अहवाल लिहिता येतील
CO3	मराठी साहित्याचा आस्वाद घेता येईल व त्यातून नैतिक/सामाजिक विचार करता येतील
CO4	इंग्रजी-मराठी भाषांतराचे प्राथमिक कौशल्य आत्मसात होतील
CO5	अभियंता क्षेत्रात वापरली जाणारी तांत्रिक मराठी समजून घेता येईल

Module No.	Detailed Contents		CO Mapped	BL	Hrs
1	1.1	**मराठी भाषेची रचना व व्याकरण** • वर्णमाला, उच्चार व लेखन • शब्दभेद (नाम, सर्वनाम, क्रियापद, विशेषण)	**CO1**	**BL2**	**04**
	1.2	• वाक्यरचना व वाक्यप्रकार • संधी व समास (उदाहरणांसह)			
	1.3	• काळ, लिंग, वचन, कारके, शुद्धलेखन नियम			
2	2.1	**व्यवहारातील मराठी व संवाद कौशल्य** • अभिवादन, ओळख, सौजन्यपूर्ण संवाद • औपचारिक व अनौपचारिक भाषा	**CO2**	**BL2, BL3**	**06**
	2.2	• दैनंदिन व्यवहारातील संवाद (बसस्टँड, बँक, महाविद्यालय) • मुलाखत संवाद, चर्चासत्र संवाद			
	2.3	• प्रास्ताविक व आभार प्रदर्शन लेखन			
3	3.1	**लेखन कौशल्य विकास** • निबंध लेखन: सामाजिक, शैक्षणिक व तांत्रिक विषयांवर	**CO3**	**BL2, BL3**	**04**
	3.2	• पत्रलेखन: औपचारिक (अर्ज, तक्रार, विनंती) व अनौपचारिक • अहवाल लेखन (Project report, field visit report)			
	3.3	• परिचय व आत्मचरित्र लेखन • रोजनिशी / अनुभवनिवेदन			
4	4.1	**मराठी साहित्याची ओळख**	**CO4**	**BL2, BL3**	**06**

		• कथा: पु.ल. देशपांडे, व.पु. काळे यांच्या लघुकथा • कविता: कुसुमाग्रज, बहिणाबाई, ग्रेस यांच्या निवडक कविता			
	4.2	• लघुनाट्य: विनोदी किंवा सामाजिक लघुनाट्य वाचन			
	4.3	• समीक्षा लेखन: वाचलेल्या साहित्यावर चिंतन			
5	5.1	**भाषांतर व तांत्रिक शब्दसंपत्ती** • इंग्रजी ते मराठी आणि मराठी ते इंग्रजी भाषांतर	**CO5**	**BL2, BL3**	**06**
	5.2	• संवादांचे भाषांतर • अनुच्छेदांचे भाषांतर			
	5.3	• शब्दसंग्रह (Glossary): संगणक, इलेक्ट्रॉनिक्स, यांत्रिकी, नागरी अभियांत्रिकी • तांत्रिक माहितीपत्रकांचे वाचन व भाषांतर			
6	6.1	**मराठी भाषा – प्रसार, माध्यम व डिजिटल वापर** • वर्तमानपत्रातील मराठी: संपादकीय, लेख, बातम्या • सोशल मीडियावर मराठीचा वापर	**CO6**	**BL2**	**04**
	6.2	• शासकीय कार्यालयीन वापरातील मराठी • भाषेचा व्यावसायिक व व्यावहारिक उपयोग			
			Total		**30**

Text Books :	
1	"व्यवसायोपयोगी मराठी" – डॉ. मधुकर चव्हाण, Publisher: लोकवाङ्मय गृह
2	"सोपं मराठी व्याकरण व लेखनकला" – प्रा. सुधीर सु. जाधव, Publisher: मेहता पब्लिकेशन
3	"भाषांतर व व्यवहार मराठी" – डॉ. अशोक गोडबोले, Publisher: ग्रंथाली
Reference Books :	

1	"मराठी भाषा आणि व्यवहार" – डॉ. रघुनाथ कुळकर्णी
2	"साहित्यदृष्ट्या निवडक मराठी कथा व कविता" – संपादक मंडळ
3	"शब्दसंग्रह – अभियांत्रिकी मराठी" – तांत्रिक मराठी समिती

Modern Language (German)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AE3022	Modern Language (German)	2	0	0	2	0	0	2
		Evaluation Scheme						
		Component		CIA	MSE		ESE	Total
		Theory		50	-		-	50

Prerequisite:	
Course Objectives: 1. Understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of concrete needs. 2. Gain foundational understanding of German grammar, including sentence formation, verb conjugation. 3. Comprehend simple spoken and written texts related to daily life. 4. Engage in simple conversations in German using basic vocabulary and sentence structures.	
Course Outcomes (COs): At the End of the course students will be able to	
1	1. Identify and use basic vocabulary in expressing oneself orally in German.
2	2. Apply foundational grammar concepts to construct and understand simple sentences.
3	3. Demonstrate basic speaking and listening skills by participating in simple conversations.
4	4. Interpret meaning from short texts and respond appropriately about day-to-day activities.

Module No.	Detailed Contents		CO Mapped	BL	Hrs
1	1.1	VOCABULARY: 1. Introductions and Personal Information: Name, age, nationality, profession. 2. Family and Relationships: Basic family terms like Mutter (mother), Vater (father), Bruder (brother), etc. 3. Everyday Activities: Shopping, dining, traveling, and hobbies. 4. Numbers and Time: Telling the time, days of the week, months, seasons. Common Adjectives and Adverbs: Colors, sizes, and descriptions.	1	BL1 BL2 BL3	8
2	2.1	GRAMMAR: 1. Nouns and Articles: Differentiating between definite (der, die, das) and indefinite (ein, eine) articles. 2. Pronouns: Personal pronouns like ich (I), du (you), er / sie / es (he / she / it), and possessive pronouns. 3. Verb Conjugation: Regular and irregular verbs in the present tense, including sein (to be) and haben (to have). 4. Sentence Structure: Subject-verb-object order and basic questions. 5. Prepositions: Usage of prepositions such as in, auf, unter. Negation: Using nicht and kein to negate sentences.	2	BL1 BL2 BL3	8
3	3.1	SPEAKING & LISTENING SKILLS: 1. Understanding simple conversations about familiar topics. 2. Practicing greetings, introductions, and polite expressions. 3. Participating in role-play exercises for daily scenarios like ordering food or asking for directions.	3	BL1 BL2 BL3	4

4	4.1	READING & WRITING: 4.1 Reading exercises: ● Reading advertisements, notices, or emails. ● Identifying main ideas and keywords in a text. ● Following simple instructions. 4.2 Writing exercises: ● Writing about oneself, such as hobbies, family, or daily routine. ● Filling out forms with personal information. ● Composing brief messages or emails. 4.3 Reading comprehension and basic writing: ● Reading Short Texts – Emails, signs, menus, invitations ● Writing Simple Sentences – Mein Name ist Anna. Ich wohne in Berlin. Filling Forms – Name, Adresse, Geburtsdatum	4	BL1 BL2 BL3	10
Total				30	

Text Books :	
1	*Netzwerk A1 Textbook for German* by Stefanie Dengler: Klett Publication
2	*Maximal A1 Textbook + Workbook* by Giorgio Motta, Elzbieta Krulak Kempisty & Dagmar Gluck claudia Brass: Goyal Publisher
Reference Books:	
1	1. *A first book in German* by H C G Brandt: Alpha Edition
2	2. *Netzwerk Deutsch als Fremdsprache A1* (Textbook + Workbook + Glossar) by Helen Schmitz Stefanie Dengler & Paul Rusch: BlueNBells Publication
3	3. *Let's Learn German A1* by Gourav Vivek Kulkarni: Notion Press
4	4. *Fit Fur Goethe - Zertifikat A1 (Start Deutsch 1) – German* by Johannes Gerbes & Frauke Van Der Werff: Hueber Publication
5	5. *Mit Erfolg Zum Goethe - Zertifikat A1 Fit in Deutsch 1* by Uta Loumiotis: Goyal Publishers

Modern Language-Functional Arabic

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AE3023	Modern Language Functional Arabic	2	0	0	2	0	0	2
		Evaluation Scheme						
		Component		CIA	MSE		ESE	Total
		Theory		50	-		-	50

Prerequisite: Basic understanding of language

Course Objectives:

CO1:Introduce Arabic script, basic vocabulary, and sentence construction.

CO2 : Enable practical usage of Arabic in formal and informal settings.

CO3: Teach basic Arabic grammar (nahw) and morphology (sarf).

CO4: Enable reading and comprehension of simple verses.

CO5: Promote confidence in listening, speaking, reading, and writing Arabic.

Course Outcomes (COs):

CO1	Recall and write Arabic alphabets, vocabulary, and simple phrases. L1
CO2	Understand and explain grammar concepts like sentence types and noun–verb agreement
CO3	Apply verb conjugations and construct grammatically sound sentences
CO4	Analyze Qur’anic texts for grammar and vocabulary
CO5	Use Arabic in functional communication situations like greeting, asking, describing

Module No.	Detailed Contents		CO Mapped	BL	Hrs
1	Arabic Script and Basic Vocabulary		CO1	BL3	4 hrs
	1.1	Alphabets, short vowels (harakat)			
	1.2	Joining letters, basic nouns, pronouns			
2	Basic Grammar and Sentence Formation		CO2	BL3	6 hrs
	2.1	Nominal/verbal sentences, demonstratives,			
	2.2	prepositions, noun-adjective agreement			
3	Verb Conjugation and Morphology (Sarf)		CO3	BL3	6 hrs
	3.1	Past/present tense,			
	3.2	root patterns (forms I–IV),			
	3.3	subject–verb agreement			
4	Advanced Grammar and Text Analysis		CO4	BL4	6 hrs

	4.1	Dual/plural forms			
	4.2	case endings, particles (إنّ، كان، لعلّ), passive voice			
5	Functional Usage and Integration		CO5	BL3/ BL4	8 hrs
	5.1	Functional expressions,			
	5.2	Greetings, dialogues, basic sentence analysis			
			Total	**30**	

Text Books :	
1	Durus al-Lughah al-‘Arabiyyah (Madina Books 1, 2, 3)
Reference Books :	
1	"Al-Kitaab fii Ta’allum al-‘Arabiyya" Series
2	"A New Arabic Grammar of the Written Language"

Entrepreneurship Development

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AE303	Entrepreneurship Development	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
30	10	10	50	-	-

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (30)

Minimum Two (02) of the above mentioned activities each of 30 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (10)

Minimum Two (02) of the above mentioned tests each of 10 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (10)
As per the rubric provided by the Attendance committee.

Prerequisite: Basic understanding of business, innovation, and management principles.

Course Objectives:

1	To equip students with the skills to identify problems, generate innovative solutions, and develop viable prototypes using structured ideation and innovation management tools
2	To develop the mindset and skills necessary for entrepreneurial thinking and venture creation.
3	To introduce students to entrepreneurial processes including opportunity identification,

	business model development, and resource mobilization.
4	To enhance analytical and decision-making abilities in real-world entrepreneurial scenarios.
Course Outcomes (COs):	
CO1	Apply entrepreneurial traits, ideation tools, and opportunity evaluation methods.
CO2	Analyze market needs and define a customer-focused value proposition.
CO3	Analyze startup financing, team building, and lean strategies.
CO4	Apply business model canvas and assess venture feasibility
CO5	Evaluate and pitch entrepreneurial ideas effectively.

Module No.	Detailed Contents		CO Mapped	BL	Hrs
1	**Entrepreneurship Fundamentals**		CO1	BL3	4
	1.1	Characteristics of Entrepreneurs			
	1.2	Types of Startups			
	1.3	Entrepreneurial Mindset			
2	**Opportunity Discovery and Ideation**		CO1,CO2	BL3, BL4	6
	2.1	Problem Identification			
	2.2	Opportunity Evaluation			
	2.3	Creativity and Innovation Tools (SCAMPER, Brainstorming)			
3	**Business Model & Customer Discovery**		CO2,CO4	BL3, BL4	6
	3.1	Business Model Canvas			
	3.2	Value Proposition Design			
	3.3	Lean Startup Methodology			
4	**Startup Planning and Resources**		CO3	BL4	6
	4.1	Building a Team and Co-founders			

	4.2	Startup Financing Basics			
	4.3	Bootstrapping and Funding Options			
5	**Pitching and Launch Readiness**		CO5	BL4	8
	5.1	Investor Pitch Preparation			
	5.2	Pitching Frameworks and Techniques			
	5.3	Legal and Regulatory Aspects (MSME, Startup India)			
			Total	**30**	

Text Books :	
1	Entrepreneurship – Rajeev Roy
2	The Startup Owner's Manual – Steve Blank
3	Innovation and Entrepreneurship – Peter F. Drucker
Reference Books :	
1	The Lean Startup – Eric Ries
2	Disciplined Entrepreneurship – Bill Aulet
3	Zero to One – Peter Thiel

Artificial Intelligence Lab

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL301	Artificial Intelligence Lab	0	0	2	0	0	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: Python Programming

Course Objectives:

1	Design an appropriate agent architecture tailored to solve a real-world AI problem.
2	Implement knowledge representation and reasoning techniques using an AI programming language.
3	Develop a problem-solving agent capable of addressing specific tasks effectively.

4	Incorporate methods of reasoning under uncertainty to enhance the decision-making capabilities of an AI agent.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	**Identify** suitable Agent Architecture for a given real world AI problem. (L2)
CO2	**Implement** simple programs using Prolog. (L3)
CO3	**Implement** various search techniques for a Problem-Solving Agent. (L3)
CO4	**Construct** a Bayesian Belief Network for a given problem and draw probabilistic inferences from it. (L3)

Suggested Experiments: Students are required to complete at least 10 experiments.					
Week No.	**Exp. No.**	**Detailed Contents**	**CO Mapped**	**Bloom's Level**	**Hrs**
1	1	Case study on AI applications published in IEEE/ACM/Springer or any prominent journal.	CO1	BL2	2
2	2	Provide the PEAS description and TASK Environment for a given AI problem.	CO1	BL2	2
3	3	Write simple programs using PROLOG as an AI programming Language.	CO2	BL3	2
4	4	Write a program using PROLOG for first order logic.	CO2	BL3	2
5	5	Implement any one of the Uninformed search techniques.	CO3	BL3	2
6	**Internal Assessment -I & Submission**				
7	7	Implement a hill climbing algorithm to solve 8 puzzle problems.	CO3	BL3	2
8	8	Implement any 2 player game using game playing algorithms.	CO3	BL3	2
9	9	Implement adversarial search using min-max algorithm.	CO3	BL3	2

10	10	Implement BFS and DFS search problems using Python.	CO3	BL3	2
11	11	Create a Bayesian Network for the given Problem Statement and draw inferences from it.	CO4	BL3	2
12	12	Implement Q-Learning for Grid World Navigation problem.	CO1, CO3	BL3, BL3	2
13	**Internal Assessment -II & Submission**				
14	14	Design a prototype of an expert system.	CO1, CO4	BL3, BL3	2

Text Books :	
1	Stuart J. Russell and Peter Norvig, "Artificial Intelligence, A Modern Approach —Second Edition" Pearson Education.
2	Elaine Rich and Kevin Knight —Artificial Intelligence‖ Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
3	George F Luger —Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition.
Reference Books :	
1	Ivan Bratko —PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition
2	D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall
3	Saroj Kaushik —Artificial Intelligence‖, Cengage Learning.

