St. John College of Engineering and Management
Autonomous Institute
(A Christian Religious Minority Institution)
Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE
DTE Code : 3218 AICTE Permanent ID : 1-4790201
NAAC Accredited with Grade 'A+', Three Programs NBA Accredited

Autonomy Scheme and Syllabus of Master of Computer Application (MCA) (Semester: I,II,III & IV)

Academic Year 2025-26

AUTONOMY SCHEME

SJCEM: R – 25

Sr. No.	Heading	Particulars
1	Title of the Course	**Master of Computer Application (MCA)**
2	Eligibility for Admission	**As per the Institute Examination Ordinance**
3	Theory Passing Marks (IAE / ESE)	**40%**
4	Continuous Assessment (CA) / Oral / Practical	**50%**
5	To be implemented from Academic Year	**With effect from Academic Year: 2025 – 2026**

Preface

University Grant Commission vide Letter No. F. 2–10/2023 (AC–Policy) dated 19th January 2024 conferred the autonomous status to St. John College of Engineering and Management, Village Vevoor, Manor Road, Palghar (East), 401404 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations 2023. Designing the curriculum as an autonomous institution raises challenges pertaining to maintaining quality engineering education.

Systematic approach has been adapted in the design and implementation of curriculum with the intent of ensuring quality education catering to the sensitive needs of a learner, society, and industry. The curriculum is aligned with NEP and UGC guidelines as per Government of Maharashtra guidelines for autonomous institutions Government Resolution dated 4th July 2023.

Based on recent recommendations of the GR, holistic curriculum for 2024-28, a "H-Tree Model" of Engineering Education is offered. A unique "H-Tree Model" of Engineering Education Curriculum is followed and curriculum is designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient), and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which a learner receives 34% teacher-led learning, 15% peer learning, 26% self-learning, and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to a leaner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science and mathematics foundation and program core, sequel of electives, multidisciplinary minor courses, humanities & management courses, and sufficient experiential learning through projects and semester-long industry/research internship along with employable skill-based courses. A learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Additional options of choosing from Honors/Double Minor/Honors with Research are also provided to a learner.

The curriculum balances contact hours and total credits of the entire program. The total credits are 80, wherein focus is not only on providing knowledge but also on building skills, attitude and self-learning. Therefore, in the present curriculum, skill-based laboratories, mini-projects, multi-disciplinary projects, and internships are made mandatory across all disciplines of engineering, which will definitely facilitate self-learning of students. The overall credits and approach of curriculum proposed in the scheme and syllabus are in line with AICTE model curriculum. SJCEM: R-25 curriculum will be implemented for First Year of Master of Computer Applications (MCA) from the academic year 2025-26

Nomenclature

Abbreviation	Title
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Professional Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
SC	Skill Courses
LLC	Liberal Learning Courses
VSEC	Vocational and Skill Enhancement Course
VEC	Value Education Course
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
IKS	Indian Knowledge System
CC	Co-curricular Courses

Credit Specification:

- Theory: 1 credit = 15 hrs of teaching
- Lab: 1 Credit = 30 hrs of lab work.
- Workshop Based Activities: 1 Credit = 30 hrs of hands-on activities related to vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit = 15 hrs of participation
- Community Engagement Projects: 1 Credit = 30 hrs of contact time along with 15 hrs of activities preparation, report writing, independent reading etc.

Dr. Nilesh T. Deotale
BoS Chairperson

Dr. Kamal Shah
Principal

Master of Computer Application

Semester – I, II, III & IV

SJCEM: R – 25

Effective from Academic Year 2025-26

Semester - I

Course Code	Vertical	Course Name	Contact Hrs.			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MCABSC101	BSC	Linear Algebra for Computer Applications	3	1	-	3	1	-	4
25MCAPCC101	PCC	Data Structures and Applications	3	-	2	3	-	1	4
25MCAPCC102	PCC	Fundamentals of Database Management Systems	3	-	2	3	-	1	4
25MCAPCC103	PCC	Modern Web Technologies and Frameworks	3	-	2	3	-	1	4
25MCAAEC101	AEC	Basic Communication Skills -I	2	1	-	2	1	-	3
25MCACC101	CC	Liberal Learning – Yoga and Meditation	-	-	2	-	-	1	1
		Total	14	2	8	14	2	4	**20**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
25MCABSC101	BSC	Linear Algebra for Computer Applications	20	20	60	25	-	125
25MCAPCC101	PCC	Data Structures and Applications	20	20	60	25	25	150
25MCAPCC102	PCC	Fundamentals of Database Management Systems	20	20	60	25	25	150
25MCAPCC103	PCC	Modern Web Technologies and Frameworks	20	20	60	25	25	150
25MCAAEC101	AEC	Basic Communication Skills -I	20	20	60	25	-	125
25MCACC101	CC	Liberal Learning – Yoga and Meditation	-	-	-	25	-	25
		Total	100	100	300	150	75	**725**

Semester –II
(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs.			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MCABSC201	BSC	Probability and Statistics	3	1	-	3	1	-	4
25MCAPCC201	PCC	Java Programming	2	-	2	2	-	1	3
25MCAPCC202	PCC	Design and Analysis of Algorithms	3	-	2	3	-	1	4
25MCAPCC203	PCC	Process Automation	2	-	2	2	-	1	3
25MCAPEC201X	PEC	Program Elective-I through Industry Certification	-	-	6	-	-	3	3
25MCAAEC201	AEC	Basic Communication Skills -II	-	1	-	-	1	-	1
25MCAIKS201	IKS	Introduction to Indian Knowledge System	2	-	-	2	-	-	2
		Total	12	2	12	12	2	6	**20**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
25MCABSC201	BSC	Probability and Statistics	20	20	60	25	-	125
25MCAPCC201	PCC	Java Programming	20	20	60	25	25	150
25MCAPCC202	PCC	Design and Analysis of Algorithms	20	20	60	25	25	150
25MCAPCC203	PCC	Process Automation	20	20	60	25	-	125
25MCAPEC201X	PEC	Program Elective-I through Industry Certification	-	-	-	25	100	125
25MCAAEC201	AEC	Basic Communication Skills -II	-	-	-	25	-	25
25MCAIKS201	IKS	Introduction to Indian Knowledge System	-	-	-	50	-	50
		Total	80	80	240	200	150	**750**

Semester – III

Course Code	Vertical	`Course Name	Contact Hrs.			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MCAPCC301	PCC	Data Science using Python	3		2	3		1	4
25MCAPCC302	PCC	Software Architecture & Design Patterns	3	-	2	3	-	1	4
25MCAPEC301X	PEC	Program Elective-II	2	1	-	2	1	-	3
25MCAPEC302X	PEC	Program Elective-III	2	1	-	2	1	-	3
25MCAPRJ301	PRJ	Project-I	-	-	6	-	-	3	3
25MCAVEC301	VEC	Universal Human Values	2	1	-	2	1	-	3
		Total	12	3	10	12	3	5	**20**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
25MCAPCC301	PCC	Data Science using Python	20	20	60	25	25	150
25MCAPCC302	PCC	Software Architecture & Design Patterns	20	20	60	25	25	150
25MCAPEC301X	PEC	Program Elective-II	20	20	60	25	-	125
25MCAPEC302X	PEC	Program Elective-III	20	20	60	25	-	125
25MCAPRJ301	PRJ	Project-I	-	-	-	25	100	125
25MCAVEC301	VEC	Universal Human Values	10	10	30	25	-	75
		Total	90	90	270	150	150	**750**

Semester –IV
(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs.			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MCAOE401X	OE	Open Elective-I (MOOC)	3	-	-	3	-	-	3
25MCAPRJ401	PRJ	Research Paper /Case Study	-	-	2	-	-	1	1
25MCAINT401	INT	6-Month Industry Internship/Research Internship (Project Report)	-	-	32	-	-	16	16
		Total	3	0	34	3	0	17	**20**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
25MCAOE401X	OE	Open Elective-I (MOOC)	20	20	60	-	-	100
25MCAPRJ401	PRJ	Research Paper /Case Study	-	-	-	50	50	100
25MCAINT401	INT	6-Month Industry Internship/Research Internship (Project Report)	-	-	-	100	200	300
		Total	20	20	60	150	250	**500**

PROGRAM ELECTIVES

Sr. No.	Program	Program Elective I (SEM II)	Program Elective II (SEM III)	Program Elective III (SEM III)
1	**Data Science**	Machine Learning (25MCAPEC2011)	Deep Learning (25MCAPEC3011)	Data Visualization and Analytics (25MCAPEC3021)
2	**Software Engineering**	Software Testing (25MCAPEC2012)	Quality Assurance (25MCAPEC3012)	Risk Analysis (25MCAPEC3022)
3	**Full Stack Development**	MERN Technology (25MCAPEC2014)	React (25MCAPEC3014)	Springboot and Microservices (25MCAPEC3024)
4	**Design**	Design Thinking (25MCAPEC2013)	Human Machine Interaction (25MCAPEC3013)	User Experience Design (25MCAPEC3023)
5	Any newprogram approved by BoS			

OPEN ELECTIVES /MOOC

Course Code	Course Name
25MCAOE4011	Artificial Intelligence and Soft Computing
25MCAOE4012	Cloud Computing
25MCAOE4013	IoT and I2oT I2oT (Internet of Things and Industrial Internet of Things)
25MCAOE4014	Block Chain Technology
25MCAOE4015	Computer Graphics
25MCAOE4016	Data Warehousing and Mining
25MCAOE4017	Design of Experiments
25MCAOE4018	Reliability Engineering
25MCAOE4019	Development Engineering
25MCAOE40110	Energy Audit and Management
25MCAOE40111	Ethical Hacking
25MCAOE40112	Cyber Security and Laws
25MCAOE40113	IPR and Patents
25MCAOE40114	Law for Engineers
25MCAOE40115	Disaster Management and Mitigation Measures
25MCAOE40116	Management Principles
25MCAOE40117	Organizational Behaviour
25MCAOE40118	Operation Research
25MCAOE40119	Leadership, Innovation and Entrepreneurship
25MCAOE40120	Management Information System
25MCAOE40121	Product Lifecycle Management
25MCAOE40122	Finance for Engineers
25MCAOE40123	Project Management
25MCAOE40124	Any other Course approved by the Dean Academics and Principal

Syllabus For

First Year
Master of Computer Application (MCA)

Semester – I

(With Effect from 2025 – 2026)

Course Title: Linear Algebra for Computer Applications												
Semester: I			**Term:** Odd				**Course Code:** 25MCABSC101					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	1	-	3	1	-	4	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

The objectives of this course are:

1. To build a strong foundation in matrix algebra and its computational techniques for solving linear systems.
2. To develop proficiency in applying numerical methods for the solution of linear equations relevant to computational problems.
3. To understand vector spaces, subspaces, and their properties for theoretical and applied problem-solving in computer science.
4. To explore applications of matrix transformations in coding theory and cryptography.
5. To apply concepts of eigenvalues, eigenvectors, and matrix diagonalization for system modelling and computational algorithms.
6. To illustrate real-world applications of linear algebra in computer graphics, data science, and machine learning.

. **Course Outcomes:**

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

CO1:- Analyse and solve homogeneous and non-homogeneous systems of linear equations using matrix rank.

CO2:- Apply numerical methods to solve systems of linear equations.

CO3:- Identify vector spaces and subspaces, and construct their basis using fundamental linear algebra concepts.

CO4:- Encode and decode information using matrix transformations in coding theory.

CO5:- Compute eigenvalues and eigenvectors, and determine matrix diagonalizability for system modelling.

CO6:- Apply linear algebra in computer graphics, machine learning, and data science problems.

Course Contents:

Module	Contents	Hours	CO
I	**Matrix Fundamentals and Applications** Revision of basic matrices and types of matrices, Row echelon form, Reduced Row Echelon form, Rank of a matrix. **Self-Learning Topics:** Application of inverse of a matrix to coding theory, cryptography.	05	1
II	**Solving Systems of Linear Equations** Consistency and solution of simultaneous linear homogeneous and non- homogeneous equations, Application of solving systems of equations in traffic control. Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Gauss Jordan method (3) Gauss Jacobi Iteration method (4) Gauss Seidel Method. LU Decomposition -Crout's method **Self-Learning Topics:** Total differentials, Euler theorem on Homogeneous functions with three independent variables.	10	2
III	**Vector Spaces and Orthogonal Projections** Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-schmidt process. Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method **Self-Learning Topics:** Successive differentiation, Leibnitz's Theorem.	10	3
IV	**Applications in Cryptography and Coding** Application of matrices to Coding and Decoding **Self-Learning Topics:** Indeterminate forms problems based on $\infty-\infty$, 0^0, 1^∞.	05	4
V	**Eigen Concepts and Matrix Diagonalization** Eigenvalues, Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalisation of matrices Derogatory and Non-derogatory matrices. Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalisation.	07	5
VI	**Real-World Applications in Computing** Computer graphics (transformations) Data science (dimensionality reduction) Machine learning algorithms (linear regression, SVD). **Self-Learning Topics:** Future directions in linear algebra research etc	08	6
	Total Hours	**45**	

Tutorial Component

Sr. No.	Tutorial Title	Target COs	Remarks / Focus
1	Matrix Operations & Vector Calculations	CO1, CO3	Basic operations, vector addition, scalar multiplication, transpose, inverse.
2	Rank of a Matrix: Row Echelon & Reduced Row Echelon Forms	CO1	Solve for rank using Echelon forms, and interpret solution space.
3	Solving Homogeneous and Non-Homogeneous Linear Systems	CO1, CO2	Analytical solutions using matrix rank, consistency check.
4	Solving Linear Equations via Row Echelon & Matrix Inverse	CO1, CO2	Step-by-step manual practice of inverse-based solutions and Echelon forms.
5	Numerical Solution using Gauss Elimination & Gauss-Jordan Method	CO2	Algorithmic approach, hands-on calculations, numerical stability.
6	Iterative Methods: Gauss-Jacobi & Gauss-Seidel Solvers	CO2	Practice convergence testing, iterative approximations.
7	LU Decomposition: Crout's Method	CO2	Decompose matrices and solve linear systems efficiently.
8	Vector Spaces, Basis, and Gram-Schmidt Orthogonalization	CO3	Manual construction of basis and orthogonal basis using Gram-Schmidt.
9	Eigenvalues, Eigenvectors & Matrix Diagonalization	CO5	Calculation and interpretation, applications to system modeling.
10	Applications of Linear Algebra in Coding, Cryptography & Graphics	CO4, CO6	Encode-decode examples, graphics transformations, dimensionality reduction.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment

2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

A. **Oral & Practical Exam**

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text books:

[1] Gilbert Strang ," *Linear Algebra and its applications*", Cengage publications, 4th Edition, 2014

[2] Dr. B. S. Grewal," *Higher Engineering Mathematics*", Khanna Publications, 44th Edition, 2020

Reference Books:

[1] David C. Lay," *Linear Algebra and its applications*", Pearson Education , 3rd Edition, 2006
[2] H Anton and Crorres," *Elementary Linear Algebra Application Version*", John and Wiley Sons, 6th Edition,2010
[3] H. K Das ," *Advanced Engineering Mathematics*", S.Chand,28th Edition, 2014
[4] Erwin Kreysizg," *Advanced Engineering Mathematics*", 10th Edition, 2011

Useful Links:

NPTEL playlist of video Lectures (e-Resources):		Module Covered
Matrices	https://www.youtube.com/watch?v=KaLA1cWhQlA&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2B_T	I
Multivariate Calculus	https://www.youtube.com/watch?v=XzaeYnZdK5o&list=PLtKWB-wrvn4nA2h8TFxzWL2zy8O9th_fy	II, III, IV, V
Numerical Methods	https://www.youtube.com/watch?v=TWAN_T66Cps&list=PLq-Gm0yRYwTguDcfylj1ZicXxzdZCAr5S	VI
Geogebra, Academo website links (e-Resources):		Module Covered
3D surface plotter	https://www.geogebra.org/3d?lang=en https://academo.org/demos/3d-surface-plotter/?expression=&xRange=&yRange=&resolution=25	III
Linear Algebra	NPTEL :: Mathematics - Linear Algebra	I,II,III,IV,V,VI

Course Content:

Course Title: Data Structures and Applications												
Semester: I			**Term:** Odd				**Course Code:** 25MCAPCC101					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

The objective of this course is to

1. To introduce fundamental concepts of data structures and algorithms essential for computational problem-solving.
2. To enable students to design and implement linear data structures such as arrays, stacks, queues, and linked lists.
3. To develop the ability to apply non-linear data structures like trees and graphs for real-world applications.
4. To explore efficient data searching, sorting, and hashing techniques for optimized data organization and retrieval.
5. To analyse and evaluate the time and space complexities of various algorithms.
6. To demonstrate the application of data structures for solving computational problems in diverse application domains.