Data Structures Lab

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL302	Data Structures Lab	0	0	4	0	0	2	2

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
30	10	05	05	50	25

IPE: Internal Practical Evaluation (30)

Three (03) internal practical exams of 30 marks each as per below syllabus. 15 marks for Program execution, 05 marks for Program documentation and 10 marks for viva. The average of 03 exams marks would be considered as IPE.

Exp: Experiments (10)
Program(s) Execution & Problem(s) Solving: 06; On Time: 02; Viva: 02

Activity: [Assignment/Model/Mini Project] (05)
Minimum Two (02) of the above assessment tools each of 05 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Problem Solving using C Programming

Course Objectives: The course will enable students to:

1	To implement basic data structures such as arrays, linked lists, stacks and queues.
2	Solve problems involving stacks, queues and linked lists.
3	To develop applications using data structure algorithms.
4	Solve problems involving graphs, and trees.

Course Outcomes (COs): At the end of the course, students will be able to:	
CO1	Implement various operations like insertion, deletion, and traversing on arrays, stack and queues.[BL3]
CO2	Implement various operations like insertion, deletion and traversing on linked list.[BL3].
CO3	Choose appropriate data structure and apply it to solve various problems. [BL3]
CO4	Implement various operations like insertion, deletion and traversing on non linear data structures.[BL3].
CO5	Select appropriate searching technique to solve a given problem.[BL3]

Week No.	**Detailed Contents**	**CO Mapped**	**BL**	**Hrs**
1	**1. Introduction to Arrays and Basic Operations** **Concepts**: Static vs. Dynamic Arrays, contiguous memory allocation, indexing. **Programs:** 1. Implement a menu-driven program for array operations: creation, display, insertion at a given position, deletion from a given position, searching (linear and binary search). 2. Implement menu driven program for matrix operations: addition, multiplication, transpose. **Problems:** 1. Contains Duplicate (Id 217, leetcode.com/problems) 2. Two Sum using Brute force (Id 1, leetcode.com/problems)	CO1	BL3	**4**
2	**2. Implementation of Stack** **Concepts**: LIFO principle, Push, Pop, Peek, isEmpty, isFull **Programs:** 1. Implement a Stack using arrays. 2. Implement Infix to Postfix conversion. **Problem:** 1. Valid Parentheses (Id 20, leetcode.com/problems)	CO1	BL3	**4**
3	**3. Implementation of Queue** **Concepts**: FIFO principle, Enqueue, Dequeue, Front, Rear, isEmpty, isFull **Programs:** 1. Implement a Queue using arrays.	CO1	BL3	**4**

	2. Implement a Circular Queue using arrays. **Problems:** 1. Generate Binary Numbers from 1 to N (geeksforgeeks.org) 2. Reverse First K elements of Queue (geeksforgeeks.org)			
4	**ASSESSMENT & SUBMISSION**			**4**
5	**4. Implementation of Linked Lists** **Concepts**: Singly, Doubly (previous and next pointers), and circular linked lists. **Programs:** 1. Implement a menu-driven program for a Singly Linked List. 2. Implement a menu-driven program for a Doubly Linked List **Problem:** 1. Reverse Singly Linked List (Id 206, leetcode.com/problems)	CO2	BL3	**4**
6	**5. Implementation of Trees** **Concepts**: Recursive function calls, base cases, recursion vs. iteration. Binary Tree definitions (root, node, child, parent, leaf). **Programs:** 1. Implement basic Binary Tree creation and basic traversals (In-order, Pre-order, Post-order) **Problems:** 1. Level Order Traversal (Id 102, leetcode.com/problems) OR 2. Maximum Depth of Binary Tree (Id 104, leetcode.com/problems)	CO4	BL3	**4**
7	**6. Implementation of Binary Search Trees (BST)** **Concepts**: BST properties (left child < parent < right child), searching, insertion, deletion. **Programs:** 1. Implement a menu-driven program for a Binary Search Tree: insertion, deletion, searching, finding min/max element, traversals. **Problem:** 3. Validate BST (Id 98, leetcode.com/problems)	CO4	BL3	**4**
8	**ASSESSMENT & SUBMISSION**			**4**
9	**7. Stack and Queue using Linked List** **Concepts**: Dynamic memory for stack and queue.	CO1 CO2	BL3	**4**

	Programs: 1. Implement stack using linked list. 2. Implement a queue using a linked list. **Problem:** 1. Palindrome Linked List (Id 234, leetcode.com/problems)			
10	**8. Graph Representation and Traversals** **Concepts**: Graphs (vertices, edges), Adjacency Matrix, Adjacency List, BFS, DFS. **Programs:** 1. Implement Breadth-First Search (BFS) for a given graph 2. Implement Depth-First Search (DFS) for a given graph. **Problem:** 1. Shortest Path in Binary Matrix (Id 1091, leetcode.com/problems) OR 2. Number of Islands (Id 200, leetcode.com/problems)	CO4	BL3	**4**
11	**9. Implementation of Hashing** **Concepts**: Hash functions, collisions, collision resolution techniques (chaining, linear probing, quadratic probing). **Programs:** 1. Implement a Hash Table with a chosen hash function and collision resolution technique. **Problem:** 1. Two Sum using Hashing (Id 1, leetcode.com/problems)	CO5	BL3	**4**
12	**10. Implementation of Heaps (CBS-Optional)** **Concepts**: Heap properties (min-heap, max-heap), Heapify. **Programs:** 1. Implement a Max-Heap (or Min-Heap) using arrays. 2. Implement Heap Sort **Problem:** 1. Kth largest element in an array (Id 215, leetcode.com/problems)	CO3	BL3	**4**
13	**ASSESSMENT & SUBMISSION**			**4**
14	**Assignments: Solve any two** 1. Remove Nth Node from End of Singly Linked List. (N = sum of last 2 digits of your Roll No) (Leetcode #19) 2. Lowest Common Ancestor of a Binary Tree. (Total No of Nodes = sum	CO3	BL4	**4**

	of last 2 digits of your Roll No + 3) (Leetcode #236) 3. Course Schedule (Leetcode #207)			

Textbooks:	
1	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”
2	Robert Lafore, “Data Structures and Program Design in C++”
3	Michael T Goodrich, “Data Structures and Algorithms in C++ (or Python/Java equivalent)”
Websites:	
1	Leetcode (leetcode.com)
2	GeeksforGeeks (geeksforgeeks.org)
3	Codeforces (codeforces.com)
4	HackerRank (hackerrank.com)

Database Management System Lab

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL303	Database Management System Lab	0	0	2	0	0	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IP

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: Python Programming	
Lab Objectives:	
1	To create ER diagrams and convert them into normalized schemas.
2	To install and work with relational database systems.
3	To apply SQL commands for data manipulation, including complex queries.

4	To implement transaction control, triggers, stored procedures, and integrate SQL queries with basic AI/ML datasets.
Lab Outcomes (LOs): At the End of the course students will be able to	
CO1	Design and implement ER models into normalized relational schemas. (BL3)
CO2	Execute SQL commands for creating and manipulating relational databases. (BL3)
CO3	Perform complex SQL queries using joins, subqueries, and aggregates. (BL3, BL4)
CO4	Implement transactions, stored procedures, and triggers for business logic automation. (BL3, BL4)

Week No.	Exp No.	Title of Experiment	CO Mapped	Bloom's Level	Hrs
1	1	**ER/EER Modeling** A startup food delivery company wants to launch a platform where customers can browse restaurants, place food orders, and track deliveries. To design a robust backend, the company seeks to model the entire data system capturing customers, restaurants, food menus, orders, delivery agents, and payment details. Design an Entity-Relationship (ER) or Extended ER (EER) model to represent all necessary entities, relationships, attributes, and constraints to support the functioning of the online food delivery platform.	CO1	BL3	2
2	2	**ER to Relational Mapping** A hospital management system is being planned to centralize patient, doctor, appointment, and billing records. Based on the ER model of this system, map all entities such as Patients, Doctors, Departments, Appointments, and Payments into relational tables. Identify suitable primary and foreign keys, and define how one-to-many and many-to-many relationships are handled in the schema.	CO1	BL3	2
3	3	**DDL and Integrity Constraints** A university wants to build a student information system to manage student registrations, subjects, faculty assignments, and exam results. Create the relational database using SQL DDL commands. Define integrity constraints such as primary keys for Students and Subjects, foreign keys for course	CO2	BL3	2

		registrations, and CHECK constraints for validating exam scores.			
4	4	**DML Operations** A car rental company is setting up a database to manage customers, vehicles, rental bookings, and payment status. Insert realistic sample data using SQL DML commands to simulate customer bookings, car availability updates, rental record modifications, and booking cancellations. Use a variety of INSERT, UPDATE, and DELETE commands to reflect day-to-day operations.	CO2	BL3	2
5	5	**Basic SQL & Aggregations** A fitness center chain wants to analyze customer attendance, membership types, and class popularity across its branches. Write SQL queries to find monthly attendance trends, total number of members by membership type, average class occupancy, and maximum usage of equipment. Use aggregate functions, string formatting, and grouping to support business analysis.	CO3	BL3, BL4	2
6	Internal Assessment -I & Submission				
7	6	**Join Operations** An airline booking system needs to display complete travel histories of customers, flights, and bookings. Implement various JOIN operations to display passenger names with their flight details, list flights that have not been booked, and show routes with their associated airlines. Demonstrate INNER JOIN, LEFT JOIN, and FULL OUTER JOIN in different data retrieval scenarios.	CO3	BL3	2
8	7	**Nested and Complex Queries** A retail chain is analyzing customer purchases to personalize marketing strategies. Write nested and complex SQL queries to identify high-value customers who have spent above a threshold, products that were never bought in a specific region, and brands with declining sales trends. Use subqueries, EXISTS, NOT IN, and aggregation filtering to generate actionable insights.	CO3	BL3, BL4	2
9	8	**DCL and TCL Commands**	CO4	BL3	2

		A university IT department needs to control access to its academic database. Implement DCL commands to assign permissions to roles such as Admin, Teacher, and Student for operations like result updates, course creation, and student record viewing. Demonstrate the use of TCL commands such as COMMIT, ROLLBACK, and SAVEPOINT during batch updates of internal assessments.			
10	9	**Procedures and Functions** An e-commerce warehouse system needs automation for packing and shipping processes. Create a stored procedure that assigns packing staff to new orders based on availability. Develop a user-defined function that calculates shipping charges based on weight and distance. These functions should help streamline backend operations and minimize processing time.	CO4	BL3, BL4	2
11	10	**Views and Triggers** A healthcare clinic wants to track sensitive changes to patient information and provide simplified reporting views to staff. Implement views to show today's appointments, pending payments, and top consulted doctors. Create triggers to log changes in patient medical history and notify doctors when new test results are added for their patients.	CO4	BL3, BL4	2
12	11	**Transactions & Concurrency Control** Simulate concurrent transactions in a banking system with locking and rollback/commit to ensure consistency.	CO4	BL4	2
13	Internal Assessment -II & SUBMISSION				
14		**Assignment** A university plans to develop an online course registration system to manage students, faculty, courses, and enrollments. You are hired to design and implement the backend database for this system. The system must handle the following: ● Students can register for courses. ● Each course is taught by one faculty member.	CO1 CO2 CO3 CO4	BL3, BL4	2

		• A faculty member can teach multiple courses. • A student can enroll in multiple courses. • Only active courses and eligible students should be allowed to enroll. • The system should track registration dates and auto-calculate total course credits for each student.			

Text Books :	
1	Silberschatz, Korth & Sudarshan, *Database System Concepts*, 7th Edition, McGraw Hill
2	Elmasri & Navathe, *Fundamentals of Database Systems*, 7th Edition, Pearson
3	Ramakrishnan & Gehrke, *Database Management Systems*, 3rd Edition, McGraw Hill
Reference Books :	
1	Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, *Database Systems: The Complete Book*, 1st Edition, Prentice Hall
2	C. J. Date, *An Introduction to Database Systems*, 8th Edition, Addison-Wesley
3	C. J. Date, *SQL and Relational Theory: How to Write Accurate SQL Code*, 1st Edition, O'Reilly Media

Modern Programming Lab

(Applicable for A.Y. 2025–2026)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL304	Modern Programming Lab	0	0	2	0	0	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: C Programming	
Course Objectives:	
1	To learn core OOP concepts such as classes, objects, inheritance and polymorphism.
2	To develop proficiency in concepts such as multithreading, exception handling, and the use of

	user-defined packages.
3	To familiarize with the fundamental components and structures involved in building Graphical User Interface (GUI) applications.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	To apply fundamental programming constructs. (L3)
CO2	To illustrate the concept of packages, classes and objects. (L3)
CO3	To elaborate the concept of strings, arrays to solve problems involving data manipulation. (L3)
CO4	To implement the concept of inheritance and interfaces. (L3)
CO5	To implement the concept of exception handling and multithreading. (L3)
CO6	Design interactive GUI applications. (L3)

Week No.	Detailed Contents		CO Mapped	BL	Hrs
1	**OOP concepts:** Objects, class, Encapsulation, Abstraction, Inheritance, Polymorphism, message passing, JVM, JDK, JRE **Basic programming constructs:**Input and output functions in Java: scanner class, variables, data types, Operators, I/O,		CO1	BL3	2
	1.1	Write a Java program to input the name, roll number, and CGPA of a student using the Scanner class.			
	1.2	Write a Java program that takes the following details such as Employee ID (String or Integer), Name and Monthly Basic Salary for **employee** and perform the following operations: **Calculate the Annual Basic Salary** (12 * monthly basic). Compute the following based on the monthly basic salary : ● **HRA (House Rent Allowance)** = 20% of basic salary ● **DA (Dearness Allowance)** = 10% of basic salary ● **PF (Provident Fund deduction)** = 12% of basic salary ● **Gross Monthly Salary** = Basic + HRA + DA ● **Net Monthly Salary** = Gross Salary – PF ● **Annual Net Salary** = Net Monthly Salary × 12			
	1.3	**Developing Conversion Utilities**: Develop any converter, such			

		as Rupees to dollars, temperature converter, inch to feet, etc.			
2	**Control Structures, Branching and Loops** if-else, if-else if, switch, loops (for, while and do-while), Branching Statements - Break, Continue, return		CO1	BL3	2
	2.1	Given an integer, , perform the following conditional actions: ● If is odd, print Weird ● If is even and in the inclusive range of to , print Not Weird ● If is even and in the inclusive range of to , print Weird ● If is even and greater than , print Not Weird (https://www.hackerrank.com/challenges/java-if-else/problem)			
	2.2	Write a Java program that accepts the **student's name**, **roll number**, and **marks in five subjects**, each out of 100. The program should **validate** that all entered marks are between 0 and 100. Calculate **total marks** (sum of all subjects), **Average marks and Percentage.** Assign an appropriate **grade** based on the average marks and add a **remark** based on the grade.			
	2.3	**Print number pattern using loops.** Use nested loops to generate a triangle number pattern, applying conditional checks.			
	2.4	**Test your Learning:** **Java Loops:** Read integer N (2–20) and print its first ten multiples. (https://www.hackerrank.com/challenges/java-loops-i/problem**)**			
3	**Classes & Objects: Class, object, data members, member functions**		CO2	BL3	2
	3.1	Write a Java program to create a Bank Account Simulator with BankAccount class with the attributes: account_number and balance. The program should: Create an object of BankAccount, Set account number and initial balance using setter methods or direct assignment. Accept a series of operations (deposit or withdraw) and apply them and Display the final balance after all operations.			
4	**Constructors– Types of Constructors, Constructor Overloading static members and functions, Method Overloading**				
			CO2	BL3	2

	4.1	Write a Java program that calculates the **area of 2D shapes** and the **volume of 3D shapes** using **method overloading**. The program should **include the 2D Shapes** like Circle, Rectangle, Square, Triangle, **3D Shapes like** Sphere, Cylinder, Cuboid, Cube			
	4.2	Create a Student class to demonstrate **constructor overloading** by allowing the creation of student objects using **different initialization formats**. The program should include **Student Class Fields like** rollNumber, name, department.			
	4.3	Write a program that demonstrates use of Static member and static functions.			
5	**Array, Strings, String Buffer**		CO3	BL3	2
	5.1	Write a program that demonstrates the use of various methods available in String class.			
	5.2	Write a program that demonstrates the use of various methods available in StringBuffer class.			
	5.3	Write a program to find the Maximum Element in an Integer Array			
6	**Internal Assessment -I & Submission**				
7	**Inheritance:Types, Method overriding , super and final keyword**		CO4	BL3	2
	7.1	Create a Java program to demonstrate **inheritance** by designing an Employee superclass and a Manager subclass. The program should include the appropriate methods to demonstrate the inheritance hierarchy.			
	7.2	Write a Java program to create a Vehicle class with a method showSpeed() that displays the default speed of a generic vehicle. Create a Car subclass that **overrides** this method to show specific speed. Then, extend Car with a SportsCar class that further overrides showSpeed() and uses the super keyword to invoke both the Car and Vehicle implementations of showSpeed().			
8	**Abstract Classes & Interfaces– Abstract class and methods and Interfaces**		CO4	BL3	2

	8.1	Write a program that declares an abstract class Shape that implements the Drawable method and also includes a field String color and an abstract method calculateArea(). Implements two subclasses: Circle → stores radius, overrides both methods Rectangle → stores length and breadth, overrides both methods In the main() method: Use polymorphism to refer to Shape references and call overridden methods			
	8.2	Write a Java program that defines a Payment interface with: void processPayment(double amount) ● Implements 'this' interface in two classes: 1. CreditCardPayment with additional fields: cardNumber, cardHolderName, cvv 2. UPIPayment with additional fields: upiId, mobileNumber ● Use validation where necessary (e.g., CVV must be 3 digits, UPI ID must contain '@') ● In main() method: Accept details from user Display confirmation messages			
9	**Packages in java : User defined packages, Access specifiers**		CO2	BL3	2
	9.1	Write a Java program that demonstrates the concept of user-defined packages and the use of all four access specifiers **(private, default, protected, public**) through appropriate class and method structures.			
10	**Exception Handling – Types of Exception, built-in Exceptions, try-catch, custom exception (throw and throws), finally**		CO5	BL3	2
	10.1	Write a Java program to perform the division of two numbers. The program should: ● Use try-catch to handle ArithmeticException (divide by zero) ● Use a try-catch to handle invalid inputs (InputMismatchException) ● Use a finally block to print a message that runs regardless of exception ● Loop until the user provides valid input and a successful division occurs			
	10.2	Write a Java program that: ● Defines a custom checked exception class InvalidAgeException			

		• Throws InvalidAgeException if the age is less than 18 • Catches the exception and displays an appropriate error message • Uses a loop to retry input until valid age is entered • Displays a success message on valid age entry			
11	**Thread lifecycle, thread class methods, creating threads**		CO5	BL3	2
	11.1	Write a Java program to demonstrate the concept of **multithreading** using both approaches: 1. **Extending the Thread class**, 2. **Implementing the Runnable interface**. The program should show how multiple threads can run concurrently and independently, and how to control their execution using thread methods.			
12	**GUI Programming – JavaFX basics, layout managers, Event handling, JDBC connectivity**		CO6	BL3	2
	12.1	**Write a JavaFX program to build a basic calculator GUI that performs simple arithmetic operations:** Addition, Subtraction, Multiplication, and Division. Use ActionListener to detect button clicks and perform calculations. Handle invalid input (e.g., non-numeric entries) using try-catch and display appropriate error messages. For division, include zero-check to avoid divide-by-zero errors			
	12.2	Write a Java program using JavaFX to create a login form with Backend connectivity using JDBC			
13	**Internal Assessment -II & Submission**				
14		**Assignment** **Building a Database-Driven GUI (JavaFX + JDBC)** (https://www.codeproject.com/Articles/1197811/JavaFX-JDBC-Application) Build a complete GUI-based application integrating OOP, file handling, and event handling and database connectivity.	CO6	BL5	2

Text Books :	
1	Herbert Schildt, Java: The Complete Reference, McGraw Hill
2	E. Balagurusamy, Programming with Java, McGraw Hill
3	Cay S. Horstmann, Core Java Volume I – Fundamentals, Pearson
4	Kathy Sierra & Bert Bates, Head First Java, O'Reilly
Reference Books :	
1	Oracle Java Documentation – https://docs.oracle.com/javase/
2	JavaTpoint Java Tutorial – https://www.javatpoint.com/java-tutorial
3	GeeksforGeeks Java Guide – https://www.geeksforgeeks.org/java/
4	W3Schools Java Tutorial – https://www.w3schools.com/java/

Modern Programming Lab

(Revised: A.Y. 2026–2027 Onwards)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL304	Modern Programming Lab	-	-	2	-	-	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: Problem Solving using Structured Programming Language.	
Course Objectives: The course will enable students to:	
1	Understand fundamental Python programming constructs and manipulate data structures.

2	Develop problem-solving skills to write reusable and modular code using functions**,** manage runtime errors using exception handling, and apply regular expressions for effective text processing and validation.
3	Gain knowledge of object-oriented programming (OOP) in Python.
4	Build competence in developing interactive applications by designing and implementing graphical user interfaces (GUIs) for enhancing user experience and application usability.
5	Familiarize yourself with Python libraries and tools such as NumPy, Pandas, and Matplotlib for efficient data handling, analysis, and visualization.
Course Outcomes (COs): At the end of the course, students will be able to:	
CO1	Apply core Python programming concepts by creating and manipulating data structures.
CO2	Create functions, apply exception handling, and use regular expressions in Python to develop solutions for real-life programming problems efficiently and logically.
CO3	Apply the concept of object-oriented programming to solve problems.
CO4	Design and develop graphical user interface (GUI) applications to create user-friendly applications.
CO5	Apply Python libraries to perform efficient data handling, analysis, and manipulation tasks for the given problem.

Week No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Introduction to Python:** Basic Syntax and Data Types—Variables, data types, operators, and Input-Output.		**CO1**	**BL3**	**2**
	1.1	**Personalized Greeting Generator**: Write a Python code to generate a Personalized Greeting.			
	1.2	**Calculating Areas of Geometric Figures:** Write a Python program to calculate the areas of any geometric figures like circle, rectangle, and triangle.			
	1.3	**Developing Conversion Utilities**: Develop any converter, such as Rupees to dollars, temperature converter, inch to feet, etc.			
	1.4	**Calculating EMI:** Develop a Python program to calculate the Monthly EMI (Equated Monthly Installment) for a loan based on user input.			

2	**Control Flow and Functions:** Conditional Statements: if, else, elif Loops: for and while loops.				
	2.1	**Fibonacci Sequence Generator:** Develop a Python program to print the Fibonacci sequence using a while loop.			
	2.2	**Factorial Generator:** Design a Python program to compute the factorial of a given integer N.			
	2.3	**Multiplication Table Generator:** Write a Python program to take a numerical input from the user and generate its multiplication table using loops.			
	2.4	**Automate Payroll System:** A company wants to automate its payroll system. The program should accept employee details (ID, Name, Basic Salary), calculate Gross Salary (DA = 80% of Basic, HRA = 40% of Basic), deduct PF = 12% of Basic, and Tax = 5% if salary > 50,000, and display the Net Salary after deductions.			
3	**Data Type:** Lists, Strings, Tuples, Sets, and Dictionaries, and operations on them.		**CO1**	**BL3**	**4**
	3.1	**Average speed of Runners:** A marathon event has 10 runners. A runner qualifies if their speed is more than 1.5 times the average speed of all runners. The program should accept speed values for 10 runners in a list, calculate the average speed, and print the qualified runners.			
	3.2	**Secure Transaction Records in a Banking System:** A bank needs to maintain immutable transaction records for security and auditing purposes. Since transaction details should not be modified once recorded, use an appropriate data type to store transaction logs.			
	3.3	**Check if a String is a Palindrome:** Ask the user for a string and print out whether this string is a palindrome or not.			
	3.4	**Library Book Management System:** A local library wants to manage its collection of books. Each book has a unique ID, a title, an author, and the number of available copies. The library staff should be able to add new books, update book information, search for a book by ID, and display all books. Use a Python dictionary to manage and manipulate book records.			
	3.5	**Check if Two Sets Have No Elements in Common:** Write a			

		Python program to check if two given sets have no elements in common.			
4	**Functions:** Defining functions, parameters, and return values; scope and lifetime of variables.		**CO2**	**BL3**	**2**
	4.1	**Prime Number Analyzer**: Using a function, write a Python program to analyze if the input number is prime or not.			
	4.2	**Developing Conversion Utilities**: Develop any converter, such as Rupees to dollars, temperature converter, inch to feet, etc.			
	4.3	**Convert inches to centimeters:** (Use the Map function to perform the conversion). Implement a function that takes a list of measurements in inches and returns a list of the corresponding measurements in centimeters. For example, if the input is [5, 10, 15], the output should be [12.7, 25.4, 38.1].			
	4.4	**Sum of digits of a number:** (Use the reduce() function to perform the calculation.). Implement a function that calculates the sum of the digits of a given number using the reduce() function from the functools module in Python. For example, if the input number is 12345, the function should return 15 (1 + 2 + 3 + 4 + 5 = 15).			
	Problem Statement: Create a nested dictionary of three employees, each with keys for name, age, and salary. Write a function to give each employee a 10% raise and print the updated dictionary. https://www.codechef.com/blogs/dictionary-in-python?utm_source				
5	**4. Exceptional Handling:** To enable learners to proficiently handle and manage exceptions		**CO2**	**BL3**	**2**
	5.1	**Basic Exception Handling**: To implement and demonstrate at least five different types of exception handling mechanisms in Python to ensure error-free execution and improve the robustness of programs.			
	5.2	**Custom Exceptions**: Develop a Python program that simulates a banking system with a function to withdraw money. Raise custom exceptions for scenarios such as insufficient funds and invalid account numbers.			
	Problem Statement: (https://www.codechef.com/learn/course/oops-concepts-in-python/CPOPPY12/problems/ADVPPY110?utm_source)				

6	**ASSESSMENT-I & SUBMISSION**				
7	**Introduction to OOP:** Creating Classes and Objects Class attributes and methods ,Constructor and destructor, Type of Inheritance: Single, multiple, and multilevel inheritance.		**CO3**	**BL3**	**2**
	7.1	**Online Shopping System:** Develop classes for products, customers, and shopping carts. Include methods for adding items to the cart, calculating total costs, processing orders, and managing inventory.			
	7.2	**Vehicle Rental System:** Design a system using classes for vehicles, rental agencies, and rental transactions. Implemented methods to handle vehicle availability, rental periods, pricing, and customer bookings.			
	7.3	**Area of Triangle:** Write a Python class named polygon with two methods: input sides and display sides. Inherit a Class Triangle from the polygon and calculate the area of a triangle.			
8	**Introduction to OOP: Encapsulation and Polymorphism**		**CO3**	**BL3**	**2**
	8.1	**Online Course Management System:** Consider an Online Course Management system with a base class named Student, which includes essential attributes such as name, age, and course to represent a student's basic details. From this base class, two specialized classes are derived: UndergraduateStudent and PostgraduateStudent. The UndergraduateStudent class extends the functionality of the base class by adding a semester attribute, representing the current semester of study. Similarly, the PostgraduateStudent class introduces a thesis_topic attribute, which stores the research focus of the student. Each of these subclasses overrides the display_info() method to include their additional attributes while still utilizing the base class's functionality.			
9	**Regular Expressions, Pattern matching, Regex functions in Python**		**CO3**	**BL3**	**2**
	9.1	Write a Python program to extract all valid email addresses and phone numbers from a given text file using pattern-matching techniques with regular expressions.			
	9.2	Write a Python program to handle the following cases using the 're' module functionalities: ● Retrieve all the lines that contain "This" in the			

		beginning of the line. ● Repeat Q1 but retrieve both upper- and lower-case letters. ● Retrieve all lines that contain consecutive te's ● Retrieve lines that contain a word of any length starting with s & ending with e. ● Retrieve all lines with a date in the form of 1 or 2 digits, a dot, 1 or 2 digits, a dot, and two digits.			
10	**GUI Development using any Python GUI framework**		**CO4**	**BL3**	**2**
	10.1	**GUI for Developing Conversion Utilities:** Develop a Python GUI application that performs various unit conversions such as currency (Rupees to Dollars), temperature (Celsius to Fahrenheit), and length (Inches to Feet). The application should include input fields for the values, dropdown menus or buttons to select the type of conversion, and labels to display the results.			
	10.2	**College Admission Registration Form:** The college admission registration form collects essential personal, educational, and contact information from prospective students.			
11	**8.1 Introduction to Popular Libraries**: NumPy and Pandas for data manipulation, and Matplotlib for data visualization		**CO5**	**BL3**	**2**
	11.1	A meteorological department records temperature data in different cities. You need to store and analyze this data efficiently using NumPy arrays. Create 1D, 2D, and 3D NumPy arrays to store temperature data. Perform reshaping, slicing, and indexing operations on the arrays. Consider a 1D array that represents daily temperature readings 2D array stores temperature readings for multiple cities, and a 3D array represents data for different weeks.			
	11.2	**Problem Statement:** Develop a program in Python to create a calendar as an array of 7 elements to represent 7 days of the week. ● Each Element of the array is a structure having three fields. ● The first field is the name of the Day (A string) ● The second field is the date of the Day (An integer) ● The third field is the description of the activity for a particular day https://www.codechef.com/learn/course/college-data-structures-pyth/CPDSPY01/problems/CPDSAPY10			