Course Outcomes:
By the end of the course, students will be able to:

CO1: Understand and apply the fundamentals of data structures and algorithm analysis, including the use of abstract data types and asymptotic notations for time and space complexity.

CO2: Implement and manipulate linear data structures like linked lists, stacks, and queues to solve real-world problems and perform domain-specific operations.

CO3: Apply non-linear data structures such as trees and graphs to develop efficient solutions for hierarchical and network-based problems.

CO4: Utilize searching techniques and hashing mechanisms for fast and reliable data retrieval, while applying suitable collision resolution strategies.

CO5: Analyse and implement internal and external sorting algorithms to organize data efficiently and evaluate their performance using complexity analysis.

CO6: Demonstrate the practical application of data structures in solving computational problems, including algorithmic challenges, competitive coding, and real-world software systems.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Data Structure and Algorithms** Types of Data Structure, Characteristics of an Algorithm, Abstract Data type (ADT) , Introduction to Time and Space Complexity, Asymptotic Notations (Big O, Omega, Theta) **Self-Learning Topics:** ADT Types	05	1
II	**Linked List, Stack and Queue** **Linked List** (Linked List as an ADT, Linked List Vs. Arrays, Types of Linked List: Singly, Doubly, Circular , Operations of Linked List (Insert, delete, traverse, count, search), Application of Linked List: Polynomial addition and Subtraction) **Stack** (The Stack as an ADT, Stack operations, Array and Linked list Representation of Stack, Application of stack – Evaluation of Postfix expression, Infix to Postfix expression conversion) **Queue** (The Queue as an ADT, Queue operations, Array and Linked Representation of Queue, Circular Queue, Priority Queue. Doubly Ended Queue, Application of Queues – Round Robin CPU Scheduling Algorithm) **Self-Learning Topics:** Stack and Queue Operations.	10	2
III	**Tree and Graph** **Tree** (Tree Definition and Terminologies, Binary Tree, Binary Search Tree, Expression tree, Huffman tree, AVL tree, B Tree, Heap tree) **Graph** (Graph Definition and Terminologies, Graph Representation, Graph Traversal Techniques, Single Source Shortest Path Algorithms , All Pair Shortest Path Algorithms) **Self-Learning Topics:** Shortest path Algorithm	10	3
IV	**Searching and Hashing Techniques** **Searching:** Sequential search, Binary search, Interpolation Search **Hashing Techniques** (Direct, Subtraction, Modulo Division, Mid square, Digit Extraction, Folding, Double hashing), Collision resolution techniques (Linear probe, Quadratic probe, Key offset, Chaining) **Self-Learning Topics:** Searching Algorithm, Collision Resolution Techniques.	06	4
V	**Sorting Techniques** Internal Sorting Techniques (Bubble sort, Insertion sort, Selection Sort, Radix Sort, Quick sort, Heap Sort), External Sorting Techniques (Merge Sort), Complexity Calculation **Self-Learning Topics:** Sorting Algorithm	08	5
VI	**Application of Data Structures** Applications of Linked list: Sparse Matrix and other real life applications, Applications of Stack : Recursion and other real life applications, Applications of Queue : Johnson's Algorithm and other real life applications, Applications of Tree, Applications of Graph, Competitive coding	06	6
	Total Hours	45	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	List of Practical's	CO
1.	Implement Linked List (Singly, Doubly, Circular) with Insert, Delete, Search, Traverse, and Count operations.	1
2.	Implement Stack using both Arrays and Linked Lists. Apply it to convert an infix expression to postfix and evaluate the postfix expression.	1
3.	Implement Queue using Arrays and Linked Lists. Extend it to Circular Queue, Priority Queue, and Double-Ended Queue. Demonstrate Round Robin CPU Scheduling simulation.	2
4.	Construct and perform operations (Insert, Delete, Traverse) on a Binary Search Tree.	2
5.	Implement Graph using Adjacency List and Adjacency Matrix. Perform Depth-First Search (DFS) and Breadth-First Search (BFS)	2
6.	Implement Dijkstra's Algorithm and Floyd-Warshall Algorithm for Shortest Path problems on a Graph.	2
7.	Implement Sequential Search, Binary Search, and Interpolation Search on an array. Compare their performance.	3
8.	Implement Hash Table using different Hashing Techniques (Modulo Division, Mid Square, Folding). Implement Linear Probing and Chaining for collision resolution.	3
9.	Implement and compare Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Heap Sort, Merge Sort, Radix Sort (using datasets). Record Time Complexity and compare.	4
10.	Implement real-world applications:	5,6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C Stein, "*Introduction to Algorithms*", MIT Press/McGraw Hill, Third Edition, 2009.
2. Richard F Gilberg, Behrouz A Forouzan, "*Data Structure A Pseudocode Approach with C*", Brooks/Cole Publishing Company, Second Edition, 2004.

Reference Books:

1. Moshe, Tenenbaum, "*Data Structures Using C and C++*", Pearson Education Asia Pvt. Ltd., Second Edition, 2006.
2. Tremblay, Jean-Paul & Sorenson, "*An Introduction to Data Structures with Applications*",Tata McGraw-Hills, Second Edition, 2017.

Useful Links:

- https://www.coursera.org/courses?query=data%20structures%20and%20algorithms

Course Title: Fundamentals of Database Management Systems												
Semester: I			**Term:** Odd				**Course Code:** 25MCAPCC102					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:
The objectives of this course are:

1. To introduce the fundamental concepts and architecture of database systems, including data models and relational database design.
2. To develop the ability to design entity-relationship (ER) and enhanced ER (EER) models for real-world applications.
3. To apply normalization techniques and functional dependency theory for designing optimal relational database schemas.
4. To understand transaction management, concurrency control, and recovery mechanisms to ensure data consistency and integrity.
5. To explore distributed, parallel, object-oriented, and emerging database technologies.
6. To develop proficiency in SQL and PL/SQL for database manipulation, business logic implementation, and advanced query handling.

Course Outcomes:
At the end of the course students will be able to:

CO 1-Design conceptual models using ER/EER diagrams and convert them to relational models.
CO 2-Normalize relational schemas using functional dependencies and various normal forms.
CO 3-Analyze transaction management and concurrency control mechanisms for consistency and reliability.
CO 4-Explain distributed, parallel, and emerging database technologies.
CO 5-Write complex SQL queries for data retrieval and manipulation.
CO 6-Develop PL/SQL blocks including procedures, functions, triggers, and packages for business logic implementation

Course Contents:

Module	Contents	Hours	CO
I	**Introduction to DBMS and Relational Modeling** File system organization, Purpose of Database system, Data models, Codd rules, DBMS architecture, Entity set & Relationship set, Mapping cardinalities, Designing of ER diagram, EER features, ER to Relational Model Designing	**6**	1
II	**Normalization and Query Optimization** - Query processing steps, Evaluation of Query, Relational Optimization. Functional dependency and its types, Normal forms : 1NF, 2NF, 3NF, BCNF, 4NF, 5NF **Self – Learning Topic:** Normalization	**8**	2
III	**Transaction and Concurrency Control** ACID properties, Transaction states, Serializability and its types, Recoverability, Concurrency control mechanism, Lock based protocol, Timestamp based protocol, Recovery Techniques based on Deferred and Immediate Update, Shadow paging and ARIES recovery algorithm. **Self–Learning Topic:** Concurrency Control Mechanism.	**10**	3
IV	**Distributed and Parallel Databases: -** Distributed Databases (Overview, Types of Distributed databases, Data fragmentation, replication and allocation techniques, Query processing and Concurrency control) Parallel Databases (Architecture, Types of parallelism, Types of Partitioning) **Self–Learning Topic:** Parallel Database	**8**	4
V	**XML and Object-Based Databases** XML (XML documents, Approaches to store XML documents, Extracting XML documents from Relational Database) Object Based Databases (Overview, Complex data types, Inheritance in SQL, Object identity and Reference types in SQL, Object View) **Self – Learning Topic:** XML Commands	**10**	5
VI	**Applications and Advanced Topics** EER diagram designing, Tuple Relational Calculus and Domain Relational Calculus, Advanced Transaction Processing, LDAP model of Distributed Database, Database Security, Mobile Database, Multimedia Database, Data Storage Structures and Indexing **Self – Learning Topic:** Multimedia Database and properties	**3**	6
	Total Hours	**45**	

Minimum 10 Experiment based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Design ER Diagram for a real-world scenario and map it to relational schema.	CO1
2	Implement SQL queries using **DDL, DML, DCL, TCL** commands for database creation and manipulation.	CO1
3	Write SQL queries to perform **Inner Join, Left Join, Right Join, Full Join** operations.	CO1
4	Write and test **SQL Subqueries** (Single-row, Multi-row, Correlated subqueries).	CO2
5	Implement **Normalization**: Convert an unnormalized table into 1NF, 2NF, 3NF, and BCNF.	CO2
6	Create **PL/SQL Programs** using **Cursors, Triggers, and Exception Handling**.	CO3
7	Develop PL/SQL **Procedures, Functions, Packages** for business logic encapsulation.	CO4
8	Simulate **Data Fragmentation and Replication** using SQL scripts or distributed DB tools.	CO4
9	Implement **Object-Oriented Features**: Abstract Data Types, VARRAY, Nested Tables, Inheritance in SQL.	CO5
10	Extract **XML Documents** from a relational database and perform basic manipulation on the result.	CO5

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit

6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Henry F. Korth and S. Sudarshan, "*Database System Concepts*", McGraw Hill Education, Seventh Edition, 2019.
2. Elmasri and Navathe, "*Fundamentals of Database Systems*", Pearson Education, Seventh Edition, 2015.

Reference Books:

1. J. Date, A. Kannan and S. Swamynathan, "*An Introduction to Database Systems*", Pearson Education, Eighth Edition, 2003.
2. Dr. P.S. Deshpande, "*SQL & PL/SQL for Oracle 11g*", Dreamtech Press, First Edition, 2011.
3. Kevin Loney, "*Oracle Database 11g the complete Reference*", McGraw Hill Education, First Edition, 2009.

Useful Links:

https://www.coursera.org/learn/database-structures-and-management-with-mysql

Course Title: Modern Web Technologies and Frameworks												
Semester: I			**Term:** Odd				**Course Code:** 25MCAPCC103					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

The objectives of this course are:

1. To introduce students to the architecture and core features of server-side development using Node.js.
2. To enable students to integrate and manage databases within web applications for dynamic content handling.
3. To familiarize learners with client-side scripting using AngularJS for building modular web applications.
4. To develop skills for designing and implementing Single Page Applications (SPA) using AngularJS forms and routes.
5. To apply JavaScript frameworks and their ecosystem to develop scalable, real-time web applications.
6. To encourage self-learning of modern tools and trends in web development for lifelong technical adaptability.

Course Outcomes:

CO 1-Build basic websites using **Node.js** core modules and functionalities.
CO 2-Design dynamic applications with **database connectivity** (MySQL).
CO 3-Implement **AngularJS directives, controllers, and filters**.
CO 4-Construct **forms and single page applications** using AngularJS.
CO 5-Apply AngularJS concepts to build **modular and maintainable applications**.
CO 6-Demonstrate understanding of **built-in filters** and **custom directives**.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Node.js :** What is Node.js, Advantages of Node.js, Node.js Process Model, Traditional Web Server Model, Setup Development Environment: Installation of Node.js on Windows, Working in REPL, Node JS Console **Self-Learning Topic:** Node.js Examples,W3C Architecture	05	1
II	**Node.js Modules, Events & Functions**: Standard Call-back Pattern, Event Emitter Pattern, Event Types, Event Emitter API, Creating an Event Emitter, Defer Execution of a Function, Cancel Execution of a Function, Schedule/Cancel repetitive execution of a Function, Block/Escape Event Loop Self-Learning Topics: Additional Events. **Self-Learning Topic:** Additional Events	08	2
III	**File Handling& HTTP Web Server:** File Paths, fs Module, Opening a file, Reading from a file, Writing to a file, Closing a file. HTTP request/response object, Headers, Piping, Shutting down the server **Self-Learning Topic:** TCP server	12	3
IV	**Databases:** Connect and Communicate with a MySQL Database, Adding data to the database, Reading data **Self-Learning Topic:** Working with any other database	06	4
V	**Angular JS Basics :** Introduction to AngularJS, MVC Architecture, Conceptual Overview:Setting up the Environment, First Application, Understanding ng attributes, Expressions: Number and String Expressions, Object Binding and Expressions, Working with Arrays. Self-Learning Topics: Comparison of Angular and React js	6	5
VI	**Filters, Directives:** Built-In Filters, Uppercase and Lowercase Filters, Currency and Number Formatting Filters,OrderBy Filter, Introduction to Directives, Directive Lifecycle, Conditional Directives,Styles Directives, Mouse and Keyboard Events Directives, Using Angular JS built in directives: app, init, model **Self-Learning Topic:** Creating a custom filter and a custom directive	8	6
	Total Hours	45	

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Develop a basic Node.js application to demonstrate the use of **Core Modules** (HTTP, URL, FS and Path).	CO1
2	Create a Node.js application that handles **Events** using Event Emitter — emit and handle custom events.	CO2
3	Implement **File Handling in Node.js**: Create, Read, Update, and Delete files using the fs module.	CO2
4	Build a basic **HTTP Server** in Node.js that serves dynamic HTML content and Handles routing.	CO3
5	Design a Node.js application that connects to a **MySQL Database**, performs INSERT, UPDATE, and SELECT operations.	CO4
6	Build a simple **AngularJS application** to use expressions, data binding, and ng-model.	CO5
7	Implement **AngularJS Filters** (uppercase, lowercase, order By, currency) in a web application.	CO6
8	Create and demonstrate **AngularJS Directives** (ng-app, ng-in it, ng-model, and a custom directive).	CO6
9	Create an AngularJS-based **Form Application** using validation, two-way binding, and error handling.	CO4
10	Develop a full **Single Page Application (SPA)** using AngularJS modules, routes, controllers, and services.	CO6

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems

5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Powell TA, Powell TA. HTML & CSS: the complete reference. New York: McGraw-Hill; 2010. ISBN No. 9780071496292
2. Haverbeke M. Eloquent JavaScript: A modern introduction to programming. No Starch Press; 2018. ISBN No. 9781593279509

Reference Book:

1. Teixeira P. Professional Node.js: Building JavaScript based scalable software. John Wiley & Sons; 2012. ISBN No. 9781118185469
2. Brown E. Web development with node and express: leveraging the JavaScript stack. O'Reilly Media; 2014. ISBN No. 9781491949306
3. Karpov V, Netto D. Professional AngularJS. John Wiley & Sons; 2015. ISBN No. 9781118832073
4. Dayley B. Learning AngularJS. Pearson Education; 2014. ISBN No. 9780134034546
5. Seshadri S, Green B. AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps. O'Reilly Media; 2014. ISBN No. 9781548785710

Useful links:

1. https://nptel.ac.in/courses/106106222/
2. https://learn.shayhowe.com/html-css/
3. https://www.w3schools.com/nodejs/
4. https://www.coursera.org/learn/server-side-nodejs
5. https://www.coursera.org/learn/single-page-web-apps-with-angularjs
6. https://docs.angularjs.org/tutorial
7. https://www.freecodecamp.org/news/want-to-learn-angular-heres-our-free-33part-course-by-dan-wahlin-fc2ff27ab451/

Course Title: Basic Communication Skills -I												
Semester: I			**Term:** Odd				**Course Code:** 25MCAAEC101					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	3	20	20	60	25	--	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

The objectives of this course are:

1. To strengthen the foundation of English vocabulary for professional and academic contexts.
2. To develop the ability to write clear, coherent, and structured business documents.
3. To train students in summarization techniques for articles, research papers, and reports.
4. To enhance practical writing skills including emails, letters, resumes, and job applications.
5. To familiarize students with basic grammar rules essential for error-free written communication.
6. To encourage independent reading, comprehension, and critical analysis through review writing

Course Outcomes:

At the end of the course students will be able to:

CO 1-Apply correct vocabulary and grammar for clear and precise communication in both written and verbal forms.
CO 2-Demonstrate an understanding of business writing principles and apply them in preparing professional documents.
CO 3-Summarize books, articles, and research papers with coherence and accuracy.
CO 4-Compose formal business communications, including emails, letters, job applications, and resumes.
CO 5-Draft informative and analytical reports, notices, agendas, and meeting minutes using proper formats.
CO 6-Review and critically evaluate written material, enhancing reading comprehension and writing proficiency.

Course Contents:

Module	Contents	Hours	COs
I	**Vocabulary Building & Grammar** Concept of word formation, the root words from foreign languages and their use in English, Common errors in writing, confused pair of words, redundancies, clichés	04	1
II	**Writing Skills** Principles of Business Writing: 7Cs of communication, sentence structure, organizing paragraph in direct and indirect style, Summarization **Self-Learning Topic:** 7Cs of Communication	04	2
III	**Summary Writing Skill** Book , Article, Research Paper Summarization **Self-Learning Topic:** Article Summary Writing	03	3
IV	**Practices in Writing** Business E-mail: e-mail etiquettes, Business letter: full block format, modified block format, enquiry, complaints and redressal, Job Application Letter: Cover letter. **Self-Learning Topic:** E-Mail writing formal and unformal	09	4
V	**Resume & report Building** Resume Writing, Meeting: Notice, Agenda, Minutes, Report Writing: Informative, Analytical report **Self-Learning Topic:** Proposal Writing	04	5
VI	**Introduction to Grammar** Basic Rules of Grammar, GRE Vocabulary, Reading a book (fiction/non-fiction) and writing a review of it. **Self-Learning Topic:** Writing a review techniques.	06	6
	Total Hours	**30**	

Tutorial Contents:

Sr. No.	Tutorial Topic	CO Mapped
1	Vocabulary Building: Root words, Synonyms, Antonyms, Homonyms, Word Formation Exercises.	CO2
2	Identification and Correction of Common Errors in English Writing (e.g., redundancies, clichés).	CO2
3	Drafting Business Emails: Formal & Informal — structure, tone, and etiquette practice.	CO4
4	Practicing the 7Cs of Business Communication (Clarity, Conciseness, etc.) through examples.	CO1
5	Summary Writing Exercise: Summarizing an article, story, or academic paper.	CO3
6	Resume Drafting and Review Workshop (reverse chronological and skills-based formats).	CO5
7	Cover Letter Writing Practice for job applications.	CO5
8	Drafting Official Letters: Inquiry, Complaint, and Application formats.	CO4
9	Writing Notice, Agenda, and Minutes of Meeting for a simulated professional situation.	CO5
10	Grammar and Vocabulary Test: Applying basic rules through sentence construction exercises.	CO2

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems

5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Shirley Mathews, "Communication Skills", Technical Publication, Pune, 2013.
2. Michael McCarthy, Felicity O'Dell," English Vocabulary in Use", Cambridge University Press, India, 1999.

Reference Books:

[1] John Eastwood, "Oxford Practice Grammar", Oxford, India, 1999.
[2] Meenakshi Raman, Sangeeta Sharma," Communication Skills", Oxford, India, 2011.
[3] Dr. Meera Bharwani," Communication Skills", Synergy Knowledge ware, India, 2010.
[4] Geoffrey Leech, "English Grammar for Today", Palgrave, UK, 2005.
[5] Norman Lewis," Word Power Made Easy", Anchor Books, New York, 1978.

Useful Links:

- https://www.udemy.com/course/communication-skills-simplified/

Course Title: Liberal Learning – Yoga and Meditation												
Semester: I			**Term:** Odd				**Course Code:** 24MCAECC101					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	2	-	-	1	1	-	-	-	25	-	25

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:
The objectives of this course are:

1. To enable students to explore yoga as a scientific system for enhancing physical, mental, and emotional well-being.
2. To introduce structured practices in yoga postures, breathing techniques, and meditation for stress reduction and self-discipline.
3. To encourage mindful living and holistic health awareness by integrating the ethical and philosophical foundation of yoga.
4. To foster the ability to develop personal health regimes through yoga and meditation for lifelong wellness.
5. To cultivate emotional stability, mental clarity, and resilience through consistent mindfulness practices.
6. To instil the values of self-awareness, ethical conduct, and conscious living through the study and application of yogic principles.

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

CO 1-Demonstrate proficiency in foundational yoga asanas to improve strength, flexibility, and posture.
CO 2-Apply pranayama techniques to enhance respiratory health, emotional stability, and focus.
CO 3-Practice meditation to promote self-awareness, stress management, and emotional regulation.
CO 4-Illustrate the core principles of yoga philosophy and its relevance to balanced living.
CO 5-Develop an individualized yoga and meditation practice aligned with personal well-being goals.
CO 6-Integrate ethical and philosophical concepts of yoga into daily life for personal and professional growth.

Course Contents:

Module	Contents	Hours	COs Mapped
I	Introduction to Yoga & Historical Perspective	3	CO1
	- Meaning, origins, and evolution of Yoga. Eight Limbs of Patanjali Yoga Sutras.		
II	Asana: Alignment, Practice, and Application	7	CO1, CO5
	- Posture groups: standing, sitting, forward bend, backward bend, twist, and inversion. - Sequence design, safety, and contraindications.		
III	Pranayama: Breath Awareness and Control	8	CO2, CO5
	- Techniques: Ujjayi, Nadi Shodhana, Kapalabhati, Bhastrika, Bhramari.		
IV	Meditation: Techniques and Practice	8	CO3, CO5
	- Techniques: Mindfulness, Loving-kindness, Body Scan, Mantra Meditation.		
V	Philosophy of Yoga and Mindfulness-Based Ethical Living	4	CO4, CO5
	- Yamas, Niyamas, Dhyana & Samadhi, Yoga in daily life (modern applications).		
	Total Hours	**30**	

Practical session

Sr. No.	Activity Description	CO Mapped
1	Demonstration of daily yoga warm-up and cool-down sequence	CO1
2	Practice: Forward bend, Twist & Balance postures	CO1
3	Perform Ujjayi and Nadi Shodhana pranayama	CO2
4	Practice Kapalabhati for active breath control	CO2
5	Practice: Guided Mindfulness Meditation	CO3
6	Practice: Loving-kindness Meditation	CO3
7	Assignment: Write personal reflections on a week's yoga practice	CO5
8	Quiz / Group Discussion: Yamas, Niyamas, Dhyana, Samadhi	CO4

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference and Text Books:

YOGA:

1. "Light on Yoga" by B.K.S. Iyengar: A classic guide that covers yoga philosophy, asanas (postures), pranayama (breathcontrol), and meditation. It includes detailed instructions and photographs.

2. "The Key Muscles of Yoga" by Ray Long: This book delves into the anatomy of yoga postures, explaining how differentmuscles are engaged in each pose. It provides a deeper understanding of alignment and movement.

3. "The Heart of Yoga: Developing a Personal Practice" by T.K.V. Desikachar: T.K.V. Desikachar, son of the renowned yogateacher Krishnamacharya, offers insights into the philosophy and practical aspects of yoga, emphasizing individualized practices.

4. "The Yoga Bible" by Christina Brown: As mentioned earlier, this comprehensive guide covers a wide range of yoga postures, making it a great resource for both beginners and experienced practitioners.

Meditation

1. "The Miracle of Mindfulness: An Introduction to the Practice of Meditation" by Thich Nhat Hanh: Thich Nhat Hanh introduces mindfulness meditation, emphasizing its simplicity and applicability to daily life.

2. "The Power of Now: A Guide to Spiritual Enlightenment" by Eckhart Tolle: While not focused solely on meditation, this book explores the concept of being present and offers insights that align with meditation practices.

3. "Mindfulness in Plain English" by Bhante Henepola Gunaratana: A practical guide to mindfulness meditation, providing clear instructions on techniques and addressing common challenges.

4. "Lovingkindness: The Revolutionary Art of Happiness" by Sharon Salzberg: This book introduces lovingkindness meditation, which cultivates compassion and goodwill. It's a valuable addition to meditation practices.

5. "The Tibetan Book of Living and Dying" by Sogyal Rinpoche: This book draws from Tibetan Buddhist teachings and discusses meditation, the nature of life and death, and the importance of cultivating compassion and wisdom.

6. "Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life" by Jon Kabat-Zinn: Jon Kabat-Zinn, known for bringing mindfulness into mainstream psychology, explores how mindfulness can be integrated into daily life.

Note: Number of activities to be conducted under TAE would be as per the subject need

Syllabus For

First Year
Master of Computer Application
(MCA)

Semester – II

(With Effect from 2025 – 2026)

Course Title: Probability and Statistics												
Semester: II			**Term:** Even				**Course Code:** 25MCABSC201					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	1	--	3	1	--	4	20	20	60	25	--	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1: Understand measures of central tendency, dispersion, and graphical data representation tools.
2: Master skewness, correlation, and regression techniques for data relationships.
3: Learn hypothesis testing using t-tests, ANOVA, and Chi-Square methods.
4: Grasp probability concepts, distributions, and functions (PMF, PDF, CDF).
5: Apply conditional probability, Bayes' theorem, and standard theoretical distributions.
6: Analyze joint distributions, covariance, and properties of random variables.

Course Outcomes:

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

CO 1 - Compute and interpret central tendency, dispersion, and construct data visualization plots.
CO 2 - Calculate skewness, correlation, and perform regression analysis on datasets.
CO 3 - Conduct and interpret hypothesis tests using appropriate statistical procedures.
CO 4 - Define events and derive PMF, PDF and CDF for various random variables.
CO 5 - Solve problems using Bayes' theorem and standard probability distributions.
CO 6 - Evaluate joint probability, covariance, and expectation in multivariate systems.

Course Contents:

Module	Contents	Hours	CO
I	**Measures of Central Tendency & Measures of Dispersion** Continuous Frequency Distribution, Histogram, Frequency Polygon, Stem and leaf diagram, ogives, Arithmetic Mean, Geometric mean, Harmonic mean, Median, Range, Quartile Deviation, Mean Deviation, Box whisker plot, Standard Deviation, Coefficient of Variation **Self-Learning Topics:** Types of Histogram etc.	05	1
II	**Skewness, Correlation & Regression** Karl Pearson's coefficient of Skewness, Bowley's coefficient of Skewness, Scatter Diagram, Correlation, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, Linear Regression and Estimation, Coefficients of regression **Self-Learning Topics:** Linear Regression, Logistic Regression etc.	08	2
III	**Testing of Hypothesis** Hypothesis, Type I and Type II errors, Tests of significance – Student's t-test: Single Mean, Difference of means, F, Z, Paired t-test, ANOVA, Chi-Square test: Test of Goodness of Fit, Independence Test **Self-Learning Topics:** Types of Hypothesis etc	07	3
IV	**Introduction to Probability** Random experiment, Sample space, Events, Axiomatic Probability, Algebra of events, Discrete, continuous and mixed random variables, probability mass function(PMF), Probability Density Function(PDF) and cumulative distribution function(CDF). **Self-Learning Topics:** study of Applied Probability etc.	05	4
V	**Conditional Probability** Conditional Probability, Multiplication theorem of Probability, Independent events, Baye's Theorem, Special Theoretical Probability Distributions- Bernoulli, Binomial, Uniform, Normal, Exponential Cumulative distribution function, Expectation and Variance. **Self-Learning Topics:** study of Stochastic Processes etc.	10	5
VI	**Random variables and Mathematical Expectation** Discrete random variable, Continuous random variable, Two- dimensional random variable, Joint probability distribution, Stochastic independence, Properties of expectation, Properties of variance, Covariance. Self-Learning Topics:, Geometric etc.	10	6
	Total Hours	45	

Tutorial Component

Sr. No	Title of the Tutorial
1	Problems on Mean Deviation
2	Problems on Coefficient of Variation
3	Solution to Karl Pearson's coefficient of correlation
4	Solution of Linear Regression and Estimation.
5	Solutions of Test of Goodness of Fit.
6	Solutions of continuous and mixed random variables.
7	Solutions of Multiplication theorem of Probability.
8	Solutions of Exponential Cumulative distribution function.
9	Solutions of Joint probability distribution
10	To find Stochastic independence

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems

5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text books:

1. J. Susan Milton, Jesse C. Arnold," Introduction to Probability & Statistics", Tata McGraw Hill, 4th Edition, 2014
2. Kishore Trivedi, "Probability and Statistics with Reliability, Queuing, And Computer Science Applications", Wiley publication, 2nd Edition,2018

Reference Books:

1. Dr J Ravichandran ," Probability & Statistics for Engineers", Wiley,1st Edition,2010
2. Schaum's ,"Outlines Probability, Random Variables & Random Process", Tata McGraw Hill , 3rd Edition, 2017

Useful Links:

Coursera Lectures (e-Resources):		Module Covered
Matrices	coursera.org/specializations/probability-statistics	I ,II, III, IV, V,VI
Multivariate Calculus	Statistics and Probability | Khan Academy	I,II, III, IV, V,VI

Course Title: JAVA Programming												
Semester: II			**Term:** Even				**Course Code:** 25MCAPCC201					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
02	--	02	02	--	01	3	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Master Java fundamentals including OOP concepts, inheritance, polymorphism, and interfaces.
2. Understand concurrency, exception handling, threads, and JDBC database connectivity.
3. Develop server-side applications using Servlets, HTTP, and session management.
4. Build dynamic web pages with JSP, directives, scripting, and error handling.
5. Explore Spring Framework architecture, MVC, and aspect-oriented programming.
6. Create GUI applications using Swing components and event-driven programming.

Course Outcomes:

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

CO 1 - Implement classes, inheritance, polymorphism, and interfaces using Java packages.
CO 2 - Handle exceptions, manage threads, and connect databases via JDBC.
CO 3 - Build and deploy Servlets with request/response handling and session tracking.
CO 4 - Develop JSP pages with directives, actions, and session management.
CO 5 - Design applications using Spring MVC and dependency injection.
CO 6 - Develop interactive GUIs using Swing components and event listeners.

Course Contents:

Module	Contents	Hours	CO
I	**Introduction to JAVA** Classes, Instance variables, Methods, Constructors, Access Specifiers, Abstract Classes and Wrapper Classes, Inheritance, Polymorphism, Method Overriding, final, super and thiskeyword Creating user defined package, Access control protection, Defining interface, Implementing interface **Self-Learning Topics:** Generic Class, Generic Methods etc.	04	1
II	**Concurrent Programming** Exception Keywords - Try, catch, finally, throw, throws, Creating User defined Exceptions, Working with Thread class and the Runnable interface, Thread priorities, File handlingwith java, File stream, File connection methods, JDBC architecture, Types of drivers, Java.sql package, Establishing connectivity and working with connection interface **Self-Learning Topics:** Bounded Type, Java thread model, Life Cycle of Thread etc.	05	2
III	**Web development using Servlets** Server side programming with Java Servlet, HTTP and Servlet, Servlet API, life cycle, configuration and context, Request and Response objects. **Self-Learning Topics:** Session handling and event handling in servlet, The JSP Expression Language EL etc	06	3
IV	**JAVA server Pages** JSP architecture, JSP page life cycle, JSP Directives, JSPscripting elements, JSP Actions, Error handling in JSP, Session tracking techniques in JSP **Self-Learning Topics:** Spring with JPA, Exploring Architecture of Hibernate etc.	05	4
V	**Java Web Frameworks** Spring Architecture, Spring MVC Module, Life Cycle of Bean Factory, Spring Aspect of Object Oriented Concepts – JoinPoint and Point Cuts **Self-Learning Topics:** Hibernate Annotation etc.	04	5
VI	**Java GUI Programming** **Introduction to Swing** Creating graphical user interfaces Components (JFrame, JButton, JTextField, etc.) **Event Handling** Handling user interactions **Self-Learning Topics:** Hibernate Query Language CRUD Operation using Hibernate API etc.	06	6
	Total Hours	30	

Laboratory Component

Sr. No	Title of the Practical
1	Fundamentals of Java Programming
2	Designing a real world problem based on Packages and Interfaces Lambda Expression
3	Implementation of Generics and Collections
4	Apply file handling methods for JAVA
5	Design and implementation of Exception handling Multi-threading and File Handling
6	Event handling and GUI programming Database Programming
7	Implementation of real world problem based on servlet concept
8	Implementation of real world problem based on JSP designing concept
9	Demonstrate implementation of real world problem based on Spring Frameworks
10	Demonstrate Working model based on real time problem using Hibernate

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate

4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books

[1] Herbert schildt, "The complete reference JAVA" Tata McGraw Hill, Seventh 2007
[2]Sharanam Shah and Vaishali Shah "Core Java for beginner" SPD 2010

Reference Books

[1]K. Arnold and J. Gosling "The JAVA programming language" Pearson Education third edition 2008
[2] Black Book "Java server programming J2EE" Dream Tech Publishers first edition 2008
[3] James Keogh "Complete Reference J2EE" McGraw Hill Education Indian Edition 2001
[4] Claudio Eduardo de Oliveira, Dinesh Rajput, Rajesh R V "Spring MVC: Beginner's Guide" Packt Second edition 2016
[5] Paul Tepper, Fisher, Brian Murphy "Spring Persistence with Hibernate" Springer-Verlag Berlin and Heidelberg GmbH & Co. KG First edition 201

Useful Links:

Coursera Lectures (e-Resources):		Module Covered
Java Programming	https://www.coursera.org/specializations/java-programming	I ,II, III, IV, V,VI
	https://www.khanacademy.org/computing/computer-programming/programming	I,II, III, IV, V,VI

Course Title: Design and Analysis of Algorithms												
Semester: II			**Term:** Even				**Course Code:** 25MCAPCC202					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	--	02	03	--	01	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To introduce the fundamentals of algorithm analysis, asymptotic notation, and problem-solving methodologies.
2. To analyse and evaluate the efficiency of various sorting and searching algorithms using divide and conquer strategies.
3. To understand and apply greedy and dynamic programming techniques for solving optimi-zation problems.
4. To explore backtracking and branch-and-bound approaches for complex problem solving.
5. To study and implement advanced graph algorithms and their applications in real-world scenarios.
6. To develop an understanding of complexity classes like P, NP, NP-Complete, and NP-Hard, and explore the basics of complexity theory and randomized algorithms.