<table>
<tr><td rowspan="2">12</td><td colspan="2">Introduction to Popular Libraries: Pandas for data manipulation, Matplotlib for data visualization</td><td>CO5</td><td>BL3</td><td>2</td></tr>
<tr><td>12.1</td><td>Using the Iris Data (https://www.kaggle.com/datasets/saurabh00007/iriscsv), perform the following tasks:
i) Read the first 8 rows of the dataset.
ii) Display the column names of the Iris dataset.
iii) Fill any missing data with the mean value of the respective column.
iv) Remove rows that contain any missing values.
v) Group the data by the species of the flower.
vi) Calculate and display the mean, minimum, and maximum values of the Sepal length column.</td><td></td><td></td><td></td></tr>
<tr><td>13</td><td colspan="5">ASSESSMENT- II & SUBMISSION</td></tr>
<tr><td colspan="2">Assignment 1</td><td colspan="4">Student Marks Management System Using Python

Educational institutions often need a basic system to manage and analyze student performance data. Manual handling of marks for multiple students and subjects is error-prone and inefficient. Design a Python program that can:

● Accept student details (Name, Roll Number)
● Accept marks in 3 or more subjects
● Calculate:
○ Total marks
○ Percentage
○ Grade based on percentage
● Display the result in a formatted report card
● Allow multiple student entries

Step 1: Define a function to input student details. Create a function named after yourself (e.g., input_details_by_rahul())
Step 2: Collect marks for 3+ subjects
Step 3: Calculate total, percentage, and grade
Step 4: Store student data in a dictionary or list
Step 5: Allow the user to view report cards
Step 6: Save all student reports to a file</td></tr>
<tr><td colspan="2">Assignment 2</td><td colspan="4">Write the output of the following code:
1)
<pre>x = 5
while x > 0:
  if x % 2 == 0:
  print(x, end=' ')
  x -= 1</pre></td></tr>
</table>

	2)
	Li = ['Harsh', 'Pratik', 'Bob', 'Dhruv']
	print (Li[1][-1])
	3)
	def my_func():
	  x = 10
	  print("Inside function:", x)
	
	x = 20
	my_func()
	print("Outside function:", x)
	4)
	for char in 'hello':
	  if char == 'l':
	  break
	  print(char, end=' ')
	
	5)
	items = ['pen', 'pencil', 'eraser']
	items.remove('pencil')
	print(items)
	items.pop()
	print(items)
	
	6) for char in 'PYTHON STRING':
	  if char == ' ':
	  break
	  print(char, end='')
	  if char == 'O':
	  continue

Textbooks:	
1	Dr. R. Nageswara Rao, “Core Python Programming,” Dreamtech Press.
2	Andrew NG, “Introduction to Python Programming.”
3	E. Balagurusamy, “Introduction to computing and problem-solving using Python,” McGraw-Hill Education.

Reference Books:	
1	Charles Dierbach, “Introduction to Computer Science using Python.”
2	David Beazley, “*Python Cookbook"* .
3	Luciano Ramalho, *"Fluent Python".*

Semester-IV

Semester - IV									
Course Code	Course Name	Course Abbr	Teaching Contact Hours			Credits			
			Theory	Tutorial	Practical	Theory	Tutorial	Practical	Total
25CAIPCC401	Machine Learning	ML	2	-	-	2	-	-	2
25CAIPCC402	Analysis of Algorithms	AoA	2	-	-	2	-	-	2
25CAIPCC403	Operating System	OS	2	-	-	2	-	-	2
25CAIMDC402	Multidisciplinary Minor II	MDM-II	3	-	-	3	-	-	3
25OE401X	Open Elective I	OE-I	2	-	-	2	-	-	2
25CAISEC401	Communication & Personality Dev II	CPD-II	2	-	-	2	-	-	2
25CAISEC402	Problem Solving & Aptitude Building III	PSAB-III	2	-	-	2	-	-	2
25CAIPCL401	Machine Learning Lab	ML-L			2			1	1
25CAIPCL402	Analysis of Algorithms Lab	AoA-L	-	-	2	-	-	1	1
25CAIPCL403	Operating System Lab	OS-L	-	-	2	-	-	1	1
25CAIPCL404	Data Visualization Lab	DV-L	-	-	2	-	-	1	1
25CAIMDL402	Multidisciplinary Minor II Lab	MDM-IL	-	-	2	-	-	1	1
25CAICEP401	Community Engagement Project	CEP	-	-	4	-	-	2	2
TOTAL			29 hrs			22 Credits			

Semester - IV							
Course Code	Course Name	Course Abbr	Internal Assessment		External Assessment		TOTAL
			CIA	MSE	ESE	Prac / Pres / Oral	
25CAIPCC401	Machine Learning	ML	20	20	40	-	80
25CAIPCC402	Analysis of Algorithms	AoA	20	20	40	-	80
25CAIPCC403	Operating System	OS	20	20	40	-	80
25CAIMDC402	Multidisciplinary Minor II	MDC-II	20	30	50	-	100
25OE401X	Open Elective I	OE-I	20	20	40	-	80
25CAISEC401	Communication & Personality Dev II	CPD-II	25	-	-	25	50
25CAISEC402	Problem Solving & Aptitude Building III	PSAB-III	50				50
25CAIPCL401	Machine Learning Lab	ML-L	25	-	-	25	50
25CAIPCL402	Analysis of Algorithms Lab	AoA-L	25	-	-	25	50
25CAIPCL403	Operating System Lab	OS-L	25	-	-	25	50
25CAIPCL404	Data Visualization Lab	DV-L	25	-	-	25	50
25CAIMDL402	Multidisciplinary Minor II Lab	MDM-II-L	25	-	-	25	50
25CAICEP401	Community Engagement Project	CEP	50	-	-	25	75
TOTAL			460 (54%)		385 (46%)		845

Machine Learning

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCC401	Machine Learning	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Data Structures, Basic Probability and Statistics, Algorithms

Course Objectives:

1	Understand and articulate the fundamental concepts of Machine Learning
2	apply essential mathematical concepts—such as linear algebra, calculus, probability, and optimization—to understand, implement, and analyze machine learning algorithms
3	Evaluate and compare appropriate machine learning models

4	Understand the machine learning model types
5	apply dimensionality reduction techniques to simplify data, enhance model performance, and facilitate data visualization.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	Discuss the basic concepts of Machine Learning
CO2	Use mathematical foundation for machine learning
CO3	Select suitable Machine learning models
CO4	Identify the appropriate model types for classification, regression, and clustering tasks.
CO5	Apply Dimensionality Reduction techniques

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Introduction to Machine Learning**			**4**
	1.1	Introduction and Applications: Definition of ML, ML vs AI, Applications in domains, Types of ML (Supervised, Unsupervised, Reinforcement)	CO1	BL1	
	1.2	Workflow & Concepts: ML process, datasets, overfitting/underfitting	CO1	BL1	
	1.3	Performance Metrics: Confusion Matrix, Accuracy, Precision, Recall, F1 Score,RMSE	CO1	BL1	
		Self Learning:AI vs ML			**1**
2	**Title**	**Supervised Learning**			**7**
	2.1	Regression Techniques: Linear Regression, Multiple linear Regression,Cost Function, Gradient Descent	CO2	BL2	
	2.2	Classification Algorithms: Logistic Regression, k-Nearest Neighbors (kNN)	CO2	BL3	
	2.3	Model Evaluation: Cross-validation, Bias-variance trade-off, confusion matrix revisit	CO2	BL2	
		Self Learning: Apply regression/ classification on			**1**

		real-world data			
3	**Title**	**Unsupervised Learning**			
	3.1	Clustering: k-Means algorithm, Applications, Evaluation techniques (Elbow method, Silhouette score)	CO3	BL2	**5**
	3.2	Dimensionality Reduction: PCA concepts, use cases, data visualization	CO3	BL2	
	3.3	Hierarchical Clustering : Agglomerative approach, dendrograms	CO3	BL2	
		Self Learning: Practice clustering and PCA on real datasets			**1**
4	**Title**	**Model Optimization & Deployment**	CO4		**6**
	4.1	Regularization: L1 and L2 regularization, avoiding overfitting	CO4	BL1	
	4.2	Scaling and Pipelines: Feature scaling methods, Building ML pipelines in Scikit-learn	CO4	BL2	
	4.3	Hyperparameter Tuning: Train/test split, GridSearchCV, Random search	CO4	BL2	
		Self Learning: AutoML and model versioning concepts			**1**
5	**Title**	**Specialized Models & Emerging Trends**			**6**
	5.1	Tree-Based Models: Decision Trees and Random Forests, feature importance	CO5	BL1	
	5.2	SVM & Neural Networks: Concept of SVM, kernel trick (overview), Neural Network basics	CO5	BL2	
	5.3	Applications in NLP, Healthcare, Finance, Recommendation Systems	CO5	BL3	
		Self Learning: Case Study on Customer Churn Prediction			**1**
				Total	**28***

*Total Hours 28 Excluding Self Learning Session

Text Books :	
1	Nathalie Japkowicz & Mohak Shah, ―Evaluating Learning Algorithms: A Classification Perspective‖, Cambridge.
2	Marc Peter Deisenroth, Aldo Faisal, Cheng Soon Ong, ―Mathematics for machine learning‖
3	Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press McGraw-Hill Higher Education
Reference Books :	
1	Tom M. Mitchell, ―Machine Learning‖, McGraw Hill
2	Kevin P. Murphy, ―Machine Learning ― A Probabilistic Perspective‖, MIT Press
3	Shai Shalev-Shwartz, Shai Ben-David, ―Understanding Machine Learning‖, Cambridge University Press

Analysis of Algorithms

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCC402	Analysis of Algorithms	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)

As per the rubric provided by the Attendance committee.

Prerequisite: Data structure concepts, Discrete structures

Course Objectives:

1	To provide mathematical approaches for Analysis of Algorithms.
2	To understand and solve problems using various algorithmic approaches.
3	To analyze algorithms using various methods.

Course Outcomes (COs): At the end of the course students will be able to	
CO1	Explore the fundamentals of complexity analysis and analyze the performance of different algorithms in terms of time and space complexity. (L3)
CO2	Illustrate the concept of divide and conquer and greedy strategies and analyze the complexity of relevant algorithms.(L3)
CO3	Apply dynamic programming techniques to solve computational problems and evaluate the time and space complexity of the corresponding algorithms. (L3)
CO4	Utilize backtracking and branch and bound techniques to solve computational problems and to solve complex problems and assess their computational efficiency. (L3)
CO5	Explore various string matching techniques and their applicability to different problem types. (L3)

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Introduction to Algorithm**	CO1	BL3	5
	1.1	Performance analysis: space, and time complexity			
	1.2	Asymptotic Notations: O, Θ, Ω notations, Recurrences: Substitution Method, Master Theorem			
	1.3	Bubble Sort, Selection Sort, insertion sort and their Complexity Analysis			
	1.4	**Self Learning:** Complexity class: Definition of P, NP, NP-Hard, NP-Complete			
2	**Title**	**Divide and Conquer Approach and Greedy Approach**	CO2	BL3	10
	2.1	**Divide and Conquer Approach:** General Method, Merge sort, Quick sort, Finding minimum and maximum algorithms and their Analysis, Analysis of Binary search			
	2.2	**Greedy Approach**: General Method, Single source shortest path: Dijkstra Algorithm, Fractional Knapsack problem, Minimum cost spanning trees: Kruskal and Prim's algorithms, Job			

		sequencing with deadlines			
	2.3	**Self Learning:** Applications in Recommended System and Clustering			
3	**Title**	**Dynamic Programming**	CO3	BL3	07
	3.1	General Method, Multistage graphs, Single source shortest path: Bellman Ford Algorithm, All pair shortest path: Floyd Warshall Algorithm			
	3.2	0/1 knapsack Problem, Longest common subsequence, Travelling Salesperson problem			
	3.3	**Self-Learning:** Assembly-line scheduling			
4	**Title**	**Backtracking and Branch and bound**	CO4	BL3	06
	4.1	General Method, **Backtracking:** N-queen problem, Sum of subsets, Graph coloring			
	4.2	**Branch and Bound:** Travelling Salesperson Problem, 15 Puzzle problem			
	4.3	**Self-Learning**: Hamiltonian Cycle			
5	**Title**	**String Matching Algorithms**	CO5	BL3	05
	5.1	The Naïve string-matching algorithm, The Rabin Karp algorithm, The Knuth-Morris-Pratt algorithm			
	5.2	**Self-Learning**: Applications in Search Engines and Information Retrieval			
				Total	**28***

*Total Hours 28 Excluding Self Learning Session

Text Books :	
1	Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. “Fundamentals of computer algorithms” University Press.
2	T. H. Cormen, C.E. Leiserson,R.L. Rivest, and C. Stein, “Introduction to algorithms”, 2nd Edition, PHI Publication 2005.
3	Harsh Bhasin.”Design and Analysis of Algorithms” Oxford University Press
Reference Books :	
1	Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, “Algorithms”, Tata McGraw- Hill Edition.
2	S. K. Basu, “Design Methods and Analysis of Algorithm”, PHI

Operating System

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCC403	Operating System	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10) Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.
Test [Open Book Test/Class Test/Multiple Choice Questions] (05) Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.
Att: Attendance (05) As per the rubric provided by the Attendance committee.

Prerequisite: Basic understanding of C Programming, Familiarity with Computer Architecture concepts like memory hierarchy, instruction execution, Knowledge of Data Structures (e.g., queues, stacks, trees).

Course Objectives:	
1	To introduce students to the fundamentals and architectural structure of operating systems.
2	To explain process management, thread scheduling, and multitasking techniques.
3	To provide an understanding of synchronization mechanisms and deadlock handling.