Course Outcomes:

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

1 **CO1**: Explain the role of algorithms in computing and evaluate algorithm performance using asymptotic analysis.

2 **CO2**: Analyse and compare divide and conquer strategies like merge sort, quick sort, and matrix multiplication.

3 **CO3**: Apply greedy and dynamic programming methods to solve real-world optimization problems.

4 **CO4**: Implement backtracking and branch-and-bound algorithms for solving combinato-rial and decision problems.

5 **CO5**: Demonstrate the use of graph algorithms in solving shortest path and maximum flow problems efficiently.

6 **CO6**: Understand the theoretical foundations of computational complexity and distinguish between tractable and intractable problems.

Course Contents:

Module	Contents	Hours	CO
I	**Fundamentals of Algorithmic problem solving and efficiency** The Role of Algorithms in Computing, Growth of Functions, The substitution method, master method, Recursion tree method. Time complexity: worst case, best case, average case analysis, space complexity. Asymptotic notations (Big O, Omega, Theta) **Self-Learning Topics:** String Matching Algorithm : Brute Force String matching etc.	06	1
II	**Analysis of various algorithms and Divide and Conquer** Binary Search analysis, Merge sort analysis, Quick sort analysis Matrix multiplication, Internal Sorting Techniques, External Sorting, Techniques, Complexity calculation of Sorting Techniques using Asymptotic notation **Self-Learning Topics:** String Matching with Finite Automata	07	2
III	**Greedy Method & Dynamic Programming** Introduction to Greedy method, Knapsack problem, Minimum cost spanning tree-kruskal and prims algorithm Introduction to Dynamic programming 0/1 Knapsack problem, Matrix Chain Multiplication, Longest Common Subsequence, Optimal Binary Search Tree, Backtracking **Self-Learning Topics:** Introduction to Backtracking method, 8 queens problem, Graph coloring. Hamiltonian cycles, The subset sum problem etc	08	3
IV	**Branch and Bound** Introduction to Branch and bound technique, Bounding and FIFO branch and bound, Least Cost search branch and bound .15 puzzle problem, Travelling salesman problem **Self-Learning Topics:** Rabin Carp string matching Approximation Algorithm etc.	08	4
V	**Graph algorithm** Single source shortest path- Dijkstra's algorithm, Bellman Ford Algorithm, All pair shortest path-Floyd Warshalls algorithm, Johnson's Algorithm, Max Flow Algorithm: Ford-Fulkersonmethod, Maximum, Bipartite Matching, Push-relabel algorithm **Self-Learning Topics:** P and NP complete problem etc.	08	5
VI	**Complexity Theory** P vs NP problem: Understanding classes of problems and their complexities, NP-Complete and NP-Hard problems, Reductions and their role in complexity theory. **Self-Learning Topics:** Randomized algorithms: Using random numbers to make decisions (e.g., Quick Sort). etc.	08	6
	Total Hours	45	

Laboratory Component

Sr. No	Title of the Practical
1	To implement Divide and conquer method
2	To implement Greedy Technique
3 & 4	To implement dynamic algorithms
5	To implement Backtracking algorithm
6	To implement branch and bound algorithm
7	To implement Single source shortest path
8 & 9	To implement All pair shortest path
10	To implement String matching algorithm

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project

7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books

1. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
2. "Algorithms" by Robert Sedgewick and Kevin Wayne

Reference Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C Stein, "Introduction to Algorithms", MIT Press/McGraw Hill,2012 Version, 2/E, PHI Learning, 3rd Edition,
2. S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis",Addison Wesley, 2000, 3rd edition.
3. Michael Gooddrich & Roberto Tammassia, "Algorithm design foundation, analysis and internet examples", Second edition , wiley student edition.

Useful Links**:**

Coursera Lectures (e-Resources):		Module Covered
Design and Analysis of Algorithms	https://www.coursera.org/specializations/algorithms	I ,II, III, IV, V,VI
	https://www.khanacademy.org/computing/computer-science/algorithms	I,II, III, IV, V,VI

Course Title: Process Automation												
Semester: II			**Term:** Even				**Course Code:** 25MCAPCC203					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	-	2	2	-	1	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives

1. To introduce students to the concepts, importance, and types of process automation, including RPA, BPA, and AI.
2. To provide knowledge of popular automation tools and technologies, enabling students to choose appropriate solutions for various automation needs.
3. To equip students with skills in process mapping, analysis, and best practices for designing user-cantered automated solutions.
4. To teach students how to set up automation environments, develop scripts, and deploy automation solutions effectively.
5. To provide an understanding of governance frameworks, compliance requirements, and security best practices for automated processes.
6. To analyse advanced topics in process automation, including AI integration and case studies of successful implementations, preparing students for future developments in the field.

Course Outcomes

CO 1 -Students will be able to explain key concepts of process automation and its significance in various industries.
CO 2 -Students will be able to assess and compare different automation tools and select the most suitable ones for specific processes.
CO 3 -Students will be capable of documenting processes using flow diagrams and conducting feasibility analyses to determine automation potential.
CO 4 -Students will be able to write, debug, and test automation scripts using industry-standard tools.
CO 5 -Students will understand and apply governance frameworks and risk management strategies to ensure secure automation practices.
CO 6 -Students will be able to discuss the implications of AI and machine learning in automation and evaluate real-world case studies to derive insights for future applications.

Course Contents:

Module	Contents	Hours	CO
I	**Introduction to Process Automation** [1] **Overview of Process Automation** o Definition and importance o Types of automation: RPA, BPA, and AI · **Benefits and Challenges** o Cost savings, efficiency, and accuracy o Change management and workforce impact · **Key Concepts and Terminology** **Self-Learning Topics:** S Robotic Process Automation (RPA) Implementation etc.	05	1
II	**Tools and Technologies** [1] **RPA Tools Overview** o Popular tools: UiPath, Automation Anywhere, Blue Prism · **Workflow Automation Tools** o Microsoft Power Automate, Zapier, Integromat · **Integration Technologies** o APIs, webhooks, and middleware **Self-Learning Topics:** Business Process Mapping and Analysis	05	2
III	**Designing Automated Processes** [1] **Process Mapping and Analysis** o Identifying and documenting processes o Process flow diagrams and tools · **Feasibility Analysis** o Criteria for automation o Cost-benefit analysis · **Best Practices for Design** o User-centered design principles **Self-Learning Topics:** Integration of AI with Automation etc	05	3
IV	**Development and Implementation** [1] **Setting Up the Environment** o Installation and configuration of tools · **Developing Automation Scripts** o Basic scripting and programming concepts o Debugging and testing automated processes · **Deployment Strategies** o Staging, production, and monitoring **Self-Learning Topics:** Automation Security Best Practices etc.	05	4

V	**Governance and Security** [1] **Automation Governance Framework** o Policies and compliance o Change management in automated processes **Security Best Practices** o Data protection and privacy concerns o Managing access and credentials **Risk Management** o Identifying and mitigating risks in automation **Self-Learning Topics:** Study compliance standards and regulations affecting data security in automated processes.	05	5
VI	**Future Trends and Advanced Topics** [1] **AI and Machine Learning in Automation** o Natural Language Processing, computer vision · **Intelligent Process Automation (IPA)** o Combining RPA with AI capabilities · **Case Studies and Real-world Applications** o Success stories across industries · **Preparing for the Future** o Continuous improvement and scaling automation **Self-Learning Topics:** Change Management in Automation Projects etc.	05	6
	Total Hours	**30**	

Sr. No	Title of the Practical
1	Basic RPA Bot Creation Use an RPA tool (like UiPath or Automation Anywhere) to create a simple bot that automates data entry from an Excel sheet into a web form.
2	Web Scraping Automation Develop a script using tools like UiPath or Python (with libraries such as BeautifulSoup or Selenium) to scrape data from a website and store it in a CSV file.
3	Email Automation Set up an automation workflow to automatically send emails based on certain triggers (e.g., receiving an email with a specific subject) using Microsoft Power Automate or Zapier
4	File Management Automation Create a process that automatically organizes files in a directory based on their types (e.g., moving PDFs to one folder, images to another) using a scripting language like Python.
5	Process Mapping Exercise Select a business process in your organization or a hypothetical scenario and create a detailed process map using BPMN notation to identify automation opportunities.
6	Data Validation Automation Design a bot that validates data entered in a spreadsheet against a predefined set of rules, highlighting errors and providing feedback for corrections.
7	Integration of APIs Build a simple automation that pulls data from a public API (e.g., weather data) and pushes it to a Google Sheet or a database.
8	Testing and Debugging Automation Create a simple automation script and intentionally introduce errors. Practice debugging the script to identify and resolve issues.
9	Deployment and Monitoring Simulate the deployment of an RPA bot and set up monitoring alerts (using tools like UiPath Orchestrator) to track its performance and failures.
10	End-to-End Automation Project Choose a business process, such as invoice processing, and design, develop, test, and deploy an end-to-end automation solution. Document each phase and the results.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Textbooks

1. "Robotic Process Automation and Cognitive Automation: A Guide to the Future of Work" by Mary C. Lacity and John F. Martin
2. "Business Process Automation: A Practical Guide to Implementation" by A. K. Jain and K. S. Sharma
3. "Automate This: How Algorithms Came to Rule Our World" by Christopher Steiner

Reference Books

1. Greg McMillan and Dale Fady, "Process Automation Handbook: A Comprehensive Guide to Process Automation," McGraw-Hill, 2013.
2. Mary Poppendieck and Tom Poppendieck, "Lean Software Development: An Agile Toolkit," Addison-Wesley, 2003.
3. Thomas Siebel, "Digital Transformation: Survive and Thrive in an Era of Mass Extinction," RosettaBooks, 2019.

Useful Links:

Coursera Lectures (e-Resources):		Module Covered
Process Automation	UiPath Academy (e-Resources): Robotic Process Automation Courses https://academy.uipath.com/	I ,II, III, IV, V,VI
	Automation Anywhere University: RPA Training and Certifications https://university.automationanywhere.com/	I,II, III, IV, V,VI
	Coursera – Business Process Automation Specialization: Comprehensive online courses on automation https://www.coursera.org/specializations/business-process-automation	I,II, III, IV, V,VI

Course Title: Machine Learning												
Semester: II			**Term:** Even				**Course Code:** 25MCAPEC2011					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
--	--	06	--	--	03	03	20	20	60	25	--	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives

1. To provide a comprehensive overview of machine learning concepts, types, and key terminology.
2. To equip students with skills in data collection, cleaning, and exploratory data analysis, enabling them to prepare datasets for modelling.
3. To teach students the principles and applications of supervised learning techniques, including regression and classification methods.
4. To familiarize students with unsupervised learning techniques, such as clustering and dimensionality reduction, for discovering patterns in data.
5. To introduce students to model optimization techniques, including hyperparameter tuning and ensemble methods, for improving predictive performance.
6. To explore advanced areas of machine learning, including deep learning and natural language processing, while discussing ethical considerations and future trends.

Course Outcomes

CO 1 - Students will be able to explain the different types of machine learning and key terminology relevant to the field.

CO 2 - Students will be capable of collecting, cleaning, and exploring datasets using various techniques and visualization methods.

CO 3 - Students will be able to implement supervised learning algorithms and evaluate their performance using appropriate metrics.

CO 4 - Students will demonstrate the ability to apply unsupervised learning methods to identify patterns and reduce dimensionality in datasets.

CO 5 - Students will be able to conduct hyper parameter tuning and apply ensemble learning techniques to enhance model accuracy.

CO 6 - Students will be able to discuss and implement basic concepts in deep learning and NLP while considering ethical implications and future directions in machine learning.

Course Contents:

Module	Contents	Hours	CO
I	**Introduction to Machine Learning** · **Overview of Machine Learning** o Definition and types of machine learning: supervised, unsupervised, and reinforcement learning. · **Key Concepts and Terminology** o Features, labels, training sets, testing sets, and evaluation metrics. · **Applications of Machine Learning** o Real-world examples in various fields (healthcare, finance, etc.). **Self-Learning Topics:** Feature Engineering etc.	03	1
II	**Data Pre-processing and Exploration** · **Data Collection and Sources** o Types of data: structured vs. unstructured. · **Data Cleaning and Preparation** o Handling missing values, outliers, and data normalization. · **Exploratory Data Analysis (EDA)** o Visualization techniques and statistical summaries to understand data. **Self-Learning Topics:** Deep Learning Fundamentals	03	2
III	**Supervised Learning Techniques** · **Linear Regression** o Concepts, implementation, and evaluation metrics (MSE, R^2). · **Classification Algorithms** o Logistic regression, decision trees, k-nearest neighbours, support vector machines. · **Model Evaluation Techniques** o Cross-validation, confusion matrix, precision, recall, and F1-score. **Self-Learning Topics:** Natural Language Processing (NLP)etc.	03	3
IV	**Unsupervised Learning Techniques** · **Clustering Algorithms** o K-means, hierarchical clustering, and DBSCAN. · **Dimensionality Reduction** o Principal Component Analysis (PCA) and t-SNE. · **Association Rule Learning** o Apriori algorithm and market basket analysis. **Self-Learning Topics:** Time Series Analysis etc.	02	4

V	**Model Optimization and Ensemble Methods** **Hyper parameter Tuning** o Grid search and random search techniques. **Ensemble Learning** o Bagging, boosting (e.g., AdaBoost, Gradient Boosting), and stacking. **Feature Engineering** o Techniques for improving model performance through feature selection and extraction. **Self-Learning Topics:** Reinforcement Learning	02	5
VI	**Advanced Topics in Machine Learning** · **Deep Learning Basics** o Introduction to neural networks and architectures (CNNs, RNNs). · **Natural Language Processing (NLP)** o Text pre-processing, sentiment analysis, and common algorithms (e.g., LSTM). · **Ethics and Future Trends in Machine Learning** o Bias in ML models, interpretability, and the future landscape of AI technologies. **Self-Learning Topics**: Model Deployment and Monitoring etc.	02	6
	Total Hours	15	

Laboratory Component

Sr. No	Title of the Practical
1	Data Exploration and Visualization Load a dataset (e.g., Iris or Titanic) and perform exploratory data analysis (EDA) using libraries like Pandas and Matplotlib. Create visualizations to identify patterns and correlations.
2	Data Pre-processing Take a raw dataset and perform data cleaning tasks: handle missing values, outliers, and normalize/standardize the data. Use Scikit-learn's pre-processing functions for this
3	Implementing Linear Regression Build a simple linear regression model to predict housing prices using the Boston Housing dataset. Evaluate the model using metrics like Mean Squared Error (MSE) and R^2.
4	Classification with Logistic Regression Use logistic regression to classify whether a passenger survived on the Titanic based on features such as age, gender, and class. Evaluate model performance using confusion matrix and accuracy score.
5	Decision Trees and Random Forests Implement a decision tree classifier on the Iris dataset, then extend the model to a random forest classifier. Compare their performance and discuss overfitting vs. generalization.
6	K-Means Clustering Apply K-means clustering on a dataset (e.g., customer segmentation) to identify distinct groups. Visualize the clusters in a 2D plot and determine the optimal number of clusters using the elbow method.
7	Dimensionality Reduction with PCA Use Principal Component Analysis (PCA) on the MNIST dataset to reduce its dimensionality. Visualize the data in 2D and observe how well the clusters represent the original data.
8	Hyperparameter Tuning Take a machine learning model (e.g., SVM or Random Forest) and perform hyperparameter tuning using Grid Search or Random Search with cross-validation on a dataset like the Wine Quality dataset.
9	Building a Neural Network Create a simple feedforward neural network using TensorFlow or PyTorch to classify handwritten digits from the MNIST dataset. Train and evaluate the model, discussing its architecture and performance.
10	Natural Language Processing (NLP) Project Use an NLP library (like NLTK or SpaCy) to perform sentiment analysis on a dataset of movie reviews. Build a model using techniques such as TF-IDF and logistic regression or a simple neural network.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Textbooks

[1] "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
[2] "Pattern Recognition and Machine Learning" by Christopher M. Bishop
[3] "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

Reference Books

[1] Trevor Hastie, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction," Springer, 2nd Edition, 2009.
[2] Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective," MIT Press, 2012.
[3] Christopher M. Bishop, "Pattern Recognition and Machine Learning," Springer, 2006.

Useful Links:

Coursera Lectures (e-Resources):		Module Covered
Machine Learning	Coursera – Machine Learning Specialization: Comprehensive online courses on machine learning https://www.coursera.org/specializations/machine-learning	I ,II, III, IV, V,VI
	Kaggle – Learn Machine Learning: Hands-on tutorials and competitions for practical experience https://www.kaggle.com/learn/machine-learning	I,II, III, IV, V,VI
	TensorFlow Tutorials: Official TensorFlow tutorials for various machine learning applications https://www.tensorflow.org/tutorials	I,II, III, IV, V,VI

Course Title: Basic Communication Skill -II												
Semester: II			**Term:** Even				**Course Code:** 25MCAAEC201					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	01	--	--	01	--	01	--	--	--	25	--	25

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives

1. To develop effective speaking techniques that ensure clarity, engagement, and impact in verbal communication.
2. To cultivate an understanding of body language and its role in communication, along with active listening skills.
3. To teach strategies for building rapport, effective networking, and conflict resolution in interpersonal contexts.
4. To improve business writing capabilities, focusing on clarity, professionalism, and the importance of tone in written communication.
5. To enhance skills in team dynamics, including collaboration, meeting facilitation, and constructive feedback.
6. To prepare students for delivering effective presentations and speeches while adapting to diverse audiences and cultural sensitivities.

Course Outcomes

CO 1 - Students will be able to articulate ideas clearly and engage audiences using appropriate tone and pacing.

CO 2 - Students will be able to recognize and interpret body language and non-verbal signals to enhance communication effectiveness.

CO 3 - Students will demonstrate the ability to build connections, trust, and resolve conflicts through effective interpersonal communication techniques.

CO 4 - Students will be capable of writing clear, concise, and professional emails, reports, and creative narratives suitable for various contexts.

CO 5 - Students will be able to work effectively within teams, facilitating productive discussions and providing constructive feedback.

CO 6 - Students will demonstrate proficiency in public speaking and presentation skills, effectively handling audience interactions and adapting to cultural differences.

Course Contents:

Module	Contents	Hours	CO
I	**Advanced Verbal Communication** 1. **Effective Speaking Techniques** o Clarity, tone, and pacing in speech. o Techniques for engaging an audience. · **Presentation Skills** o Structuring presentations: introduction, body, conclusion. o Use of visual aids and technology (e.g., PowerPoint, props) **Self-Learning Topics:** Feature Engineering etc.	03	1
II	**Non-Verbal Communication** 1. **Understanding Body Language** o The role of gestures, facial expressions, and posture. o Cultural variations in non-verbal communication. · **Active Listening Skills** o Techniques for enhancing listening abilities. o Understanding and interpreting non-verbal cues. **Self-Learning Topics:** Deep Learning Fundamentals	03	2
III	**Interpersonal Communication** 1. **Building Rapport** o Techniques for establishing connections and trust. o Strategies for effective networking. · **Conflict Resolution** o Identifying sources of conflict and strategies for resolution. o Negotiation skills and collaborative communication. **Self-Learning Topics:** Natural Language Processing (NLP)etc	03	3
IV	**Writing Skills for Communication** 1. **Business Writing Techniques** o Writing clear and concise emails, reports, and memos. o Importance of tone and professionalism in written communication. · **Creative Writing** o Techniques for developing narrative skills and engaging storytell-ing. **Self-Learning Topics:** Time Series Analysis etc.	02	4
V	**Communication in Teams** 1. **Team Dynamics** o Understanding roles within a team and effective collaboration.	02	5

	o Techniques for facilitating productive team meetings. · **Feedback and Evaluation** o Giving and receiving constructive feedback. o Using feedback to improve communication skills **Self-Learning Topics:** Reinforcement Learning		
VI	**Communication in Professional Contexts** 1. **Public Speaking and Presentations** o Preparing for and delivering effective speeches and presentations. o Handling questions and managing audience interaction. · **Cultural Sensitivity in Communication** o Understanding and respecting cultural differences. o Adapting communication styles to diverse audiences **Self-Learning Topics**: Model Deployment and Monitoring etc.	02	6
	Total Hours	15	

Laboratory Component

Sr. No	Title of the Practical
1	Effective Speaking Practice Activity: Students prepare and deliver a short speech on a chosen topic, focusing on clarity, tone, and pacing. Peer feedback will be provided to enhance speaking techniques.
2	Body Language Workshop Activity: Students engage in exercises to identify and interpret various non-verbal cues. Role-playing scenarios will help illustrate the impact of body language on communication.
3	Active Listening Exercise Activity: Conduct a listening activity where one student shares a story while others practice active listening techniques. Follow-up discussions will assess understanding and interpretation.
4	Building Rapport Role-Play Activity: Students participate in role-playing scenarios to practice techniques for building rapport and trust in professional networking situations.
5	Conflict Resolution Simulation Activity: Students are presented with a conflict scenario to resolve in pairs or small groups, utilizing negotiation skills and collaborative communication strategies.
6	Business Writing Workshop Activity: Students write and revise professional emails and memos based on provided scenarios, focusing on clarity, tone, and structure. Peer reviews will enhance learning.
7	Creative Storytelling Session Activity: Students create and share a short narrative or story. This encourages engagement and helps develop narrative skills and creativity in communication.
8	Team Dynamics Discussion Activity: Conduct a group discussion on team roles and dynamics. Students will analyze their own experiences in teams and identify effective collaboration techniques.
9	Feedback Exchange Activity: Students practice giving and receiving constructive feedback in pairs, discussing their experiences and strategies for improvement.
10	Public Speaking Presentation Activity: Students prepare a presentation on a relevant topic, using visual aids and technology. They will practice managing audience questions and interactions.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Textbooks

[1] "Effective Communication Skills" by John Adair
[2] "The Art of Public Speaking" by Stephen E. Lucas
[3] "Business and Professional Communication: Keys for Workplace Excellence" by Andrew D. Wolvin and Carolyn Gwinn Wolvin

Reference Books

[1] Dale Carnegie, "How to Win Friends and Influence People," Simon & Schuster, 2010 Edition.
[2] Robert C. Davis and Karen A. Davis, "The Communication Skills Workbook," Wiley, 2016.
[3] Judith S. Gale, "Communicating Effectively," McGraw-Hill, 2013

Useful Links:

Coursera Lectures (e-Resources):		Module Covered
Skill Communication Skill-II	**Coursera – Communication Skills for Professionals:** Comprehensive online courses on communication skills https://www.coursera.org/specializations/communication-skills	I ,II, III, IV, V,VI
	Toastmasters International: Resources for improving public speaking and leadership skills https://www.toastmasters.org/	I,II, III, IV, V,VI
	LinkedIn Learning – Communication Foundations: Video tutorials and courses on various communication topics https://www.linkedin.com/learning/paths/communication-foundations	I,II, III, IV, V,VI

Course Title: Introduction to IKS												
Semester: II			**Term:** Even			**Course Code:** 25MCAIKS201						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
02	--	--	02	--	--	02	--	--	--	50	--	50

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives

1. **Understanding IKS Foundations**: To explore the historical, cultural, and philosophical roots of Indian Knowledge Systems.
2. **Exploring Diverse Disciplines**: To examine various domains of IKS, including Ayurveda, Yoga, Mathematics, and Literature, and their relevance in contemporary society.
3. **Integration with Modern Science**: To investigate how IKS can complement and enhance modern scientific and technological approaches.
4. **Promoting Sustainable Practices**: To analyse the sustainable practices within IKS and their application to current environmental challenges.
5. **Cultural Appreciation**: To foster an appreciation for the rich cultural heritage of India and its impact on global knowledge systems.
6. **Critical Thinking and Application**: To develop critical thinking skills to assess and apply IKS in addressing contemporary issues.

Course Outcomes

CO 1-Comprehensive Knowledge of IKS: Students will gain a thorough understanding of the foundational concepts and historical developments of Indian Knowledge Systems.
CO 2-Interdisciplinary Approach: Students will be able to analyse and articulate the interconnections between different fields within IKS and their applications.
CO 3-Practical Applications: Students will demonstrate the ability to apply IKS principles in real-world scenarios, particularly in areas like health, environment, and community development.
CO 4-Research and Analysis Skills: Students will develop skills to conduct research and critically analyse the relevance and implications of IKS in modern contexts.
CO 5-Cultural Sensitivity: Students will cultivate a respect for and understanding of the cultural dimensions of knowledge, recognizing the importance of indigenous perspectives.
CO 6-Innovative Thinking: Students will enhance their ability to think innovatively, integrating traditional knowledge with contemporary challenges to propose sustainable solution.

Course Contents:

Module	Contents	Hours	CO
I	**Foundations of Indian Knowledge Systems** · **Overview of IKS**: Definition, significance, and historical context. · **Philosophical Underpinnings**: Key philosophies (e.g., Vedanta, Samkhya, Buddhism). · **Epistemology**: Ways of knowing and traditional methods of knowledge acquisition. **Self-Learning Topics:** Feature Engineering etc.	05	1
II	**Traditional Sciences and Practices** · **Ayurveda**: Principles, practices, and relevance in health and wellness. · **Yoga**: Philosophical aspects and practical applications. · **Mathematics**: Contributions of ancient Indian mathematicians (e.g., Aryabhata, Brahmagupta). **Self-Learning Topics:** Deep Learning Fundamentals	05	2
III	**Arts and Literature** · **Classical Literature**: Exploration of texts like the Mahabharata, Ramayana, and Vedas. · **Performing Arts**: Understanding traditional music, dance, and theatre forms. · **Visual Arts**: Role of art in expressing cultural narratives and philosophies **Self-Learning Topics:** Natural Language Processing (NLP)etc	05	3
IV	**Environmental Wisdom and Sustainability** · **Traditional Ecological Knowledge**: Practices that promote biodiversity and sustainability. · **Water Management**: Ancient techniques (e.g., step wells, rainwater harvesting). · **Agriculture**: Indigenous farming practices and their ecological significance. **Self-Learning Topics:** Time Series Analysis etc.	05	4
V	**Integration with Modern Science** · **Bridging Traditions**: Comparative analysis of IKS and modern scientific paradigms. · **Case Studies**: Successful integration of IKS in contemporary science and technology. · **Challenges and Opportunities**: Addressing the potential and limitations of integrating IKS with modern practices.	05	5

	Self-Learning Topics: Reinforcement Learning		
VI	**Cultural Context and Global Relevance** · **Cultural Heritage**: The role of IKS in shaping cultural identity and heritage. · **Global Perspectives**: The impact of IKS on global knowledge systems and intercultural dialogue. · **Future Directions**: Promoting and preserving IKS in the face of globalization and modernization. **Self-Learning Topics**: Model Deployment and Monitoring etc.	05	6
	Total Hours	30	

Evaluation and Assessment Scheme:

B. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

C. **End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

D. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz

10. Mind Mapping

11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Textbooks

[1] "Indian Knowledge Systems: Perspectives and Practices" by Rajiv Malhotra
[2] "Traditional Indian Medicine: A Comprehensive Guide" by K. K. Sharma
[3] "The Roots of Ayurveda: Selections from Sanskrit Medical Writings" by Dominik Wujastyk.

Reference Books

[1] David Frawley, "Ayurveda and the Mind: The Healing of Consciousness," Lotus Press, 2000.
[2] Kapil Kapoor, "Indian Knowledge Systems: A Study of Tradition and Modernity," Rupa Publications, 2016.
[3] M. N. Srinivas, "Indian Sociology: The Development of Indian Sociology," Rupa Publications, 2001.

Useful Links:

Coursera Lectures (e-Resources):		Module Covered
Introduction to Indian Knowledge System	Indian Knowledge System - Ministry of Education, Government of India https://www.education.gov.in/en	I ,II, III, IV, V,VI
	Indian Council of Historical Research (ICHR) http://ichr.ac.in	I,II, III, IV, V,VI
	National Programme on Technology Enhanced Learning (NPTEL) https://nptel.ac.in	I,II, III, IV, V,VI

Syllabus For

First Year
Master of Computer Application
(MCA)

Semester – III

(With Effect from 2025 – 2026)

Course Title: Data Science using Python												
Semester: III			**Term:** Odd				**Course Code:** 25MCAPCC301					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3		2	3		1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand the fundamentals of Python programming for data analysis.
2. To explore Python libraries such as NumPy, Pandas, and Matplotlib for data manipulation and visualization.
3. To perform statistical analysis and hypothesis testing using Python.
4. To apply data pre-processing techniques and handle real-world datasets.
5. To introduce machine learning algorithms and their implementation using Scikit-learn.
6. To develop complete data science pipelines from data acquisition to predictive modelling.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Write Python programs for data analysis and scientific computing.
CO 2 - Use NumPy and Pandas for efficient data manipulation and cleaning.
CO 3 - Visualize data using Matplotlib and Seaborn to derive insights.
CO 4 - Apply statistical techniques and hypothesis testing for data validation.
CO 5 - Implement machine learning algorithms for predictive analytics.
CO 6 - Construct end-to-end data science solutions using Python tools and libraries.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Data Science and Python Basics** Data Science Lifecycle, Introduction to Python Programming, Data Types, Control Structures, Functions, File Handling, Virtual Environments. **Self-Learning Topic** : Python IDE setup, Jupyter Notebook, Python data types in depth	06	1
II	**Data Manipulation Using NumPy and Pandas** Arrays, Array Operations, DataFrames, Data Cleaning, Handling Missing Values, Data Transformation. **Self-Learning Topics:** Reading data from various formats: JSON, Excel, SQL	08	2
III	**Data Visualization** Using Matplotlib, Seaborn, Plotly, Data Plots: Bar Chart, Histogram, Pie Chart, Line Chart, Heatmaps. **Self-Learning Topics:** Interactive Dashboards with Plotly and Streamlit	07	3
IV	**Statistical Analysis Using Python** Descriptive Statistics, Probability Distributions, Hypothesis Testing, Correlation and Regression Analysis. **Self-Learning Topics:** Statistical testing with SciPy and real-world datasets	07	4
V	**Introduction to Machine Learning with Python** Supervised vs Unsupervised Learning, Data Splitting, Model Evaluation, Regression and Classification using Scikit-learn. **Self-Learning Topics:** Hands-on with datasets from Kaggle (Titanic, Iris, Housing)	09	5
VI	**Data Science Project Lifecycle** Data Collection, Preprocessing, Model Building, Evaluation, and Deployment Overview. **Self-Learning Topics:** Model Deployment using Flask / Streamlit	08	6
	Total Hours	45	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Python Basics: Variables, Control Flow, Functions	CO1
2	Working with NumPy Arrays and Mathematical Operations	CO2
3	Data Cleaning and Manipulation using Pandas	CO2
4	Exploratory Data Analysis and Visualization using Matplotlib	CO3
5	Creating Advanced Visualizations using Seaborn	CO3
6	Statistical Analysis and Hypothesis Testing in Python	CO4
7	Linear and Logistic Regression using Scikit-learn	CO5
8	Classification Algorithms Implementation (KNN, Decision Trees)	CO5
9	Data Science Mini-Project: End-to-End Workflow	CO6
10	Model Evaluation and Performance Tuning	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study

3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, O'Reilly Media.
2. Jake VanderPlas, *Python Data Science Handbook*, O'Reilly Media.

Reference Books:

3. Wes McKinney, *Python for Data Analysis*, O'Reilly Media.
4. Joel Grus, *Data Science from Scratch*, O'Reilly Media.
5. Sebastian Raschka, *Python Machine Learning*, Packt Publishing.