4	To analyze memory management concepts in operating systems
5	To analyze file, and I/O management concepts in operating systems
Course Outcomes (COs): At the End of the course students will be able to	
CO1	Explain the structure, functions, and services of modern Operating Systems
CO2	Analyze the process, thread, and scheduling concepts
CO3	Apply concurrency mechanisms and deadlock handling strategies
CO4	Implement and evaluate memory management strategies
CO5	Implement and evaluate file, and disk scheduling strategies

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Module 1: OS Fundamentals**	CO1	BL-2	4
	1.1	Introduction, Objectives Operating System, Types of OS, Functions and Evolution of Operating System			
	1.2	OS Architectures: Monolithic, Microkernel Layered etc., Linux Kernel, Shell and System Calls			
2	**Title**	**Module 2: Process & Thread Management**	CO2	BL-3	6
	2.1	Concept of a Process, Process States, Process Lifecycle, Process Description, Process Control Block.			
	2.2	Uniprocessor Scheduling-Types: Preemptive and Non-preemptives, CPU Scheduling (FCFS, SJF, RR, Priority)			
	2.3	Threads: Definition and Types, Concept of Multithreading			

3	**Title**	**Module 3: Concurrency & Deadlocks**	CO3	BL4	6
	3.1	Concurrency: Principles of Concurrency, Interprocess Communication, Process Synchronization, Mutual Exclusion:Critical Section, TSL, Semaphores, Producer-Consumer Problem			
	3.2	Deadlock Detection & Banker's Algorithm			
4	**Title**	**Module 4: Memory Management**	CO4	BL4	6
	4.1	Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation (First, Best, Worst Fit), Paging, Segmentation, TLB			
	4.2	Virtual Memory, Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU,			
5	**Title**	**File & Disk Management**	CO5	BL3	6
	5.1	File system, Directory implementation, File Allocation Techniques.			
	5.2	Disk Organization, I/O Management, Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK.			
6	**Title**	**Self-Learning:**			
	1.1	Virtual OS for ML	CO1	BL3	1
	2.1	Threads in ML pipelines	CO2	BL4	1
	3.1	Synchronization in distributed ML	CO3	BL4	1
	4.1	Memory optimization ML	CO4	BL4	1
	5.1	ML file handling	CO5	BL4	1
				Total	**28***

*Total Hours 28 Excluding Self Learning Session

Text Books :	
1	Operating System Concepts by Galvin, Silberschatz, Gagne.
2	Operating Systems by D.M. Dhamdhere
3	Operating Systems by Achyut Godbole
Reference Books :	
1	Modern Operating Systems by Andrew Tanenbaum
2	Linux Kernel Development by Robert Love
3	Design of UNIX OS by Maurice Bach

Multidisciplinary Minor II

Artificial Intelligence

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIMDC4021	MDM-II-Artificial Intelligence	3	0	0	0	0	0	3

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	05	05	20	30	50

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)
Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)
Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: C Programming	
Course Objectives:	
1	Describe the fundamental characteristics of intelligent environments and compare various agent architectures
2	Understand different search algorithms to solve problems
3	Discuss knowledge representation techniques and reasoning methods to evaluate and

	solve problems.
4	Analyze and evaluate different decision-making approaches used in uncertain situations.
5	Explain and differentiate between various machine learning techniques
Course Outcomes (COs): At the End of the course students will be able to	
CO1	**Understand** the characteristics of the environment and differentiate between various agent architectures. (BL4)
CO2	**Apply** and **analyze** search algorithms to solve problems using various search techniques (BL3)
CO3	Use knowledge and reasoning to **analyze** problems and **evaluate** solutions (BL3)
CO4	**Evaluate** and reason through uncertain situations to make informed decisions. (BL5)
CO5	**Comprehend** various learning techniques (BL2)

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Title**	**Introduction to Artificial Intelligence**	**CO1**	**BL2**	**6**
	1.1	Artificial Intelligence (AI): History of AI, Applications of AI, The present state of AI, Ethics in AI	**CO1**	**BL2**	
	1.2	Intelligent Agents and Environment the structure of an agent, Types of Agents, Environments and Its Properties, PEAS Representation for an Agent	**CO1**	**BL2**	
		Self Learning: Applications of AI			**1**
2	**Title**	**Problem-Solving using Searching**	**CO2**	**BL3, BL4**	**11**
	2.1	Solving Problems by Searching, Performance evaluation of search strategies, Time Complexity, Space Complexity, Completeness, Optimality	**CO2**	**BL4**	
	2.2	Uninformed Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bidirectional Search	**CO2**	**BL3**	

	2.3	Informed Search: Heuristic Function, Admissible Heuristic, Informed Search Technique, Greedy Best First Search, A* Search, Local Search: Hill Climbing Search, Simulated Annealing Search, Optimization: Genetic Algorithm	**CO2**	**BL4**	
	2.4	Game Playing, Adversarial Search Techniques, Mini-max Search, Alpha-Beta Pruning	**CO2**	**BL4**	
		Self Learning: Solving Problems by Searching Techniques			**1**
3	**Title**	**Knowledge and Reasoning**	**CO3**	**BL2, BL3**	**12**
	3.1	Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems	**CO3**	**BL2**	
	3.2	Propositional Logic (PL): Syntax, Semantics, Formal logic-connectives, truth tables, tautology, validity, well-formed-formula, Introduction to logic programming (PROLOG)	**CO3**	**BL3**	
	3.3	Predicate Logic: FOPL, Syntax, Semantics, Quantification, Inference rules in FOPL	**CO3**	**BL3**	
	3.4	Forward Chaining, Backward Chaining and Resolution in FOPL	**CO3**	**BL4**	
		Self Learning: Case study on Knowledge and Reasoning in AI			**1**
4	**Title**	**Reasoning Under Uncertainty**	**CO4**	**BL3, BL4**	**7**
	4.1	Handling Uncertain Knowledge, Random Variables, Prior and Posterior Probability, Inference using Full Joint Distribution	**CO4**	**BL4**	
	4.2	Bayes' Rule and its use, Bayesian Belief Networks	**CO4**	**BL3**	
		Self Learning: Case study and Applications on Healthcare Systems			**1**
5	**Title**	**Planning and Learning**	**CO5**	**BL2, BL3,**	**6**

				BL4	
	5.1	The planning problem, Partial order planning, total order planning	**CO5**	**BL4**	
	5.2	Learning in AI, Learning Agent, Concepts of Supervised, Unsupervised, Semi -Supervised Learning, Reinforcement Learning, Ensemble Learning	**CO5**	**BL2**	
	5.3	Expert Systems, Components of Expert System: Knowledge base, Inference engine, user interface, working memory, Development of Expert Systems	**CO5**	**BL3**	
		Self Learning: Types of Learning			**1**
				Total	**42***

*Total Hours 42 Excluding Self Learning Session

Text Books :	
1	Stuart J. Russell and Peter Norvig, "Artificial Intelligence, A Modern Approach —Second Edition" Pearson Education.
2	Elaine Rich and Kevin Knight —Artificial Intelligence‖ Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
3	George F Luger —Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition.
Reference Books :	
1	Ivan Bratko —PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition
2	D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall
3	Saroj Kaushik —Artificial Intelligence‖, Cengage Learning.

Open Elective I-Track -I Finance & Economics

Fundamentals of Accounting and Finance

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25OE6031	Fundamentals of Accounting and Finance	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	5	5	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisites: No prior background in finance or accounting is required.	
Course Objectives:	
1	Understand the types of legal business entities and their implications for engineers.
2	Interpret financial statements such as the Profit & Loss Account and Balance Sheet.
3	Understand basic accounting principles and terminologies.
4	Gain familiarity with the Indian banking system and digital finance tools.
5	Democracy and awareness of investment avenues.Develop financial literacy.

Course Outcomes:	
CO1	Identify suitable business structures for entrepreneurial projects.
CO2	Analyse financial statements to understand firm performance.
CO3	Apply basic accounting concepts in real-life decision making.
CO4	Use digital banking tools and understand banking terminology.
CO5	Plan personal finances and select suitable investment options.

Sr. No.	Topics	CO Mapping	BL	(Hours)
1	Introduction to Business & Legal Forms (Sole Prop, LLP, Pvt Ltd, etc.)	CO1	BL2	3
2	Understanding Financial Statements – P&L, Balance Sheet etc.	CO2	BL2	6
3	Basics of Accounting – Concepts, Transactions, Terminology	CO3	BL2	4
4	Introduction to Banking – Types of Accounts, Digital Payments, UPI	CO4	BL2	5
5	Personal Finance & Investments – Saving, Budgeting, Mutual Funds, FDs	CO5	BL3	6

6	Case Studies & Applications – How to read an Annual Report, Mock Portfolio, Financial Tools	CO1-CO5	BL3	6
		TOTAL		30

Text Books :	
1	Pierre G. Bergeron,"Financial Management for Non-Finance Managers"
2	Ashish K. Bhattacharyya, "Essentials of Financial Accounting"
3	M.Y. Khan, "Indian Financial System"
Reference Books :	
1	Accounting for Managers" - T.S. Grewal / S.N. Maheshwari
2	Personal Finance" - Jack Kapoor, Les Dlabay, Robert J. Hughes
3	How to Read a Financial Report" - John A. Tracy
4	Rich Dad Poor Dad" - Robert T. Kiyosaki

Open Elective I-Track -II Human Dynamics & Leadership

Stress Management

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25OE6032	Stress Management	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	5	5	20	20	40 -

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Thriving Under Pressure: Strategies for Handling Stress and Performance

Course Objectives:

1	To equip participants with effective strategies for handling pressure and thriving in challenging situations.

2	By exploring techniques to manage stress, building resilience, and addressing the impact of comparison on self-esteem, participants will develop skills to navigate pressure with confidence and resilience.
Course Outcomes (Stress Management): At the End of the course students will be able to	
CO1	Have a deeper understanding of stress and resilience, and their impact on handling pressure.
CO2	Acquire practical strategies for managing stress and pressure, including stress management techniques and time organization skills
CO3	Develop skills to maintain self-confidence and self-worth in the face of comparison with others.
CO4	Build a support network and communication skills to seek help and resources when facing pressure.

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	1.1	**Introduction to Handling Pressure** Defining pressure and its impact on performance and well-being	CO1	BL2	5
	1.2	Overview of workshop objectives and structure			
	1.3	Creating a supportive and non-judgmental environment for learning			
	1.4	Understanding Stress and Resilience, Exploring the physiological and psychological aspects of stress			
	1.5	Identifying individual stress triggers and responses			
	1.6	Introducing concepts of resilience and its role in managing pressure			
2	2.1	**Strategies to Handle Pressure** Stress Management Techniques 1. Breathing exercises: deep breathing, progressive muscle relaxation. 2.Mindfulness meditation: cultivating present-moment awareness	CO2	BL2	6
	2.2	Time Management and Organization. 1. Prioritizing tasks and setting realistic goals			

		2. Breaking tasks into manageable steps to reduce overwhelm			
3	3.1	**Thriving Under Pressure** Shifting mindset from stress to challenge: embracing opportunities for growth	CO3	BL2	5
	3.2	Cultivating a positive attitude and self-belief in facing pressure			
	3.3	Reframing negative thoughts and self-talk to promote resilience.			
4	4.1	**Group Discussion** Comparison and Self-Esteem,Exploring the impact of comparison on self-esteem and well-being	CO4	BL2	6
	4.2	Sharing personal experiences and insights on coping with comparison, Identifying strategies to maintain self-confidence and self-worth in the face of comparison			
	4.3	Building Support Networks, Recognizing the importance of social support in managing pressure			
	4.4	Identifying sources of support within personal and professional networks, Building communication skills to seek help and resources when needed			
5	5.1	Application and Practice, Role-playing scenarios to practice applying pressure-handling strategies	CO5	BL3	6
	5.2	Reflective exercises to assess progress and identify areas for growth			
	5.3	Setting personalized goals for implementing strategies in daily life			
				Total	**28**

Text Books :	
1	Greenberg, J. S. (2008). Comprehensive Stress Management. (10th ed). New York: McGraw Hill publications.
Reference Books :	
1	1) Olpin, M. & Hesson, M. (2021). Stress Management for Life: A Research-Based Experiential Approach. 5th Edition
2	Bam, B. P. (2008). Winning Habits: Techniques for Excellence in Sports. New Delhi: Pearson Power, Dorling Kindersley India pvt ltd.
3	Hariharan, M., & Rath, R. (2008). Coping with Life Stress: The Indian Experience. New Delhi: Sage publications India pvt ltd.
4	Rice, P.L. (1999). Stress and Health. (3rd ed). Brooks/Cole publishing co.

Open Elective I-Track -III Life Sciences

BIOLOGY

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25OE6033	Biology	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	5	5	20	20	40 -

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Basic Knowledge of High School Science

Course Objectives: To provide engineering students with fundamental biological knowledge and interdisciplinary insight to inspire innovative solutions in healthcare and biotechnology

Course Outcomes (COs): At the End of the course students will be able to

CO1	Demonstrate the knowledge of the structure and function of cells and tissues and relate basic biological components to engineering analogies such as CPU, pumps, and filters.
CO2	Describe the anatomy and physiology of the circulatory and respiratory systems, and compare their working principles with engineering systems like pumps and filters.
CO3	Demonstrate the role of the nervous, sensory, and musculoskeletal systems in control and movement, and map their operations to signal-processing and mechanical systems.
CO4	Analyze the digestive, excretory, and immune systems and their simulation through bioinspired devices such as dialysis machines, drug delivery systems, and vaccine mechanisms.