Useful Links:

1. **NumPy Documentation**
   https://numpy.org/doc/
2. **Pandas Documentation**
   https://pandas.pydata.org/docs/
3. **Matplotlib User Guide**
   https://matplotlib.org/stable/contents.html
4. **Seaborn Tutorials**
   https://seaborn.pydata.org/tutorial.html
5. **Scikit-learn Documentation**
   https://scikit-learn.org/stable/documentation.html
6. **Kaggle: Learn Data Science**
   https://www.kaggle.com/learn/overview

Course Title: Software Architecture & Design Patterns												
Semester: III			**Term:** Odd				**Course Code:** 25MCAPCC302					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To introduce fundamental principles of software architecture and its role in system design.
2. To explore various architectural styles and understand their applications.
3. To learn key design patterns that promote reusable and maintainable software.
4. To apply design patterns for solving common software design problems.
5. To develop critical thinking about the impact of architectural decisions.
6. To enable students to document and communicate architectural designs effectively.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Describe the importance and principles of software architecture.
CO 2 - Compare and select suitable architectural styles for real-world systems.
CO 3 - Apply design patterns to solve common software design problems.
CO 4 - Analyse and document the structure of complex software systems.
CO 5 - Implement selected design patterns in object-oriented programming languages.
CO 6 - Evaluate trade-offs involved in architectural and design decisions.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Software Architecture** Architectural structures, Architectural views, 4+1 View Model, Architecture vs. Design, Software quality attributes. **Self-Learning Topic** : Research: Examples of architecture in large systems (Google, Amazon)	06	1
II	**Architectural Styles and Patterns** Layered architecture, Client-Server, Microservices, Event-Driven, Model-View-Controller (MVC), Pipes & Filters. **Self-Learning Topics:** Study: Monolithic vs. Microservice architectures.	08	2
III	**Introduction to Design Patterns** Overview of design patterns, Pattern categories (Creational, Structural, Behavioral), Pattern catalog. **Self-Learning Topics:** Explore: Design patterns in open-source projects (GitHub examples).	06	3
IV	**Creational Patterns** Singleton, Factory, Abstract Factory, Builder, Prototype patterns with UML and implementation examples. **Self-Learning Topics:** Comparison of design patterns in Java vs. Python.	08	4
V	**Structural Patterns** Adapter, Decorator, Composite, Proxy, Facade, Flyweight, Bridge patterns with UML and implementation. **Self-Learning Topics:** Hands-on with datasets from Kaggle (Titanic, Iris, Housing)	08	5
VI	**Behavioral Patterns** Observer, Strategy, Command, Template Method, State, Mediator, Iterator, Memento, Visitor patterns. **Self-Learning Topics:** Study: Behavioral patterns in event-driven systems.	09	6
	Total Hours	45	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Study of 4+1 View Model and architectural documentation tools	CO1
2	Design and implementation of a Layered Architecture application	CO2
3	Implementation of Singleton and Factory Patterns	CO3, CO4
4	Implementation of Abstract Factory and Builder Patterns	CO4
5	Implementation of Adapter and Decorator Patterns	CO5
6	Implementation of Composite and Proxy Patterns	CO5
7	Implementation of Observer and Strategy Patterns	CO6
8	Implementation of Command and State Patterns	CO6
9	Mini Project — Combine multiple patterns to design a real-world problem solution	CO4, CO5, CO6
10	Design patterns case study analysis (Software Architecture documentation review)	CO1, CO2

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit

6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides — *Design Patterns: Elements of Reusable Object-Oriented Software*, Addison-Wesley.
2. Len Bass, Paul Clements, Rick Kazman — *Software Architecture in Practice*, Pearson.

Reference Books:

1. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal — *Pattern-Oriented Software Architecture*, Wiley.
2. Eric Evans — *Domain-Driven Design: Tackling Complexity in the Heart of Software*, Addison-Wesley.
3. Mark Richards — *Software Architecture Patterns*, O'Reilly Media.

Useful Links:

- https://refactoring.guru/design-patterns — Design Patterns Illustrated
- https://martinfowler.com/architecture/ — Martin Fowler's Software Architecture Articles
- https://sourcemaking.com/design_patterns — Design Patterns Source Examples
- https://microservices.io/ — Microservices Architecture Patterns

Course Title: Deep Learning												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-II) 25MCAPEC3011					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand the theoretical foundation of deep learning and artificial neural networks.
2. To explore various architectures of deep neural networks, including CNN, RNN, LSTM, and Auto encoders.
3. To develop practical knowledge in training, testing, and evaluating deep learning models.
4. To apply optimization techniques for model performance enhancement.
5. To implement deep learning solutions using Python frameworks like TensorFlow and PyTorch.=
6. To solve real-world problems in computer vision, natural language processing, and sequence modelling.

Course Outcomes:

At the end of the course students will be able to:

CO 1 -

CO 2 - Explain the mathematical foundations of neural networks and deep learning.

CO 3 - Design and implement feedforward neural networks using modern tools.

CO 4 - Apply convolutional neural networks (CNN) for image-based tasks.

CO 5 - Implement recurrent neural networks (RNN) for sequence-based data.

CO 6 - Train, fine-tune, and evaluate deep learning models using real datasets.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Deep Learning** History and Evolution, Difference between AI, ML, and DL, Perceptron and Multilayer Perceptron, Activation Functions, Backpropagation Algorithm. **Self-Learning Topic**: Self-study: Real-world Deep Learning applications in industry.	05	1
II	**Feedforward Neural Networks & Optimization** Loss functions, Gradient Descent, Learning Rate Scheduling, Batch Normalization, Weight Initialization. **Self-Learning Topics:** Study: Vanishing & Exploding Gradient Problem.	05	2
III	**Convolutional Neural Networks (CNN)** Convolution Layers, Pooling, Padding, Stride, Dropout, Transfer Learning, Image Classification Case Studies. **Self-Learning Topics:** Research: YOLO and Object Detection Architectures.	05	3
IV	**Recurrent Neural Networks (RNN) & LSTM** RNN Architecture, Vanishing Gradient Problem, Long Short-Term Memory, Gated Recurrent Units (GRU), Sequence-to-Sequence Models. **Self-Learning Topics:** Study: Attention Mechanism and Transformers.	05	4
V	**Generative Models & Autoencoders** Autoencoders, Variational Autoencoders (VAE), Generative Adversarial Networks (GAN), Applications of Generative Models. **Self-Learning Topics:** Explore: Diffusion Models in Image Generation.	05	5
VI	**Deep Learning Frameworks and Case Studies** Overview of TensorFlow, Keras, PyTorch, Transfer Learning, Real-world Case Studies in Image, Text & Speech Data. **Self-Learning Topics:** Self-practice: Building models using HuggingFace Transformers.	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Implementing Perceptron Learning Algorithm	CO1
2	Building Feedforward Neural Networks in Tensor Flow / Keras	CO2
3	Applying CNN for image classification using CIFAR-10 / MNIST	CO3
4	Fine-tuning a pre-trained CNN (Transfer Learning)	CO3
5	Implementing RNN for text sequence prediction	CO4
6	LSTM-based sentiment analysis using IMDB Dataset	CO4
7	Implementing Auto encoders for image reconstruction	CO5
8	Building a simple GAN for image generation	CO5
9	Deep Learning Project: Real-world dataset (image/text/audio)	CO6
10	Model Deployment using TensorFlow Serving / ONNX	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
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6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville — *Deep Learning*, MIT Press.
2. François Chollet — *Deep Learning with Python*, Manning Publications.

Reference Books:

1. Aurélien Géron — *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, O'Reilly.
2. Simon Haykin — *Neural Networks and Learning Machines*, Pearson.
3. Michael Nielsen — *Neural Networks and Deep Learning* (Free online book).

Useful Links:

1. https://www.deeplearningbook.org/ — Deep Learning Book by Goodfellow.
2. https://pytorch.org/tutorials/ — PyTorch Tutorials.
3. https://www.tensorflow.org/tutorials — TensorFlow Official Tutorials.
4. https://keras.io/examples/ — Keras Deep Learning Examples.
5. https://paperswithcode.com/ — Latest research with code samples.

Course Title: Quality Assurance												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-II) 25MCAPEC3012					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Introduce students to the concepts and principles of software quality assurance.
2. Equip students with skills to apply software testing techniques and quality models.
3. Explore industry standards and tools for quality improvement and assurance.
4. Enable students to develop and execute test plans and automate testing processes.
5. Teach metrics-based evaluation of quality in software projects.
6. Promote understanding of risk assessment and quality audits in development life cycles.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Explain the fundamentals and importance of software quality assurance.

CO 2 - Apply software testing techniques and design effective test cases

CO 3 - Use quality models and metrics to evaluate software processes and products.

CO 4 - Perform testing using tools and automation frameworks.

CO 5 - Analyze and implement quality standards like ISO, CMMI in software projects.

CO 6 - Identify risks, perform audits, and ensure compliance in QA processes.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Software Quality Assurance** Basics of Quality: Quality, Quality Control (QC), Quality Assurance (QA), Software quality vs. software reliability vs. testing, Quality attributes: ISO/IEC 25010 (Functionality, Reliability, Usability, etc.) **Self-Learning Topic**: Cost of quality: Prevention, appraisal, and failure costs	05	1
II	**Software Quality Models and Metrics** McCall's, Boehm's, ISO 9126/25010 models Product vs. process metrics Defect density, cyclomatic complexity, **Self-Learning Topics:** Study: code coverage Goal-Question-Metric (GQM) paradigm	05	2
III	**Software Testing Fundamentals:** Black-box, White-box, Regression, Test Coverage **Self-Learning Topics:** Test Coverage	05	3
IV	**Test Case Design & Automation:** BVA, ECP, Test Plans, Automation Tools (Selenium, JUnit, **Self-Learning Topics:** Study: TestNG)	05	4
V	**Quality Standards and Models:** IEEE 730/829, ISO 9001, CMMI, **Self-Learning Topics:** Explore: Six Sigma.	05	5
VI	**QA Practices, Audits, and Risk Management:** Risk Prioritization, RCA, FMEA, Walkthroughs, Audits **Self-Learning Topics:** Self-practice: Audits	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Writing test cases for simple applications	CO1
2	Unit testing using JUnit or PyTest	CO2
3	Automated UI testing with Selenium	CO3
4	Performance testing with Apache JMeter	CO3
5	Using SonarQube for static code analysis	CO4
6	Test management using TestLink or Zephyr	CO4
7	Quality metrics calculation and reporting	CO5
8	Defect tracking simulation	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project

7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

- **Software Quality Assurance** by Daniel Galin – Pearson Education

1. **Software Testing: Principles and Practices** by Srinivasan Desikan & Gopalaswamy Ramesh – Pearson
2. **Software Engineering** by Ian Sommerville (Chapters on QA & Testing) – Pearson

Reference Books:

1. **Foundations of Software Testing** by Rex Black, Erik van Veenendaal, Dorothy Graham – Cengage
2. **Effective Software Testing** by Elfriede Dustin – Addison Wesley
3. **CMMI Guidelines for Process Integration and Product Improvement** – SEI / Addison Wesley
4. IEEE Standards (730, 829, 1012).

Useful Links:

1. https://www.softwaretestinghelp.com – Tutorials and tool reviews
2. https://junit.org – JUnit testing framework
3. https://www.selenium.dev – Selenium official site
4. https://jmeter.apache.org – Apache JMeter

Course Title: Human-Machine Interaction												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-II) 25MCAPEC3013					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To introduce the principles and theories of human-computer interaction (HCI).
2. To understand user-centered design and usability engineering.
3. To explore interaction design, interface evaluation, and prototyping.
4. To examine emerging interaction modalities such as gesture, speech, and AR/VR.
5. To equip students with the ability to design effective and usable user interfaces.
6. To understand about Advanced Interfaces and Emerging Trends.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Describe HMI principles, models, and design goals.

CO 2 - Perform testing using tools and automation frameworks.

CO 3 - Identify risks, perform audits, and ensure compliance in QA processes.

CO 4 - Design and evaluate user interfaces using prototyping and usability testing.

CO 5 - Explore advanced interaction technologies like multimodal interfaces and VR/AR.

CO 6 - Understand about advanced inferface s and Emerging Trends

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to HMI:** Definitions, goals, usability, accessibility, design lifecycle **Self-Learning Topic**: Cost of quality: Design Life cycle	05	1
II	**Human Factors & Cognitive Models:** Perception, GOMS, KLM, Fitts' Law, Hick's Law **Self-Learning Topics:** Hick's Law	05	2
III	**Interaction Styles & Devices:** WIMP, direct manipulation, haptics, eye tracking, BCI **Self-Learning Topics:** BCI	05	3
IV	**User-Centered Design & Prototyping:** Personas, prototyping, heuristic evaluation, usability testing **Self-Learning Topics:** Study: usability testing	05	4
V	**UI Design Principles:** Layout, color, typography, accessibility (WCAG), responsive design **Self-Learning Topics:** Explore: responsive design	05	5
VI	**Advanced Interfaces:** Multimodal input, wearables, VR/AR, conversational UI, ethical design **Self-Learning Topics:** Self-practice: ethical design	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Creating wireframes and prototypes	CO1
2	Designing and evaluating UI for an app	CO2
3	Usability testing with user feedback	CO3
4	Implementing speech or gesture interaction	CO3
5	Designing for AR/VR platforms	CO4
6	Figma / Balsamiq / Adobe XD	CO4
7	HTML/CSS/JS or Android Studio	CO5
8	Observation / Interview techniques	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. **Human-Computer Interaction** – Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale
2. **Designing the User Interface** – Ben Shneiderman, Catherine Plaisant
3. **The UX Book** – Rex Hartson and Pardha Pyla

Reference Books:

1. Don Norman – *The Design of Everyday Things*
2. Jakob Nielsen – *Usability Engineering*
3. Coursera / edX Courses: "Interaction Design", "HCI for UX"

Useful Links:

1. https://www.nngroup.com – Nielsen Norman Group
2. https://www.w3.org/WAI/ – Web Accessibility Initiative

Course Title: React												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-II) 25MCAPEC3014					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	4	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Introduce the fundamentals of modern front-end development.
2. Teach students to build interactive, component-based single-page applications (SPAs) using React.
3. Enable the use of React features like Hooks, Context API, and routing.
4. Explore integration with REST APIs and state management tools.
5. Prepare students for real-world React development with industry practices.
6. Understand a full-featured application and deploy it using modern tools

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Apply software testing techniques and design effective test cases

CO 2 - Build dynamic UIs using JSX, components, and props.

CO 3 - Manage component state and lifecycle effectively using Hooks.

CO 4 - Identify risks, perform audits, and ensure compliance in QA processes.

CO 5 - Integrate APIs and manage global state using Redux or other libraries.