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Introduction to Human Biology & Bioengineering Analogy**		**CO1**	**BL3**	**7**
	1.1	Cell as a basic unit of life: structure, function, organelles			
	1.2	Human tissue types: epithelial, muscular, nervous, connective			
	1.3	Systems approach to the human body			
	1.4	Analogy: Cell ↔ Factory, Brain ↔ CPU, Heart ↔ Pump, Kidney ↔ Filter			
	Circulatory and Respiratory Systems				
2	2.1	Structure & function of heart, blood vessels	**CO.2**	**BL2**	7
	2.2	Blood circulation and ECG basics			
	2.3	Gas exchange in lungs, respiration types (aerobic/anaerobic)			
	2.4	Analogy: Heart ↔ Hydraulic pump; Lungs ↔ Air filter			
	2.5	Engineering insight: Pulse sensors, Ventilators, Artificial heart-lung systems			
	Nervous, Sensory, and Musculoskeletal Systems				
3	3.1	Brain & spinal cord: neurons, neurotransmission	**CO3**	**BL3**	**7**

	3.2	Eye & ear anatomy and signal conversion			
	3.3	Muscles and joints: biomechanics, prosthetics			
	3.4	Analogy: Nervous system ↔ Wiring/Control system, Eye ↔ Camera, Bones ↔ Structural frame			
	Digestive, Excretory, and Immune Systems				
4	4.1	Food breakdown and absorption, gut microbiota	**CO4**	**BL4**	**7**
	4.2	Kidney function and dialysis concepts			
	4.3	Basics of immunity and vaccines			
	4.4	Engineering tie-ins: Dialysis machines, Drug delivery systems, Biodegradable packaging from gut flora study			
				TOTAL	**28**

Text Books :	
1	Human Physiology – Stuart Ira Fox, McGraw Hill
2	Biology for Engineers – Arthur T. Johnson, CRC Press
3	Biomimetics: Nature-Based Innovation – Yoseph Bar-Cohen

Open Elective I-Track -IV Law

Indian Constitution

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25OE4015	Indian Constitution	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	5	5	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: • None (general awareness of society/governance helpful)

Course Objectives:

1	To introduce students to the basic legal system of India.

2	To develop understanding of constitutional rights and duties.
3	To sensitize students to personal laws, civil rights, and justice mechanisms.
4	To provide foundational knowledge of media regulations, corporate law, and cyber legislation.
5	To promote awareness of legal responsibilities and ethical decision-making in professional and digital contexts.
Course Outcomes (COs):	
CO1	Explain the structure and fundamental principles of the Indian Constitution.
CO2	Understand and compare personal laws applicable in India.
CO3	Recognize and interpret civil rights and social justice frameworks.
CO4	Describe laws governing media, corporate entities, and commercial practices.
CO5	Apply India's corporate laws, including company law, contracts, consumer and labour rights, CSR, start-up compliance, and corporate legal reforms.
CO6	Apply key principles of Cyber Law, IT Act provisions, cybercrime regulations, data protection, and global cyber security frameworks.

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	1.1	Introduction to Indian Constitution Evolution of Indian Constitution, Preamble of the Indian Constitution, Comparison of Indian Constitution with Constitutions of other countries (e.g., USA, UK), Salient Features of the Constitution	CO1	BL2, BL3	04
	1.2	Role of Election Commission in India Recent Amendments to the Indian constitution			
	1.3	Fundamental Rights and Duties Self-Learning topics Basic Structure Doctrine (Judicial Interpretation). Landmark Cases related to Fundamental Rights (e.g., Kesavananda Bharati Case)			

2	2.1	Basics of Personal Law Concept of Secularism and Personal Law in India Role of Judiciary in Reforming Personal Law	CO2	BL2, BL3, BL4	04
	2.2	Overview of Hindu Law, Muslim Law, Christian Law. Marriage, Divorce, Maintenance			
	2.3	Succession and Inheritance Laws. Special Marriage Act & Concept of Uniform Civil Code. Self-Learning Topics: Triple Talaq Case and its Impact (Shayara Bano v. Union of India) Marriage and Divorce Procedures under Special Marriage Act, 1954			
3	3.1	Civil Rights and Social Justice Meaning of Civil Rights Equality before Law and Equal Protection	CO3	BL2, BL3, BL5	05
	3.2	Reservation and Affirmative Action Protection against Social Discrimination (SC/ST Atrocities Act)			
	3.3	Role of National Human Rights Commission (NHRC), National Commission for Women (NCW). Right to Education, Right to Work Implementation of Right to Education (RTE) Act **Self-Learning topics:** Landmark Cases on Equality (e.g., Indra Sawhney Case - Reservations) Constitutional Safeguards for Minorities Recent Developments in Social Justice (e.g., Reservation for Economically Weaker Sections).			
4	4.1	Media Law and Freedom of Expression Historical Evolution of Press Freedom in India Freedom of Press and Speech (Article 19(1)(a))	CO4	BL2, BL3	05

	4.2	Media Ethics and Regulation Social Media Regulations - IT Rules 2021 Censorship and Broadcasting Laws			
	4.3	RTI Act 2005: Features and Applications Fake News, Social Media Liability, Defamation Law Legal Aspects of Defamation and Fake News Self-Learning topics: Famous Cases on Freedom of Speech (e.g., Romesh Thappar vs. State of Madras) Contemporary Issues in Media Ethics (Paid News, Sensationalism) Case Studies on RTI Act Applications			
5	5.1	Introduction to Corporate Law History and Evolution of Company Law in India Salient Features of Companies Act, 2013 Nature and Types of Companies Overview of Companies Act, 2013	CO5	BL2, BL3, BL4	05
	5.2	Basic Elements of Contract Law Consumer Rights and Protection Act			
	5.3	Concept of Corporate Social Responsibility (CSR) Labour Rights and Workplace Laws Role of SEBI and Regulatory Authorities Self-Learning Topics: Start-up Ecosystem and Legal Framework for Start-ups Recent Corporate Scams and Legal Reforms (e.g., Satyam Scam, IL&FS Case)			
6	6.1	Basics of Cyber Law Introduction to IT Act, 2000	CO6	BL2 BL3 BL4	05
	6.2	Cybercrimes: Types and Case Studies Legal Provisions for Hacking, Identity Theft, Cyberbullying			

	6.3	Digital Signatures, E-contracts, and E-governance Data Protection and Privacy in India Intellectual Property in the Digital Era Digital Personal Data Protection Act 2023 Self-Learning Topics: Research latest Indian cybercrime cases (National Cyber Crime Portal) Explore CERT-IN website for recent cyber security advisories Comparative study of GDPR (EU) vs. Indian Data Protection framework			
				TOTAL	28

Text Books:	
1	D.D. Basu – Introduction to the Constitution of India
2	Pavan Duggal – Cyberlaw: The Indian Perspective
3	Akhileshwar Pathak – Legal Aspects of Business
Reference Books:	
1	Flavia Agnes – Law and Gender Inequality
2	V.K. Dewan – Law for Engineers
3	Bare Acts: IT Act, Companies Act, RTI Act, Consumer Protection Act

Open Elective I-Track -V Management

Ideation and Innovation Management

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25OE4015	Ideation and Innovation Management	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
10	5	5	20	20	40

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (10)

Minimum Two (02) of the above mentioned activities each of 10 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)

Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: business fundamentals, entrepreneurship concepts, and creative thinking

Course Objectives:

1	To equip students with the skills to identify problems, generate innovative solutions, and develop viable prototypes using structured ideation and innovation management tools
2	To develop the ability to identify real-world problems and generate innovative ideas using structured ideation techniques.

3	To examine and analyze different innovation models and frameworks relevant to product and service development.
4	To apply creative and critical thinking tools in designing user-centered solutions with value-driven outcomes.
5	To evaluate feasibility, scalability, and impact of proposed innovations through case studies and validation methods.
6	To formulate and present innovation-based proposals or prototypes aligned with market or social needs.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	Apply structured ideation techniques to identify and define real-world problems.
CO2	Analyze user needs and market trends to generate innovative solution concepts.
CO3	Evaluate different innovation models and strategies for startup development.
CO4	Design and develop low-fidelity prototypes using appropriate tools and methodologies.
CO5	Assess the feasibility of innovation ideas through business model generation and validation techniques.

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Introduction to Innovation & Creativity**		CO1	BL3	4
	1.1	Types of Innovation			
	1.2	Creativity vs Innovation			
	1.3	Innovation Mindset			
2	**Ideation Tools and Techniques**		CO1,CO3	BL5	6
	2.1	SCAMPER, Brainstorming			
	2.2	Mind Mapping, TRIZ			
	2.3	Idea Evaluation Frameworks			
3	**Design Thinking & User-Centric Innovation**		CO2	BL4	6
	3.1	Empathy Maps, Persona Creation			
	3.2	Ideation, Prototyping & Testing			

4	**Innovation in Practice**		CO4	BL3	6
	4.1	Case Studies: Apple, Tesla, Local Startups			
	4.2	Business Incubation & MVP			
5	**Evaluating and Pitching Innovation**		CO5, CO3	BL3	8
	5.1	Feasibility, Desirability, Viability			
	5.2	Innovation Metrics and KPIs			
	5.3	Pitching Frameworks			
TOTAL					30

Text Books :	
1	"Innovation and Entrepreneurship" – Peter F. Drucker
2	"Managing Innovation" – Joe Tidd & John Bessant
3	"Design Thinking for Strategic Innovation" – Idris Mootee
Reference Books :	
1	"The Innovator’s Dilemma" – Clayton Christensen
2	"Ten Types of Innovation: The Discipline of Building Breakthroughs" – Larry Keeley et al.
3	"The Lean Startup" – Eric Ries

Communication & Personality Development-II-(CPD-II)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAISEC401	Communication & Personality Development -II (CPD-II)	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	Pres / Oral
Activity	Test	Att	Total		
15	05	05	25	-	25

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (15)
Minimum Two (02) of the above mentioned activities each of 15 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (05)
Minimum Two (02) of the above mentioned tests each of 05 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (05)
As per the rubric provided by the Attendance committee.

Prerequisite: Basic English language fluency

Course Objectives: Analyse personal traits, interests, values, aptitudes and skills.

1	Critically analyse technical documents and other literature for understanding and development of thoughts.
2	Listen and understand the dynamics of professional communication in the form of group discussions, presentations, etc. required for career enhancement.
3	Analyse personal traits, interests, values, aptitudes and skills.
4	Understand the importance of integrity and develop a personal code of ethics.

Course Outcomes (COs): At the End of the course, students will be able to	
1	Comprehend various technical literature to develop the competency of formal communication
2	Develop student's ability to actively listen, participate effectively in GD and deliver clear, engaging presentations.
3	Understand the role of communication in personal and professional success.
4	Demonstrate effective individual professional ethics at the workplace.

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	1.1	**READING AND WRITING SKILLS:** Critical Reading: Understanding the concept of critical reading	**CO1**	BL1 BL2 BL3	**06**
	1.2	Applying critical reading skills to analyse a given text.			
	1.3	Read and Summarise a Research paper (Environment, Sustainability and Social aspects)			
	1.4	Read a book (fiction / non-fiction) and prepare a review on it.			
2	2.1	**LISTENING & SPEAKING SKILLS:** Listening Comprehension (Motivational Talks or TED TALKS): Pronunciation, intonation, Stress and Rhythm	**CO2**	BL1 BL2 BL3	**10**
	2.2	Group Discussion: Principles of Group Discussion, Do's and Don'ts of Group Discussion			
	2.3	Giving Presentations: Dealing with Stage Fear, Planning, Structuring and Delivering Presentation			
3	3.1	**PERSONAL DEVELOPMENT PLANNING:** Self- Assessment strategies (SWOT Analysis)	**CO3**	BL1 BL2 BL3	**05**
	3.2	Digital Footprints-Maintaining a Professional Persona			

	3.3	Goal Setting: (Defining goals, Types of goals, Establishing SMART goals, Steps in setting goals, Goal setting activity)			
4	4.1	**PROFESSIONAL ETHICS:** Body language	**CO4**	BL1 BL2 BL3	**07**
	4.2	Assertive Behaviour & Conflict Resolution			
	4.3	Decision-making Skills			
	4.4	Leadership and Qualities of a successful leader			
	4.5	Character-building			
	4.6	Work Ethics and Etiquette.			
			Total	**28**	

LIST OF ASSIGNMENTS: (In the form of Short Notes, Questionnaire / MCQ Test, Role Play, Case Study, Quiz, etc.)	
Sr. No.	**Assignment Questions**
1	Literature Review of Research Papers
2	Summary of a (fiction / non-fiction) Book
3	Summary of a TED talk / Motivational Video
4	Based on SWOT analysis, create a plan that leverages strengths, minimizes weakness, capitalizes on opportunities and mitigates threats.
5	Write a personal essay reflecting your experiences, values & aspirations.
6	How to use body language effectively?
6	Describe your favourite leader highlighting his key skills.
7	Write in detail about a personal set of values that determines how an employee behaves in the workplace.
Note:	
1	The group size for the presentation and group discussion should not be less than 5 students or exceed 7 students.
2	There will be an end–semester presentation on any technical topic.

Textbooks:	
1	Communication Skills by Sanjay Kumar & Pushp Lata
2	Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi
Reference Books:	
1	Arms, V. M. (2005). *Humanities for the engineering curriculum: With selected chapters from Olsen/Huckin: Technical writing and professional communication, second edition*. Boston, MA: McGraw-Hill.
2	Bovée, C. L., &Thill, J. V. (2021). *Business communication today*. Upper Saddle River, NJ: Pearson.
3	Butterfield, J. (2017). *Verbal communication: Soft skills for a digital workplace*. Boston, MA: Cengage Learning.
4	Masters, L. A., Wallace, H. R., & Harwood, L. (2011). *Personal development for life and work*. Mason: South-Western Cengage Learning
5	Robbins, S. P., Judge, T. A., & Campbell, T. T. (2017). *Organizational behaviour*. Harlow, England: Pearson.
6	Meenakshi Raman, Sangeeta Sharma (2004) Technical Communication, Principles and Practice. Oxford University Press
7	Archana Ram (2018) Place Mentor, Tests of Aptitude for Placement Readiness. Oxford University Press

Problem Solving and Aptitude Building-II

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAISEC402	Problem Solving and Aptitude Building Part-II	2	0	0	2	0	0	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	End Semester Examination
Activity	Test	Att	Total		
30	10	10	50	-	-

Activity: [Presentation/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (30)

Minimum Two (02) of the above mentioned activities each of 30 marks have to be conducted. The average marks would be considered.

Test [Open Book Test/Class Test/Multiple Choice Questions] (10)

Minimum Two (02) of the above mentioned tests each of 10 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (10)
As per the rubric provided by the Attendance committee.

Prerequisite: Completion of Part-1 or equivalent problem-solving foundation	
Course Objectives: The course will enable students to	
1	To enhance understanding of complex aptitude and reasoning patterns
2	To develop analytical thinking through data interpretation and puzzles.
3	To prepare for aptitude-based recruitment assessments and competitive exams.
Course Outcomes (COs): At the End of the course students will be able to	

CO1	Analyze data using arithmetic and tabular methods.
CO2	Apply mensuration and geometry concepts in real-life contexts.
CO3	Solve problems involving counting principles and probability.
CO4	Use structured logic to solve puzzles and reasoning problems.
CO5	Apply critical thinking to abstract reasoning and decision-making problems.