CO 6 - Develop a full-featured application and deploy it using modern tools.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to React and SPA Architecture** Introduction to Single Page Applications (SPAs), React vs. Traditional DOM manipulation, Setting up with Node.js, npm, create-react-app, Webpack, Babel, ESLint **Self-Learning Topic**: ESLint	05	1
II	**React Basics and JSX** JSX syntax and expressions, Functional and Class Components, Props and PropTypes, State and setState, Conditional and list rendering **Self-Learning Topics:** Study: Conditional and list rendering	05	2
III	**Hooks and Lifecycle Management** Component Lifecycle Methods, React Hooks: useState, useEffect, useRef, Custom Hooks, Event Handling, Form validation: Controlled vs. Uncontrolled Components **Self-Learning Topics:** Form validation	05	3
IV	**Routing and Navigation** : React Router DOM, Nested and Dynamic Routes, useParams, Navigate, Protected Routes **Self-Learning Topics:** Study: Protected Routes	05	4
V	**State Management and API Integration:** Lifting State and Prop Drilling, Context API, Redux Basics and Redux Toolkit, API Integration: fetch, axios, Side Effects, Loading/Error States, Debouncing, **Self-Learning Topics:** Explore: Debouncing,	05	5
VI	**Advanced Features and Deployment** :Lazy Loading and Code Splitting, Error Boundaries, Performance Optimization, Testing with Jest and React Testing Library, Deployment to Vercel, Netlify, Firebase **Self-Learning Topics:** Self-practice: Firebase	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Build a TODO list with CRUD operations	CO1
2	User authentication with conditional routing	CO2
3	Weather app using open API	CO3
4	Blogging system (create/edit/delete posts)	CO3
5	E-commerce product catalog	CO4
6	Deployment to Vercel/Netlify	CO4
7	JSX, useState	CO5
8	React Router + Context API	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA):

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project

7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

- **React – Up & Running** by Stoyan Stefanov (O'Reilly)

Reference Books:

- **Learning React** by Alex Banks and Eve Porcello (O'Reilly)

Useful Links:

1. https://reactjs.org – Official Documentation
2. https://redux.js.org – Redux Official Docs
3. https://beta.reactjs.org – React Beta Docs (Hooks-focused)

Course Title: Data Visualization and Analytics												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-III) 25MCAPEC3021					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand the fundamentals of data visualization and its role in data analysis.
2. To explore various techniques, tools, and best practices for effective visual communication of data.
3. To develop the ability to select appropriate charts, plots, and graphs for different data types and use cases.
4. To apply statistical and visual techniques to explore and summarize datasets.
5. To gain hands-on experience with modern data visualization libraries like Matplotlib, Seaborn, Plotly, and Power BI/Tableau.
6. To apply storytelling and visual design principles for impactful business insights.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Explain the concepts and importance of data visualization in analytics.
CO 2 - Identify and apply appropriate visualization techniques based on data types and objectives.
CO 3 - Create interactive visualizations using libraries like Matplotlib, Seaborn, and Plotly.
CO 4 - Analyse large datasets and derive insights using visual exploration techniques.
CO 5 - Use professional data visualization tools (Power BI / Tableau) for business analytics reporting.
CO 6 - Apply storytelling and design principles to create compelling visual reports.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Data Visualization** Need for Visualization, Visual Perception, Elements of Data Visualization, Types of Data (Quantitative, Qualitative, Categorical), Graphical Integrity. **Self-Learning Topic**: Self-study: History of Data Visualization.	05	1
II	**Visualization Techniques and Tools** Basic charts: Bar, Pie, Line, Histogram, Scatter Plots, Heatmaps, Maps, Box-plots, Treemaps. Data pre-processing for visualization. **Self-Learning Topics:** Study: Misleading graphs and ethical visualization.	05	2
III	**Python Libraries for Data Visualization** Matplotlib basics, Customizing plots, Multiple plots, Seaborn statistical plots, Correlation matrices, Pair plots, Heatmaps. **Self-Learning Topics:** Study: D3.js — Data-Driven Documents.	05	3
IV	**Interactive Visualizations** Plotly, Bokeh basics, Chart components, Layout design, Widgets, Dashboards, and event-driven visualization. **Self-Learning Topics:** Study: Attention Mechanism and Transformers.	05	4
V	**Business Intelligence Tools** Tableau / Power BI overview, Data connection, Data transformation, Basic and advanced charting, Filters and Parameters, Calculated Fields, Dashboards. **Self-Learning Topics:** Explore: Microsoft Power BI Community Gallery	05	5
VI	**Storytelling and Analytics Reporting** Principles of visual storytelling, Designing effective dashboards, Case Studies in Business and Scientific Data Visualization, Data Journalism. **Self-Learning Topics:** Self-study: TED Talks on data visualization (e.g., Hans Rosling)	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Exploring Data using Matplotlib: Line & Bar Graphs	CO3
2	Plotting Histograms, Boxplots, and Scatter Plots in Python	CO3
3	Visualizing correlations using Seaborn Heatmaps & Pairplots	CO3
4	Creating interactive visualizations with Plotly	CO4
5	Dashboard creation using Bokeh	CO4
6	Working with real-world datasets (CSV/Excel) in Power BI	CO5
7	Creating calculated fields and filters in Tableau / Power BI	CO5
8	Building an analytical dashboard in Tableau or Power BI	CO5
9	Storytelling with data: Designing a business insight report	CO6
10	Mini Project: End-to-End Visualization of a real dataset	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit

6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Alberto Cairo — *The Truthful Art: Data, Charts, and Maps for Communication*, New Riders.
2. Nathan Yau — *Data Points: Visualization That Means Something*, Wiley.

Reference Books:

1. Ben Fry — *Visualizing Data*, O'Reilly.
2. Cole Nussbaumer Knaflic — *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley.
3. Claus O. Wilke — *Fundamentals of Data Visualization*, O'Reilly (free online book).

Useful Links:

1. https://matplotlib.org/stable/contents.html — Matplotlib User Guide
2. https://seaborn.pydata.org/tutorial.html — Seaborn Tutorials
3. https://plotly.com/python/ — Plotly for Python
4. https://public.tableau.com/en-us/s/resources — Tableau Learning Resources
5. https://learn.microsoft.com/en-us/power-bi/ — Microsoft Power BI Documentation
6. https://datavizcatalogue.com/ — Data Visualization Catalogue for Chart Selection

Course Title: Risk Analysis and Management												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-III) 25MCAPEC3022					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	2	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Understand risk definitions, types, and the importance of risk management in IT and business.
2. Identify and classify risks using techniques like brainstorming, SWOT, and PESTLE.
3. Perform qualitative and quantitative risk assessments using matrices and Monte Carlo simulation.
4. Apply risk mitigation strategies including avoidance, BCP, DRP, and cost-benefit analysis.
5. Implement risk monitoring, audit processes, and reporting using dashboards and RBS.
6. Analyse global risk management frameworks like ISO 31000, NIST, COSO ERM, and FAIR.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Define and differentiate types of risks and explain the risk management process.
CO 2 - Identify internal/external risks using structured techniques and categorize them.
CO 3 - Assess risks qualitatively and quantitatively using scoring, probability, and Simulation tools.
CO 4 - Develop and evaluate risk treatment plans including BCP and DRP strategies.
CO 5 - Conduct risk audits, generate reports, and use tools like RBS and dashboards.
CO 6 - Apply ISO 31000, NIST RMF, COSO ERM, and FAIR to real-world risk scenarios.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Risk Analysis** Definition and types of risk: operational, financial, strategic, cybersecurity, legal The risk management process Risk vs. uncertainty Importance of risk management in IT, software, and business **Self-Learning Topic**: Self-study: software, and business	05	1
II	**Risk Identification and Classification** Risk sources: internal vs. external Risk identification techniques: brainstorming, checklists, interviews, SWOT, PESTLE Risk categorization: technical, organizational, human, environmental Examples from IT, cybersecurity, and software projects Self-Learning Topics: Study: software projects	05	2
III	**Risk Assessment and Evaluation** Qualitative risk analysis: risk matrix, likelihood vs. impact Quantitative risk analysis: probability models, sensitivity analysis, Monte Carlo simulation Risk prioritization using risk ranking and scoring Risk appetite and risk tolerance **Self-Learning Topics:** Study: Risk appetite and risk tolerance	05	3
IV	**Risk Mitigation and Treatment Strategies** Risk avoidance, reduction, sharing (outsourcing/insurance), acceptance Business continuity planning (BCP) Disaster recovery planning (DRP) Cost-benefit analysis of mitigation strategies **Self-Learning Topics:** Study: Cost-benefit analysis of mitigation strategies	05	4
V	Risk Monitoring and Communication Risk audit and review processes Risk reporting: dashboard, heat maps, risk logs Risk governance and compliance Tools: Risk Register, Risk Breakdown Structure (RBS) **Self-Learning Topics:** Explore: Risk Breakdown Structure (RBS)	05	5
VI	**Risk Management Frameworks and Standards** ISO 31000: Risk management guidelines NIST Risk Management Framework (RMF) COSO ERM Framework FAIR (Factor Analysis of Information Risk) **Self-Learning Topics: Self-study** FAIR	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Risk identification for an IT project	CO3
2	Risk matrix development	CO4
3	Simulating risk scenarios	CO4
4	Designing a risk register	CO5
5	SWOT, interviews	CO5
6	Excel, RStudio, or online tools	CO5
7	Monte Carlo simulation in Python/R/Excel	CO6
8	Excel/Google Sheets	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom

8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Risk Management in Organizations – Margaret Woods
2. Information Security Risk Assessment Toolkit – Mark Talabis & Jason Martin

Reference Books:

- Project Risk Management – Rita Mulcahy

Useful Links:

1. NIST SP 800 series: https://csrc.nist.gov/
2. ISO 31000: https://www.iso.org/iso-31000-risk-management.html
3. OWASP Risk Rating Methodology
4. FAIR Institute: https://www.fairinstitute.org/

Course Title: User Experience (UX) Design												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-III) 25MCAPEC3023					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	2	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Understand UX fundamentals, evolution, design thinking, and user-centered design principles.
2. Conduct user research using interviews, surveys, personas, and empathy mapping.
3. Design information architecture with site maps, task flows, and interaction models.
4. Create wireframes and prototypes using tools like Figma, Adobe XD, and Axure.
5. Apply visual design principles including color, typography, layout, and accessibility.
6. Evaluate usability through heuristics, A/B testing, and UX KPIs like task success rate.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Explain UX vs. UI, evolution, and apply design thinking in user-centered design.
CO 2 - Develop personas, journey maps, and conduct user research with empathy tools.
CO 3 - Build site maps, user flows, and design effective navigation structures.
CO 4 - Design low/high-fidelity prototypes with mobile-first and responsive approaches.
CO 5 - Implement consistent visual design using grids, typography, and Accessibility standards.
CO 6 - Perform usability testing, apply Nielsen's heuristics, and measure UX KPIs effectively.

Course Contents:

Module	Contents	Hours	COs
I	**: Introduction to UX Design (4 Hours)** Definition and importance of UX UX vs. UI vs. HCI History and evolution of UX Design thinking and user-centered design (UCD) **Self-Learning Topic**: Self-study: Design thinking and user-centered design	05	1
II	**User Research and Analysis (7 Hours)** Understanding users: goals, context, and behavior Research techniques: interviews, surveys, observation, ethnography Personas and user scenarios Empathy maps and journey mapping Competitive analysis Self-Learning Topics: Competitive analysis	05	2
III	**Information Architecture and Interaction Design (6 Hours)** Organizing content and navigation Site maps, task flows, and user flows Interaction models and affordances Feedback, constraints, and visibility **Self-Learning Topics:** Study: visibility	05	3
IV	**Wireframing and Prototyping (7 Hours)** Sketching interfaces Low-fidelity and high-fidelity wireframes Prototyping tools (Figma, Adobe XD, Balsamiq, Axure) Mobile-first and responsive design Microinteractions and animations **Self-Learning Topics:** Study: Microinteractions and animations	05	4
V	**Visual Design Principles for UX (5 Hours)** Color theory, typography, and iconography Layouts and alignment (Grid systems) Consistency and branding Accessibility and inclusive design **Self-Learning Topics:** Explore: Accessibility and inclusive design	05	5
VI	**Usability and Evaluation (6 Hours)** Usability heuristics (Nielsen's 10 heuristics) Cognitive walkthroughs and heuristic evaluation A/B testing, usability testing, and eye-tracking UX KPIs: task success rate, error rate, satisfaction score **Self-Learning Topics: Self-study** satisfaction score	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	Conduct user interview	CO3
2	Create a persona & empathy map	CO4
3	Wireframe an e-commerce app	CO4
4	Build interactive prototype	CO5
5	User report + affinity diagram	CO5
6	Document in Miro/Notion	CO5
7	Figma or Balsamiq mockup	CO6
8	Clickable Figma/Adobe XD	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project

7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. **"Don't Make Me Think"** by Steve Krug
2. **"The Design of Everyday Things"** by Don Norman
3. **"About Face:** The Essentials of Interaction Design" by Alan Cooper

Reference Books:

- "About Face: The Essentials of Interaction Design" by Alan Cooper

Useful Links:

1. https://www.interaction-design.org/
2. https://uxdesign.cc/
3. https://www.smashingmagazine.com/category/uxdesign/

Course Title: Spring Boot and Microservices Architecture												
Semester: III			**Term:** Odd				**Course Code:** (Programme Elective-III) 25MCAPEC3024					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	2	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Understand the fundamentals of Spring Boot for rapid Java-based backend development.
2. Design and develop RESTful APIs.
3. Introduce the principles of micro services architecture and its implementation.
4. Apply inter-service communication, load balancing, service discovery, and fault tolerance.
5. Use containerization and orchestration for deploying micro services.

Course Outcomes:

At the end of the course students will be able to:

1. Understand Spring Boot architecture and auto-configuration.
2. Build and test RESTful APIs using Spring MVC and JPA.
3. Design and implement micro services using Spring Cloud components.
4. Handle communication, service discovery, and load balancing between micro services.
5. Use tools like Docker, Swagger, and Postman for development, testing, and deployment.
6. Secure microservices and RESTful applications using Spring Security and implement basic monitoring and logging mechanisms.

Course Contents:-

Module	Contents	Hours	COs
I	**Introduction to Spring Boot** **S**pring Framework vs. Spring Boot · Dependency Injection (DI), IoC container · Auto-configuration, Spring Initializr · Application.properties/YAML configuration · Running embedded Tomcat server **Self-Learning Topic**: Self-study: Tomcat server	05	1
II	**RESTful Web Services** • REST API concepts (GET, POST, PUT, DELETE) · Spring MVC annotations: @RestController, @RequestMapping, @Path-Variable, @RequestBody · ResponseEntity and exception handling · Postman for API testing Self-Learning Topics: API testing	05	2
III	**Spring Data and Persistence** • Spring Data JPA & Hibernate · Entity classes, @Id, @GeneratedValue, @OneToMany, @ManyToOne · Repositories and CrudRepository, JpaRepository · Database connectivity (MySQL/PostgreSQL/H2) **Self-Learning Topics:** Study: MySQL/PostgreSQL/H2	05	3
IV	**Microservices Fundamentals** • Monolith vs. Microservices · Principles of microservice architecture · Advantages and challenges · Domain-driven design (DDD) · Decomposition patterns (business capability, subdomains) **Self-Learning Topics:** Study: business capability, subdomains	05	4
V	**Spring Cloud and Service Discovery** • Introduction to Spring Cloud ecosystem · Eureka Server & Eureka Client	05	5

	· Ribbon for client-side load balancing (deprecated → Resilience4j recommended) · Spring Cloud Config Server **Self-Learning Topics:** Explore: Spring Cloud Config Server		
VI	**Inter-Service Communication and API Gateway** • REST template and WebClient · Feign clients · API Gateway using Spring Cloud Gateway · Filtering, Routing, Rate Limiting **Self-Learning Topics: Self-study** Routing, Rate Limiting	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Lab Contents:

Sr. No.	Practical Title	CO Mapped
1	User Management System with REST APIs	CO3
2	E-Commerce Microservices System	CO4
3	Hotel Booking or Library System	CO4
4	Dockerized REST API	CO5
5	CRUD, Spring Data JPA, REST controllers	CO5
6	Product, Cart, Order services, Eureka, API Gateway	CO5
7	Microservices with Feign Clients and Config Server	CO6
8	Dockerfile, Postgres, Spring Boot	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the practical's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. *Spring Microservices in Action* – John Carnell (Manning)
2. *Spring Boot in Action* – Craig Walls (Manning)

Reference Books:

- *Cloud Native Java* – Josh Long & Kenny Bastani (O'Reilly)

Useful Links:

1. https://spring.io/projects/spring-boot
2. https://spring.io/guides
3. Baeldung Spring Tutorials

Course Title: Universal Human Values												
Semester: III			**Term:** Odd				**Course Code:** 25MCAVEC301					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	3	10	10	30	25	-	75

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To help students consciously develop the ability to understand human aspirations and harmony in life.
2. To provide a holistic perspective of self, family, society, and nature.
3. To understand the value-based universal human order and its application.
4. To develop ethical competence to evaluate and resolve day-to-day dilemmas.
5. To encourage self-exploration as a means to personal and professional growth.
6. To nurture values of mutual respect, trust, and responsibility in real-life situations.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Understand the significance of universal human values in personal and professional life.
CO 2 - Develop clarity about human aspirations and human relationships.
CO 3 - Apply ethical reasoning in real-life decisions.
CO 4 - Recognize the importance of harmony with society and nature.
CO 5 - Build responsible behavior toward self, family, society, and environment.
CO 6 - Cultivate self-confidence and holistic thinking to navigate life's challenges.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Human Values** Need, Basic Guidelines for Value Education, Self-exploration as the process of self-evolution, Natural Acceptance & Experiential Validation.. **Self-Learning Topic**: Reflective journaling on personal values.	05	1
II	**Understanding Harmony in the Self** Understanding human aspirations, Understanding harmony in the Self (I) and Body, Physical needs and mental needs, Self-regulation. **Self-Learning Topics:** Self-study: Mindfulness and self-awareness practices.	05	2
III	**Harmony in Family and Relationships** Trust as the foundation of relationships, Respect and its meaning, Difference between intention and competence, Understanding Human Relationships.. **Self-Learning Topics:** Reading: Stories from Indian philosophy and world literature on relationships.	05	3
IV	**Harmony in Society and Nature** Universal Human Order, Undivided Society and Universal Order, The interconnection of human life and nature, Co-existence and sustainability. **Self-Learning Topics:** Case Study: Social reforms & ethical businesses.	05	4
V	**Implications of Human Values on Professional Ethics** Ethical human conduct, competence, and character in work life, Conflict resolution, Social responsibility of professionals. **Self-Learning Topics:** Explore: Codes of ethics in professions like Engineering, Law, and Medicine.	05	5
VI	**Holistic Living and Universal Human Order** Harmony in the Self, Family, Society, Nature and Existence, Roadmap for holistic development, Living with definite Human Conduct. **Self-Learning Topics:** Watch & discuss: Videos by Dr. A.P.J. Abdul Kalam on human excellence.	05	6
	Total Hours	30	

Minimum 6-8 tutorials based on syllabus will be conducted.