Module No.	**Detailed Contents**		**CO Mapped**	**BL**	**Hrs**
1	**Module 1: Advanced Arithmetic & Data Interpretation**:		CO1	BL3	05
	1.1	Advanced Percentage and Interest Calculations			
	1.2	Partnerships and Investments			
	1.3	Data Interpretation Basics (Tables, Pie Charts, Bar Graphs) Caselet DI			
2	**Module 2: Geometry and Mensuration**:		CO2	BL3	05
	2.1	Basic Geometric Shapes and Properties Triangles, Circles, Quadrilaterals			
	2.2	Mensuration Formulas (2D and 3D) Area, Volume, Surface Area Problems			
	2.3	Coordinate Geometry Basics			
3	**Module 3: Permutations, Combinations & Probability**:		CO3	BL3	06
	3.1	Fundamental Counting Principle, Permutations and Combinations			
	3.2	Factorials and Arrangements Basic Probability and Conditional Probability			
	3.3	Problem Solving Techniques			
	Module 4: Advanced Logical Reasoning:		CO4	BL3	06
4	4.1	Puzzles and Seating Arrangements (Linear and Circular)			
	4.2	Input-Output, Logical Deductions			

	4.3	Statements & Assumptions, Statements & Conclusions			
	Module 5: Analytical and Abstract Reasoning:		CO5	BL3	06
5	5.1	**Module 5: Analytical and Abstract Reasoning**: Analytical Decision Making, Pattern Recognition			
	5.2	Cube and Dice Problems, Clocks and Calendars			
	5.3	Cause and Effect, Critical Thinking and Problem-Solving Techniques			
				Total	**28**

Text Books :	
1	Quantitative Aptitude for Competitive Examinations,R.S. Aggarwal,S. Chand.
2	A Modern Approach to Verbal and Non-Verbal Reasoning,R.S. Aggarwal,S. Chand
3	Quantitative Aptitude Quantum CAT,Sarvesh K. Verma,Arihant Publications
4	Fast Track Objective Arithmetic,Rajesh Verma,Arihant Publications
Reference Books:	
1	How to Prepare for Quantitative Aptitude for CAT, Arun Sharma, McGraw Hill
2	Logical Reasoning and Data Interpretation for the CAT, Nishit K. Sinha, Pearson Education
3	Analytical Reasoning, M.K. Pandey, BSC Publishing
4	Arihant's Master Resource Book – Logical Reasoning & Data Interpretation, Ajay Singh, Arihant Publications

Machine Learning Lab

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL401	Machine Learning Lab	-	-	2	-	-	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exam marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: C Programming,Python Programming

Lab Objectives:

1	Understand machine learning models for real-world problems.
2	Implement various Regression techniques
3	Implement Clustering and classification techniques

4	Assess and select the most appropriate algorithm based on problem requirements
5	Develop skills to implement and fine-tune machine learning models using programming tools.
Lab Outcomes (LOs): At the End of the course students will be able to	
CO1	Apply, analyze, evaluate, and create machine learning models for real-world problems.
CO2	Apply and evaluate regression techniques for prediction tasks.
CO3	Analyze clustering techniques to group data effectively.
CO4	Compare different algorithms to select the most suitable one for a given problem.
CO5	Build and optimize machine learning models using appropriate programming tools

Week No.	Exp No.	Title of Experiment	CO Mapped	Bloom's Level	Hrs
1	1	**Exploring Machine Learning Libraries and Tools** You are tasked with setting up an ML development environment for a new data science team. Explore and compare tools like Scikit-learn, TensorFlow, and Keras. Document the installation, key functions, and basic usage through simple examples.	CO1	BL2	2
2	2	**Sentiment Analysis of Movie Reviews Using Naive Bayes** A film streaming service wants to automate feedback analysis. Build a classifier using Naive Bayes to predict whether a user review is positive or negative. Train the model on labeled review data and evaluate using accuracy and F1-score.	CO1	BL3	2
3	3	**Predicting House Prices Using Linear Regression** A real estate agency wants to predict house prices based on features like area, number of rooms, and location rating. Build and train a linear regression model on housing datasets and evaluate its RMSE and R^2 score.	CO2	BL3	2

4	4	**Email Spam Classification Using Logistic Regression** A company wants to classify emails as spam or not. Use logistic regression to build a binary classifier using email metadata and content keywords. Evaluate the model with a confusion matrix and F1-score.	CO2	BL3	2
5	5	**Student Pass/Fail Prediction Using KNN** A college wants to predict whether students will pass based on their attendance and test scores. Implement a k-Nearest Neighbors classifier and evaluate using cross-validation. Serialize the trained model using Pickle.	CO2	BL4	2
6	Internal Assessment -I & Submission				
7	6	**Clustering Customer Locations Using DBSCAN** A food delivery service wants to identify dense customer zones. Apply DBSCAN clustering on customer location coordinates to discover potential zones for opening new hubs. Visualize clusters using matplotlib.	CO3	BL4	2
8	7	**Customer Segmentation Using K-Means Clustering** A retail chain wants to segment customers based on annual income and spending score. Apply K-Means clustering and determine optimal clusters using the Elbow method.	CO3	BL3	2
9	8	**Mumbai House Price Prediction Using Decision Tree Regression** Analyze the Mumbai housing dataset to predict median house value using decision trees. Compare model depth and features used for splitting. Visualize the tree and report on performance metrics.	CO4	BL4	2
10	9	**Algorithm Selection Case Study: Random Forest vs. Gradient Boosting** You are asked to improve a classification task's accuracy. Implement and compare Random Forest and Gradient Boosting classifiers on the same dataset (e.g.,	CO4	BL4	2

		loan default prediction). Compare accuracy and F1-score.			
11	10	**SVM for Classification of Handwritten Digits** Use the MNIST dataset to train an SVM classifier for handwritten digit recognition. Experiment with linear and RBF kernels. Evaluate precision, recall, and confusion matrix.	CO4	BL3	2
12	11	**Building a Scikit-learn Pipeline and Scaling Features** A startup needs a clean ML pipeline for deployment. Build a pipeline that includes preprocessing (scaling, encoding), model training, and prediction for a small dataset (e.g., titanic survival).	CO5	BL4	2
13	Internal Assessment -II & SUBMISSION				
14		**Hyperparameter Tuning with GridSearchCV** Optimize the performance of a classifier (e.g., SVM or Random Forest) using GridSearchCV. Tune parameters such as kernel type, number of estimators, or depth. Use cross-validation to compare results.	CO5	BL4	2

Text Books :	
1	“Pattern Recognition and Machine Learning” by Christopher M. Bishop
2	“The Elements of Statistical Learning” by Hastie, Tibshirani, Friedman
3	“Applied Predictive Modeling” by Kuhn & Johnson
Reference Books :	
1	Pattern Classification,Richard O. Duda, Peter E. Hart, David G. Stork
2	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
3	"Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy

Analysis of Algorithms Lab

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL402	Analysis of Algorithms Lab	-	-	2	-	-	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: Basic knowledge of programming and data structure

Course Objectives: The course will enable students to

1	To implement and analyze fundamental algorithmic techniques with a focus on understanding their structural design, and practical applications.
2	To develop the ability to compare algorithms based on time and space complexity and to select appropriate algorithms for solving computational problems efficiently.

3	To cultivate problem-solving skills by applying algorithmic strategies to real-world and case-based problems, while reinforcing principles of algorithm design, optimization, and correctness.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	**Implement** and **analyze** basic sorting algorithms based on input characteristics and performance. (L4)
CO2	**Develop and execute** divide and conquer algorithms to solve different computational problems and analyze their complexity. (L3)
CO3	**Implement** greedy algorithms to solve various optimization problems and evaluate their performance. (L3)
CO4	**Implement** dynamic programming solutions for various computational problems and evaluate their efficiency. (L4)
CO5	**Implement** backtracking and branch and bound methods for solving different computational problems. (L3)
CO6	**Implement** efficient string matching algorithms to accurately solve pattern searching problems in text processing and related computational tasks.(L3)

Week No.	Exp No.	Detailed Contents	CO Mapped	BL	Hrs
1	1.1	A recruitment software module needs to sort job candidates based on years of experience. Implement **Selection Sort** to order a list of candidate profiles by years of experience.	CO1	BL3	2
	1.2	Implement a program to sort a given array of integers in **ascending order** using the **Insertion Sort** algorithm.			
2	2.1	A university admission system maintains a sorted list of student roll numbers who have successfully enrolled in a course. When a student wants to check their enrollment status, the system performs a search in the list. Apply the Binary Search algorithm to quickly find the student's roll number.	CO1	BL3	2
3	3.1	A university examination department needs to sort student records based on their total marks obtained in a semester. The department wants to quickly generate a merit list. Implement the **Quick Sort** algorithm to sort the students in descending order of their total marks.	CO2	BL3	2

4	3.2	An e-commerce platform wants to show sorted results based on the price of an item. Implement **Merge Sort** to sort product listings.			
5	4.1	Implement Dijkstra's algorithm to find the shortest paths in a city map. The roads are represented as unweighted edges, and the goal is to find the shortest distance from the starting location to all other locations. **https://ds2-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html**	CO3	BL3	2
6	**Internal Assessment -I & Submission**				
7	5.1	A government agency plans to develop an **eco-friendly road network** within a large **national park** to connect all major observation points . Implement a system that helps the government **identify the most cost-effective set of roads** to be built, using **Kruskal's algorithm** to compute the **Minimum Spanning Tree** of the given network.	CO3	BL3	2
8	7.1	**Cost-Optimized Delivery Routing using Bellman-Ford Algorithm:** Develop a system to calculate the minimum delivery cost from a central warehouse to all destinations in a transport network, considering both positive and negative route costs.	CO4	BL3	2
9	9.1	Implement 0/1 **Knapsack algorithm:** In a post-disaster relief operation, a truck is being loaded with emergency supplies to be transported to an affected area. Each supply item has a weight (in kilograms) and a value, which reflects its importance or utility in saving lives or providing aid. The truck has a maximum weight capacity (W) due to road safety regulations and fuel limitations. Each item is indivisible — you either take the entire item or leave it. Select the optimal set of supplies to load into the truck so that the total importance (value) is maximized without exceeding the truck's weight limit.	CO4	BL3	2

	9.2	**Fractional Knapsack Using Greedy Approach** You are given N items, each with a weight w[i] and a value v[i], and a knapsack with a maximum weight capacity W. Your task is to determine the maximum total value that can be accommodated in the knapsack by taking fractions of items if necessary.	CO3	BL3	2
10	10.1	In academic institutions, detecting **textual similarity** between student assignments is critical to identify potential plagiarism. Given two assignment submissions as sequences of words, develop a program to compute the **Longest Common Subsequence (LCS)** using **Dynamic Programming**.	CO4	BL3	2
11	11.1	Implement a program to solve the **N-Queens problem** using the **Backtracking algorithm**. The objective of the N-Queens problem is to place N chess queens on an N×N chessboard so that no two queens threaten each other. This means that no two queens should be placed in the same row, column, or diagonal.	CO5	BL3	2
12	12.1	Implement a Naive string matching algorithm to locate occurrences of a **keyword or phrase (pattern)** within a larger **body of text**.	CO6	BL3	2
	12.2	Implement the **KMP string matching algorithm** to search for a user-provided **query string (pattern)** within a large **product description database (text)** for an e-commerce platform stores			
13	**Internal Assessment -II & SUBMISSION**				
14		Problem Solving Assignment on ● Dynamic Programming Approach ● Backtracking Approach ● String Matching Algorithms	CO4, CO5 ,CO6	BL3	**2**

Text Books :	
1	Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. “Fundamentals of computer algorithms” University Press.
2	T. H. Cormen, C.E. Leiserson,R.L. Rivest, and C. Stein, “Introduction to algorithms”, 2nd Edition, PHI Publication 2005.
Reference Books :	
1	Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, “Algorithms”, Tata McGraw- Hill Edition.
2	S. K. Basu, “Design Methods and Analysis of Algorithm”, PHI
Online Resources:	
1	**Codecademy -** Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
2	**Coursera -** Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
3	**LeetCode-** LeetCode is an online platform for coding interview preparation. The platform provides coding and algorithmic problems intended for users to practice coding.
4	**CodeChef** - Learn and Practice Coding with Problems

Operating System Lab

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL403	Operating System Lab	0	0	2	0	0	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: C Programming,Python Programming	
Lab Objectives:	
1	To provide hands-on experience with Linux commands and system-level programming.
2	To demonstrate process and thread management via fork, exec, wait system calls.
3	To simulate CPU scheduling algorithms.

4	To implement synchronization and deadlock handling.
5	To model memory and file management systems programmatically.
Lab Course Outcomes (Lab COs): At the End of the course students will be able to	
CO1	Execute basic and advanced Linux commands and scripting.
CO2	Apply system calls for file and process management.
CO3	Design and implement process scheduling and memory allocation algorithms.
CO4	Demonstrate concurrency control and synchronization using semaphores.
CO5	Simulate file management and disk scheduling techniques

Weeks	**Title**	**Problem Statement**	**Lab CO Mapped**	**Hrs**
1	Explore Linux Commands	Explore usage of basic Linux commands and system calls for file, directory, and process management. For eg: mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc. System calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid, sort, grep, awk.	CO1	2
2	Linux Shell Script	Write shell scripts to: a) Display OS version, release number, kernel version. b) Top 10 processes in descending order. c) Processes with highest memory usage. d) Current logged-in user and log name. e) Current shell, home directory, OS type, path, working directory.	CO1	2
3	Linux API	Implement a Linux command (like ls, cp, mv) using kernel APIs.	CO2	2
4	Linux Process	a) Create a child process using fork(). b) Display PID/PPID. c) Use wait/waitpid.	CO2	2
5	Process Scheduling	a) Simulate non-preemptive algorithms. b) Simulate preemptive algorithms.	CO2	2
6	**Internal Assessment Exam IA-1**			

7	Synchronization	Implement Producer-Consumer problem using semaphores.	CO3	2
8	Deadlock	Implement Banker's Algorithm.	CO3	2
9	Memory Management	a) MVT and MFT techniques. b) Best Fit, First Fit, Worst Fit algorithms.	CO4	2
10	Virtual Memory	a) Simulate demand paging. b) Implement FIFO, LRU.	CO4	2
11	File Management	a) Simulate sequential, indexed, linked allocation. b) Multi-level directory structure.	CO4	2
12	Disk Scheduling	Simulate disk scheduling algorithms: FCFS, SCAN, C-SCAN.	CO4	2
13	**Internal Assessment Exam IA-2**			
14	Assignment	Solve problems from LeetCode/GeeksforGeeks (e.g., Task Scheduler, Dining Philosophers). https://leetcode.com/problems/task-scheduler/description/ https://leetcode.com/problems/the-dining-philosophers/description/	CO5	2

Text Books :	
1	Operating System Concepts by Galvin, Silberschatz, Gagne.
2	Operating Systems by D.M. Dhamdhere
3	Operating Systems by Achyut Godbole
Reference Books :	
1	Modern Operating Systems by Andrew Tanenbaum
2	Linux Kernel Development by Robert Love
3	Design of UNIX OS by Maurice Bach

Data Visualization Lab

Lab Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIPCL404	Data Visualization Lab	0	0	2	0	0	1	1

Examination Scheme					
Continuous Internal Assessment (CIA)					External
IPE	Exp	Activity	Att	Total	Prac & Oral
15	05	03	02	25	25

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: Discrete mathematics, Database Management Systems, Programming in Python

Lab Objectives:

1	To understand the process of data analytics from raw data to actionable insights.
2	To implement regression, time series, and text analytics using Python and R.
3	To apply effective data visualization techniques using Matplotlib, Seaborn, and ggplot2.
4	To analyze data and interpret results for informed decision-making.

Lab Outcomes (LOs): At the End of the course students will be able to:	
CO1	Understand the data analytics lifecycle and tools used in each phase.
CO2	Apply regression and classification techniques to model real-world data.
CO3	Implement time series and forecasting methods.
CO4	Perform basic NLP tasks and visualize text data.
CO5	Create clear, interactive, and insightful visualizations using Python/R.
CO6	Integrate visualizations into dashboards and interpret insights effectively.

Sr.No.	**Suggested Experiment**	**CO Mapped**	**BL**	**Hrs**
1	Apply the analytics lifecycle to an e-commerce dataset to uncover sales patterns and user behavior. "We are given a raw dataset containing information about online shopping transactions (e.g., customer ID, purchase amount, product category, and date). Describe the steps you would take to convert this raw data into a meaningful visual summary that helps a business manager understand customer buying trends."	**CO1**	**BL3**	**2**
2	Predict salary based on years of experience using linear regression. You are given a dataset containing salaries of employees along with their years of experience. Using Python or R, build a simple linear regression model to predict salary based on years of experience. How would you check the accuracy of your predictions? Mention the libraries or functions you would use.	**CO2**	**BL3**	**2**
3	Analyze housing prices based on area, bedrooms, and locality using multiple regression. You are provided with a dataset containing housing information based on this you are supposed to create a Linear Regression Model using Python to predict home prices using Boston Housing Dataset	**CO2**	**BL4**	

	(https://www.kaggle.com/c/boston-housing). The Boston Housing dataset contains information about various houses in Boston through different parameters. There are 506 samples and 14 feature variables in this dataset. The objective is to predict the value of prices of the house using the given features.			**2**
4	You are given a dataset containing student attendance (%) and internal test scores. The dataset also includes whether each student passed or failed the course. Using Python , how would you build a model to predict whether a student will pass or fail?	**CO2**	**BL3**	**2**
5	You are provided with social network advertising datasets over . Using Python or R, perform 1. Implement logistic regression using Python/R to perform classification on Social_Network_Ads.csv dataset. 2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.	**CO3**	**BL4**	**2**
6	**Internal Assessment -I & Submission**			
7	From a list of given students from Data Science class you are supposed to create an "Academic performance" dataset of students and perform the following operations using Python. 1. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them. 2. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them. 3. Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non-linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution.	**CO3**	**BL5**	**2**
8	Clean and tokenize Text data to prepare for vectorized feature dataset classification.	**CO4**	**BL3**	

	You are supposed to extract Sample document and apply following document preprocessing methods: 1. Tokenization, POS Tagging, stop words removal, Stemming and Lemmatization. 2. Create representation of documents by calculating Term Frequency and Inverse Document Frequency.			**2**
9	You are given a dataset for a flower having data as iris.csv datase Write a Python program to display some basic statistical details like percentile, mean, standard deviation etc. of the species of 'Iris-setosa', 'Iris-versicolor' and 'Iris-versicolor' of iris.csv dataset. 1. Implement Simple Naïve Bayes classification algorithm using Python/R on iris.csv dataset. 2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.	**CO4**	**BL6**	**2**
10	You are given the dataset 'Titanic' ship. The dataset contains 891 rows and contains information about the passengers who boarded the unfortunate Titanic ship. 1. Use the Seaborn library to see if we can find any patterns in the data. 2. Write a code to check how the price of the ticket (column name: 'fare') for each passenger is distributed by plotting a histogram. 3.Use the above dataset 'Titanic' as used in the above problem. Plot a box plot for distribution of age with respect to each gender along with the information about whether they survived or not. (Column names : 'sex' and 'age') 4. Write observations on the inference from the above statistics.	**CO3, CO4**	**BL5**	**2**
11	Build an interactive dashboard to monitor sales or healthcare data using Tableau You are given a dataset containing either sales records or healthcare data (such as patient visits, treatments, or medication usage). Using	**CO5, CO6**	**BL6**	

	Tableau, create an interactive dashboard that allows users to explore key trends and metrics. What types of visual elements (charts, filters, maps) would you include and why? How would you make the dashboard user-friendly and interactive? How can such a dashboard help in data-driven decision-making for businesses or healthcare providers?			**2**
12	Perform the following data visualization operations using Tableau on Adult and Iris datasets. 1D (Linear) Data visualization 2D (Planar) Data Visualization 3D (Volumetric) Data Visualization Temporal Data Visualization Multidimensional Data Visualization Tree/ Hierarchical Data visualization Network Data visualization	**CO5, CO6**	**BL3, BL4**	**2**
13	**Internal Assessment –II & Submission**			
14	Mini Projects/ Case Study – PYTHON/R Develop a movie recommendation model using the scikit-learn library in python. Refer dataset https://github.com/rashida048/Some-NLP-Projects/blob/master/movie_dataset.csv	**CO6**	**BL6**	

Text Books :	
1	Colin Ware .“Visual Thinking for Design of information visualization and cognitive design” , Morgan Kaufmann (Elsevier) publisher(2008), ISBN**:** 978-0123708960
2	Alberto Cairo ,“ The Functional Art: An Introduction to Information Graphics and Visualization" Publisher New Riders (2012) , ISBN: 978-0321834737
3	Scott Murray “Interactive Data Visualization for the Web: An Introduction to Designing with D3”, Publisher O’Reilly Media, First Edition: 2013 | Updated Edition: 2017 (2nd Edition),ISBN: 978-1491921289
4	Edward R. Tufte *“*The Visual Display of Quantitative Information*”*, **Publisher**: Graphics Press,**First Published**: 1983 | **Second Edition**: 2001 **ISBN**: 978-0961392147
Reference Books :	
1	Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly Media Press,(2018). ISBN**:** 9781492031086
2	Kieran Healy ,“ Data Visualization: A Practical Introduction (R and ggplot2 for academic data)*”,* Published by: Princeton University Press (2018) ISBN**:** 978-0691181622

Multidisciplinary Minor II Lab

Artificial Intelligence lab

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAIMDC4021	Artificial Intelligence Lab	0	0	1	0	0	1	1
Examination Scheme								
Continuous Internal Assessment (CIA)						External		
IPE	Exp	Activity	Att	Total		Prac & Oral		
15	05	03	02	25		25		

IPE: Internal Practical Evaluation (15)

Two (02) internal practical exams of 15 marks each as per below syllabus. 10 marks for Program execution, 02 marks for Program documentation and 03 marks for viva. The average of 02 exams marks would be considered as IPE.

Exp: Experiments (05)
Program(s) Execution & Problem(s) Solving: 03; On Time: 01; Viva: 01

Activity: [Assignment/Model/Mini Project] (03)
Minimum Two (02) of the above assessment tools each of 03 marks have to be conducted, covering the course outcomes. The average marks would be considered.

Att: Attendance (02)
As per the rubric provided by the Attendance committee.

Prerequisite: Python Programming	
Course Objectives:	
1	Design an appropriate agent architecture tailored to solve a real-world AI problem.
2	Implement knowledge representation and reasoning techniques using an AI programming language.

3	Develop a problem-solving agent capable of addressing specific tasks effectively.
4	Incorporate methods of reasoning under uncertainty to enhance the decision-making capabilities of an AI agent.
Course Outcomes (COs): At the End of the course students will be able to	
CO1	**Identify** suitable Agent Architecture for a given real world AI problem. (L2)
CO2	**Implement** simple programs using Prolog. (L3)
CO3	**Implement** various search techniques for a Problem-Solving Agent. (L3)
CO4	**Construct** a Bayesian Belief Network for a given problem and draw probabilistic inferences from it. (L3)

Suggested Experiments: Students are required to complete at least 10 experiments.

Week No.	Exp. No.	Detailed Contents	CO Mapped	Bloom's Level	Hrs
1	1	Case study on AI applications published in IEEE/ACM/Springer or any prominent journal.	CO1	BL2	2
2	2	Provide the PEAS description and TASK Environment for a given AI problem.	CO1	BL2	2
3	3	Write simple programs using PROLOG as an AI programming Language.	CO2	BL3	2
4	4	Write a program using PROLOG for first order logic.	CO2	BL3	2
5	5	Implement any one of the Uninformed search techniques.	CO3	BL3	2
6	**Internal Assessment -I & Submission**				
7	7	Implement a hill climbing algorithm to solve 8 puzzle problems.	CO3	BL3	2
8	8	Implement any 2 player game using game playing algorithms.	CO3	BL3	2
9	9	Implement adversarial search using min-max algorithm.	CO3	BL3	2

10	10	Implement BFS and DFS search problems using Python.	CO3	BL3	2
11	11	Create a Bayesian Network for the given Problem Statement and draw inferences from it.	CO4	BL3	2
12	12	Implement Q-Learning for Grid World Navigation problem.	CO1, CO3	BL3, BL3	2
13	**Internal Assessment -II & Submission**				
14	14	Design a prototype of an expert system.	CO1, CO4	BL3, BL3	2

Text Books :	
1	Stuart J. Russell and Peter Norvig, "Artificial Intelligence, A Modern Approach —Second Edition" Pearson Education.
2	Elaine Rich and Kevin Knight —Artificial Intelligence‖ Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
3	George F Luger —Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition.
Reference Books :	
1	Ivan Bratko —PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition
2	D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall
3	Saroj Kaushik —Artificial Intelligence‖, Cengage Learning.

Community Engagement Project

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25CAICEP401	Community Engagement Project	-	-	4	-	-	2	2

Evaluation Scheme					
Continuous Internal Assessment (CIA)				Mid Semester Examination	External
Activity	Test	Att	Total		Prese. & Oral
30	10	10	50	-	25

Activity: [Community Engagement & Fieldwork/Solution Design & Prototyping/Mindmap/Case Study/Poster/Numerical Assignment/Group Discussion/Field Visit/ GATE Questions] (30)

Minimum Two (02) of the above mentioned activities each of 30 marks have to be conducted. The average marks would be considered.

Test [Presentation/Technical Documentation/Open Book Test/Class Test/Multiple Choice Questions/Prototype Design/] (10)

Minimum Two (02) of the above mentioned tests each of 10 marks have to be conducted to ensure coverage of all Course Outcomes. The average marks would be considered.

Att: Attendance (10)
As per the rubric provided by the Attendance committee.

Prerequisite: Basic Programming and Problem Solving.

Course Objectives:

1. Expose students to societal, economic, and environmental challenges in underserved communities.
2. Apply computational thinking, AI, data analytics, and software engineering principles to real-world problems.
3. Encourage teamwork, empathy, and stakeholder collaboration.
4. Build technical prototypes with measurable social impact

Course Outcomes (COs): At the End of the course students will be able to

CO1	Identify and define real-world problems in community settings using a data-driven approach.
CO2	Design solutions leveraging computing principles (AI, ML, software, or analytics).
CO3	Collaborate effectively with peers and engage with community stakeholders.
CO4	Document the development process and evaluate the social impact of the solution.

Module No.	Detailed Contents		CO Mapped	BL	Hrs
1	Preparation & Problem Discovery		CO1	BL3 & BL4	10
	1.1	Orientation on community engagement & social innovation			
	1.2	Review of tech-enabled social interventions			

	1.3	Community visits / problem identification			
2	Data Collection & Solution Development		CO2 CO3	BL5	36
	2.1	Field interaction, user interviews, surveys			
	2.2	Data cleaning, EDA / software architecture.			
	2.3	AI/ML modelling or software/app design. Prototype building and testing			
3	Documentation & Social Impact		CO4	BL5	10
	3.1	Technical report			
	3.2	Presentation to stakeholders			
	3.3	Reflective assessment			

Sample Project Titles

For CSE (Computer Engineering):

- Mobile app for nearby medicine/oxygen supply tracking during emergencies
- Complaint redressal system for urban/rural infrastructure issues
- Public grievance chatbot with NLP integration

For AIML:

- AI model to predict student dropout risk in rural schools
- ML-based waste classification system for smart bins

- Sentiment analysis of citizen feedback to local governance portals

For Data Science:

- Data-driven water consumption analysis for housing societies
- Mapping digital divide in rural regions using publicly available data
- Predictive analytics for crop yield based on community farm data

Healthcare and Well-being

- AI Chatbot for Primary Health Advice in Local Languages
- Predictive Model for Early Detection of Malnutrition in Children
- Disease Outbreak Predictor Using Public Health Data
- Appointment Scheduler and Reminder App for Rural Clinics
- Mobile Application for Tracking Medicine Availability in PHCs

Education and Digital Literacy

- AI-Based Personalized Learning Platform for Underserved Schools
- OCR App to Convert Printed Marathi/Urdu Text into Audio for Visually Impaired
- Student Performance Predictor Using Past Academic and Attendance Data
- Gamified App for Teaching Digital Literacy in Rural Schools
- Adaptive Quiz Generator for School Students Using Bloom's Taxonomy

Environment and Sustainability

- Smart Waste Segregation System Using Image Classification
- Rainwater Harvesting Monitor Using IoT and Data Dashboard
- Air Quality Data Collection and Visualization in Local Areas
- Forest Fire Alert System Using Satellite Data and ML Models
- Energy Consumption Optimizer for Small Shops Using Predictive Analytics

Infrastructure and Utilities

- Real-Time Water Supply Monitoring System with SMS Alerts
- App for Reporting Potholes and Broken Street Lights with Geo-tagging
- Crowd-sourced Mapping of Public Toilets and Cleanliness Score
- Smart Attendance System for Anganwadi Workers Using Face Recognition
- Solar Panel Efficiency Tracker with IoT Sensors and Dashboards

Agriculture and Rural Livelihood

- AI Model for Crop Disease Identification from Leaf Images
- Chatbot for Farmer Queries Using Regional Language NLP
- Market Price Predictor for Local Produce Using Time Series Analysis
- Weather-Adaptive Irrigation Recommendation System
- ML-Powered Seed Selection App Based on Soil and Season

Civic Engagement & Governance

- Sentiment Analysis on Social Media Feedback to Local Authorities
- AI-Based Fake News Detection for WhatsApp Forwards
- Transparent Beneficiary Tracking System for Govt Schemes
- Survey Analytics Tool for Panchayat-Level Decision Making
- Suggestion Box App for Ward-Level Public Feedback with Ranking System

Accessibility and Inclusion

- Sign Language Translator App Using Deep Learning
- Smart Navigation App for Visually Impaired in Public Spaces
- AI Tool to Convert Speech to Regional Text for Hearing Impaired
- Local Language Reader with Text Summarization for Elderly
- Emotion Detection App for Children with Auti**sm**