Tutorial Contents:

Sr. No.	Tutorial / Activity Title	CO Mapped
1	Reflection: Understanding Self vs. Body	CO2
2	Group Discussion: Values vs. Skills	CO1
3	Case Study: Trust in Relationships	CO3
4	Role Play: Ethical Decision-Making	CO5
5	Observation Exercise: Nature's Harmony	CO4
6	Debate: Growth vs. Sustainable Development	CO4
7	Documentary Analysis: Human Values in Society	CO6
8	Storytelling: Ethical Dilemmas	CO3
9	Personal Journal: My Aspiration and My Goals	CO1
10	Group Presentation: A Value-Based Society	CO6

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the Tutorial's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study

3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. R.R. Gaur, R. Sangal, G.P. Bagaria — *A Foundation Course in Human Values and Professional Ethics*, Excel Books.
2. Subramanian R. — *Professional Ethics*, Oxford University Press.

Reference Books:

1. Mike W. Martin, Roland Schinzinger — *Ethics in Engineering*, McGraw-Hill.
2. E. G. Seebauer, Robert L. Barry — *Fundamentals of Ethics for Scientists and Engineers*, Oxford.
3. B.L. Bajpai — *Indian Ethos and Modern Management*, New Royal Book Co.

Useful Links:

1. https://www.aiCTE-india.org/uhv — AICTE UHV Portal
2. https://www.happyhumanvalues.com/ — Human Values Learning Resources
3. https://nptel.ac.in/courses/109/104/109104115/ — NPTEL Course on Human Values

Course Title: Project I												
Semester: III			**Term:** Odd				**Course Code:** 25MCAPRJ301					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	6	-	-	3	3	-	-	-	25	100	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To apply theoretical knowledge and technical skills to solve real-world problems.
2. To develop independent project planning, execution, and reporting abilities.
3. To encourage creativity, critical thinking, and collaborative problem-solving.
4. To strengthen the understanding of professional software or system development life cycles.
5. To document and communicate project outcomes in a structured and formal manner.
6. To nurture self-confidence in handling complex technical challenges and proposing viable solutions.

Course Outcomes:

At the end of the course students will be able to:

CO 1 - Identify and define a real-world or research problem statement.

CO 2 - Apply suitable design principles, algorithms, and tools for the development of a project solution.

CO 3 - Demonstrate the ability to work independently or in a team to deliver the project objectives.

CO 4 - Evaluate and justify design decisions based on requirements and constraints.

CO 5 - Prepare structured project documentation following professional standards.

CO 6 - Present and defend the project work during oral evaluations.

Course Contents:

Phase	Description	Hours	Deliverable
Phase 1	Project Idea Finalization and Proposal	10	Synopsis Document
Phase 2	Literature Survey and Requirement Analysis	15	Literature Survey Report
Phase 3	Design and Methodology Development	20	System Design Document
Phase 4	Implementation and Coding	40	Functional Project Module(s)
Phase 5	Testing, Validation, and Optimization	20	Test Cases & Results Report
Phase 6	Project Report Compilation and Viva Preparation	15	Final Project Report + Presentation

Project Types Suggested

- Application Development Projects (Web, Mobile, Desktop)
- Data Analytics & Visualization Projects
- Machine Learning / AI Model Development
- Database System Implementation
- Simulation and System Modeling Projects
- Industry / Research Problem Solving Projects

Documentation Guidelines

The final project report should typically contain:

1. Abstract
2. Problem Statement
3. Objectives and Scope
4. System Design
5. Implementation Details
6. Results and Testing
7. Conclusion & Future Enhancements
8. References

Assessment Scheme (CA: Continuous Assessment)

Component	Marks
Problem Definition & Scope	10
Literature Survey	10
Methodology / Design Approach	20
Implementation & Testing	30
Report Quality & Documentation	15
Viva / Presentation	15
Total	**100**

Oral/Practical

Presentation of Project I with running project, evaluation as per scheme

Suggested Resources

1. IEEE Xplore Digital Library
2. SpringerLink
3. GitHub repositories for Open-source examples
4. Google Scholar for research papers
5. Stack Overflow & Technical Forums
6. NPTEL, MIT OpenCourseWare, Coursera for tutorials

Syllabus
For

Second Year
Master of Computer Application
(MCA)

Semester – IV

(With Effect from 2025 – 2026)

Course Title: Management Principles												
Semester: IV			**Term:** Even				**Course Code:** 25MCAOE40116					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1 To introduce the fundamental concepts and functions of management.

2 To understand the evolution and various schools of management thought.

3 To explore the roles, responsibilities, and skills required by managers.

4 To explain the decision-making process and the significance of planning and organizing.

5 To analyse leadership styles, motivation theories, and their impact on performance.

6 To understand modern trends in management including quality control, CSR, and business ethics.

Course Outcomes:

At the end of the course students will be able to:

CO1: Describe the functions, principles, and nature of management.

CO2: Examine classical, behavioural, and modern management theories.

CO3: Demonstrate understanding of managerial roles and skills in different organizational contexts.

CO4: Apply planning, organizing, and decision-making techniques in business scenarios.

CO5: Analyse leadership and motivational approaches to improve organizational effectiveness.

CO6: Evaluate ethical practices, quality initiatives, and social responsibility in management.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Management**: Definition, Nature, Scope, Levels of Management, Roles of Manager, Management vs Administration, Managerial Skills, Challenges in 21st Century. **Self-Learning Topic**: Evolution of Indian Management Thought, Current Trends in Management	07	1
II	**Evolution of Management Thought**: Classical, Behavioral, Quantitative, and Modern Approaches (Systems and Contingency Theory), Contributions by Taylor, Fayol, and Mayo. **Self-Learning Topics:** Self-study: Mindfulness and self-awareness practices.	07	2
III	**Planning and Decision Making** : Meaning, Nature, Types of Plans, Steps in Planning, MBO, Decision Making Process, Types of Decisions, Tools and Techniques. **Self-Learning Topics:** SWOT Analysis, Strategic vs Operational Planning	08	3
IV	**Organizing**: Organization Structure, Principles, Departmentation, Delegation, D Span of Control, Line and Staff Relationship. .**Self-Learning Topics:** Virtual Organizations, Matrix Structures	centraliz ation, 07	4
V	**Leadership, Motivation and Communication:** Leadership Styles, Theories (Trait, Behavioral, Contingency), Motivation Theories (Maslow, Herzberg, McGregor), Communication Process and Barriers**.** **Self-Learning Topics:** Emotional Intelligence in Leadership, Non-verbal Communication	08	5
VI	**Controlling and Emerging Trends**: Steps in Control Process, Types of Control, Budgetary and Non-Budgetary Control, TQM, Corporate Social Responsibility (CSR), Business Ethics, Green Management.. **Self-Learning Topics:** Six Sigma, Triple Bottom Line Approach, Sustainable Management Practices	08	6
	Total Hours	45	

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the Tutorial's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, McGraw-Hill Education

Reference Books:

1. Stephen P. Robbins and Mary Coulter, *Management*, Pearson Education.
2. Richard L. Daft, *Management*, Cengage Learning.
3. James A. F. Stoner, R. Edward Freeman, Daniel R. Gilbert, *Management*, Pearson Education.
4. L.M. Prasad, *Principles and Practice of Management*, Sultan Chand & Sons.

Useful Links:

1. https://www.managementstudyguide.com
2. https://www.coursera.org/learn/foundations-of-management
3. https://nptel.ac.in/courses/110/105/110105146
4. https://www.khanacademy.org/economics-finance-domain/core-finance

Course Title: Project Management												
Semester: IV			**Term:** Even				**Course Code:** 25MCAOE40123					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand the fundamentals of project management and its significance in business success.
2. To develop skills in project planning, scheduling, and execution.
3. To apply tools and techniques for budgeting, resource allocation, and risk management.
4. To introduce monitoring and control mechanisms for project performance.
5. To gain knowledge about project quality assurance and team management.
6. To explore modern trends in project management including agile and sustainability practices.

Course Outcomes:

At the end of the course students will be able to:

CO1: Explain the concept, life cycle, and classification of projects.

CO2: Prepare project plans, schedules, and define project scope and deliverables.

CO3: Use appropriate tools for cost estimation, budgeting, and resource management.

CO4: Identify risks and apply strategies to manage them effectively.

CO5: Apply monitoring techniques to ensure project quality, timelines, and performance.

CO6: Demonstrate an understanding of agile methodologies, sustainability, and ethical practices in project execution.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Project Management**: Definition, objectives, characteristics, project life cycle, roles of project manager, types of projects. **Self-Learning Topic**: Case study of successful/failed projects	07	1
II	**Project Planning and Scheduling:** Scope management, WBS, project scheduling techniques – Gantt Chart, CPM, PERT. **Self-Learning Topics:** Self-study: Mindfulness and self-awareness practices.	07	2
III	**Project Cost Estimation and Budgeting**: Estimation techniques, cost control, project funding and financial appraisal. **Self-Learning Topics:** Microsoft Project or any scheduling tool basics	08	3
IV	**Resource Management and Risk Management**: Resource leveling, resource allocation, types of risks, risk analysis and mitigation strategies. **Self-Learning Topics:** Risk Register & Monte Carlo simulation basics	07	4
V	**Project Monitoring and Control:** Monitoring tools, Earned Value Management (EVM), control charts, variance analysis. **Self-Learning Topics:** Key Performance Indicators (KPIs) in projects	08	5
VI	**Modern Trends and Ethics in Project Management**: Agile Project Management, Scrum framework, sustainable project practices, stakeholder engagement, ethics in project execution. **Self-Learning Topics:** PMBOK vs Agile comparison, PMI Code of Ethics	08	6
	Total Hours	45	

Note: A judicial mix of minimum 8-10 experiments needs to be performed out of which, the Tutorial's marked as ' * ' are compulsory.

Evaluation and Assessment Scheme:

Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other (as per the permission)

Note: Number of activities to be conducted under TAE would be as per the subject need.

Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Text Books:

1. **K. Nagarajan**, *Project Management*, New Age International Publishers.

Reference Books:

1. **Harold Kerzner**, *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, Wiley.
2. **Prasanna Chandra**, *Projects: Planning, Analysis, Selection, Financing, Implementation and Review*, McGraw-Hill.
3. **Pinto, Jeffrey K.**, *Project Management: Achieving Competitive Advantage*, Pearson.
4. **PMI**, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Latest Edition.

Useful Links:

1. https://www.pmi.org
2. https://www.coursera.org/specializations/project-management
3. https://nptel.ac.in/courses/110/105/110105146
4. https://www.edx.org/course/introduction-to-project-management

Course Title: Internship												
Semester: IV			**Term:** Even				**Course Code:** 25MCAOJT401					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
--	--	32	--	--	16	16	--	--	--	100	200	300

Course Objectives: The course aim to

Sr. No.	Course Objective
01	Prepare students to excel in computer applications to succeed in industry/ technical Professions.
02	Train students with good computing breadth so as to comprehend, analyze, design And create computing solutions for the real life problems.
03	Learn professional skills and international relationships in a professional Environment.
04	Design a system, component or process as per needs and specification of the Clients.
05	Apply theoretical knowledge and technical skills in a real-world industry environ-ment under professional supervision.
06	Develop workplace competencies such as teamwork, communication, problem-solving, and adherence to organizational protocols during the internship tenure.

Course Outcomes: On successful completion of course learner/student will be able to

Sr. No.	Course Outcome	Bloom Level
CO1	Demonstrate skills to use modern tools, software and equipment To analyze problems.	Understanding
CO2	Develop an exposure to real life organizational and environmental Situations.	Analyzing
CO3	Apply SDLC phases in developing software projects and in Writing the project document.	Applying
CO4	Create computing solutions for the real life problems as per the Requirements of the domain.	Creating
CO5	Adapt professional and interpersonal ethics.	Creating
CO6	Document internship experiences through structured reports, reflec-tive journals, and professional presentations to evaluate personal growth and project impact.	Evaluating

Assessment:
Internal Assessment Test: 100 marks

Internal Assessment consists of two presentations of 50 marks each. The final marks should be the sum of the two presentations.

End Semester Assessment: 200 marks

End semester assessment will be of 200 marks

Course Title: Research Paper												
Semester: IV			**Term:** Even			**Course Code:** 25MCAPRJ401						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
1	--	--	1	--	--	1	--	--	--	50	50	100

Course Objectives: The course is aimed to

Sr. No.	Course Objective
01	Understand analytic approach towards choosing a research paper and acquiring research skills.
02	Access relevant data and present new ideas related to area of research.
03	Adhere to ethical standard of research.
04	Understand what constitutes plagiarism and how to use proper citation styles.
05	Develop critical thinking to evaluate existing literature and identify research gaps effectively.
06	Formulate a clear research problem statement and propose a feasible methodology aligned with the chosen domain.

Course Outcomes: On successful completion of course learner/student will be able to

Sr. No.	Course Outcome	Bloom Level
CO1	Show data coherently, effectively and counter-hypothesis.	Understanding
CO2	Apply experience in preparation of research material for publication or presentation.	Applying
CO3	Identify relevant previous work that supports their research.	Applying
CO4	Analyze data and synthesize research findings.	Analyzing
CO5	Create research paper.	Creating
CO6	Defend research contributions and respond to peer/review feedback during presentation and publication process.	

Following are the guidelines for Research Paper, MCA Sem.- IV:

- A Student shall do a in depth study in the specialized area by doing a survey of published technical literature and write a research paper in IEEE format (6-9 pages or 2000 to 3000 words) during second year (final year) of MCA program.

- The research topic must be approved from the Institute. The institute should set up a committee/Supervisor/Research Guide to scrutinize the topics and finalize the same
- The research paper may be written in a group of maximum 2 students under the guidance of Supervisor/Research Guide.
- The research paper must be published/presented in national/international conference or national/ international journal.

b. **The paper structure should follow the IEEE format:**

c. **The following points are to be included in the Research Paper presentation:**

- Introduction
- Literature Review
- Problem Definition
- Objective/Scope
- Research Methodology
- Analysis & Findings
- Limitations & Future Scope
- Conclusion

d. **Reference**:

- James D. Lester , Writing Research Papers: A Complete Guide (10th Edition).
- How to Write a Great Research Paper, Book Builders, Beverly Chin, July 2004, Jossey-Bass.
- Kothari C. R. (2004), "Research Methodology, Methods and techniques" (2nd edition), New Delhi: New age International (p) Ltd.

e. Web References:

- https://www.ieee.org/publications_standards/publications/authors/author_guide_interactive.pdf
- http://www.fcsresearch.org/index.php?option=com_content&view=article&id=83&Itemid=166
- https://www.ece.ucsb.edu/~parhami/rsrch_paper_gdlns.htm
- http://nob.cs.ucdavis.edu/classes/ecs015-2007-02/paper/citations.html

Assessment:

Internal Assessment: 50 marks

Internal Assessment consists of two presentations of 25 marks each. The marks distribution of two presentations is as given below:

Presentation I (Mid Term)	**Marks**	**Presentation II (Mid Term)**	**Marks**
Abstract, Introduction	05	Research Methodology	05
Literature Review	05	Analysis, Findings & Conclusion	10
Objectives/Scope	10	Publication	05
Presentation	05	Presentation	05
Total	**25**	**Total**	**25**

These two presentations should be taken at Institute level by the Committee/Supervisor/Research Guide.

VISION

Excellence in Engineering Education & Creating Next-Gen Leaders / Managers in the Service of Society"

MISSION

- **To impart quality engineering education for holistic development**
- **To provide conducive environment for joyful learning, innovation and research**
- **To promote innovative technology enabled teaching and learning process**
- **To nurture socially responsible engineers, entrepreneurs and leaders**
- **To enhance employability skills to meet the changing industrial trends**