University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Institute of Engineering & Management, New Town Campus

University of Engineering & Management, Jaipur

3rd Semester Syllabus for BCA Admission Batch 2025

BCA 2025 Course structure									
SEMESTER 3									
SL NO	**TYPES OF COURSE**	**SUB CODE**	**SUB NAME**	**L**	**T**	**P**	**S**	**TOTAL CONTACT HRS**	**CREDIT POINTS**
THEORY									
1	Computer Science & Application	BCACC301	Design & Analysis of Algorithms	3	1	0	0	4	4
2	Computer Science & Application	BCACC302	Operating Systems	3	1	0	0	4	4
3	Computer Science & Application	BCACC303	Artificial Intelligence using Python	3	1	0	0	4	4
4	Ability Enhancement Course	BCAAE301	Environmental Studies	3	1	0	0	4	4
5	Value Added Course	BCAGS301	General Studies & Current Affairs -III	2	0	0	0	2	2
PRACTICAL									
6	Computer Science & Application	BCACC392	Operating Systems lab	0	0	4	0	4	2
7	Computer Science & Application	BCACC393	Programming lab with python	0	0	4	0	4	2
SESSIONAL									
8	Skill Enhancement Course	BCAGS381	Competitive Aptitude Training-III	0	0	0	2	2	2
9	Ability Enhancement Course	BCAAE381	Business Ethics & Corporate Governance	0	0	0	2	2	2
MOOCS/MAR/IFC									
10	Value Added Course	MOOCs	Massive Open Online Course	0	0	0	0	0	0
11	Value Added Course	IFC	Industry and foreign certification	0	0	0	0	0	0
12	Value Added Course	MAR	Mandatory Additional Requirements(MAR)	0	0	0	0	0	0
								30	26

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Syllabus and Lesson Plan for BCA Admission Batch 2025

Subject Name: **Design and Analysis of Algorithms** Credit: 4 Lecture Hours: 40
Subject Code: **BCACC301**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Prof. Kaustav Sarkar
2. Prof. Bisweswar Thakur
3. Prof. Raimoni Hansda

Pre-requisite: Basic knowledge of data structures, logic building, and programming in C/C++

Relevant Links:

1. Link for Study Material:
https://drive.google.com/file/d/1PqePorgnsiqtcwOtAfVR6L90Vc0sUkNP/view?usp=drive_link

2. Link for NPTEL Course:
https://archive.nptel.ac.in/courses/106/105/106105164/

3. Link for Coursera Course:
https://www.coursera.org/learn/algorithmic-toolbox

4. Link for LinkedIn Learning Course:
https://www.linkedin.com/learning/foundations-of-algorithmic-thinking-with-python/importance-of-algorithmic-thinking?u=229219690

COURSE OBJECTIVES:

1. To study basic concepts of algorithm design and performance analysis.
2. To explore strategies like Divide & Conquer, Greedy, Dynamic Programming, and Backtracking.
3. To apply algorithms in graph problems and optimization tasks.
4. To understand NP-completeness and intractable problems.

COURSE OUTCOMES:

CO1: Analyse algorithm efficiency using theoretical and empirical approaches.
CO2: Apply appropriate algorithmic techniques to solve real-world problems.
CO3: Design algorithms using various strategies such as divide-and-conquer, greedy, and dynamic programming.
CO4: Identify intractable problems and understand the relevance of NP-completeness.

Module No.	Topic	Sub-Topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
Module 1	Introduction to Algorithm Analysis	Characteristics of algorithms, performance analysis, time & space complexity	Horowitz & Sahni (Ch. 1), Cormen (Ch. 1–3)	**Academia**: MIT OCW – https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006 **Industry**: HackerRank, LeetCode problem-solving frameworks	2
	Asymptotic Analysis	Big-O, Ω, Θ notations, growth of functions, complexity comparison	Cormen (Ch. 3)	**Academia**: Stanford Algorithms Course - https://www.coursera.org/specializations/algorithms **Industry**: Runtime estimation in web search, ML model optimization	2
	Algorithm Analysis and Recursion	Sequential Search, Bubble Sort, Selection Sort, Insertion Sort, Matrix Multiplication, Recursion, Recursive analysis, Master's Theorem	Cormen (Ch. 2, 4), Horowitz (Ch. 2)	**Academia**: https://www.cs.princeton.edu/~guna/226/info.html **Industry**: Image processing, divide & conquer algorithms in libraries like OpenCV	4

Module 2	Divide and Conquer Algorithms	Binary Search, Maximum-Minimum, Merge Sort, Quick Sort, Best/Worst Case Analysis	Cormen (Ch. 4)	**Academia**: https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/ **Industry**: Sorting/search in DBMS, compiler optimizations	3
	Advanced Divide and Conquer	Strassen's Matrix Multiplication, Lower Bound for Comparison Sorting	Cormen (Ch. 4)	**Academia**: https://www.youtube.com/watch?v=EcT-Jt5WStw **Industry**: Data compression (ZIP), deadline-based CPU scheduling	2
	Greedy Algorithms	Fractional Knapsack, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm	Cormen (Ch. 16, 21, 22, 24), Horowitz (Ch. 3)	**Academia**: Stanford Algorithms **Industry**: Network design, cable layout, spanning tree in routing protocols	3
Module 3	Dynamic Programming	Fibonacci Series, Binomial Coefficients, 0/1 Knapsack	Cormen (Ch. 15), Horowitz (Ch. 5)	**Academia**: https://www.udacity.com/course/data-structures-and-algorithms-nanodegree--nd256 **Industry**: Path planning, resource optimization in cloud platforms	3
	Shortest Path Algorithms	Floyd-Warshall Algorithm, All-Pairs Shortest Path	Cormen (Ch. 23)	**Academia**: https://onlinecourses.nptel.ac.in/noc24_cs92/preview **Industry**: Path-finding (Google Maps), dynamic routing in traffic systems	2
	Graph Algorithms	BFS, DFS, Connected Components, DFS of Directed Graphs, Topological Sorting	Cormen (Ch. 22)	**Academia**: Georgia Tech CS1332 - https://www.edx.org/certificates/professional-certificate/gtx-data-structures-and-algorithms **Industry**: Friend suggestions in Facebook, recommender systems	3

Module 4	Backtracking Algorithms	N-Queen Problem, Sum of Subsets, Hamiltonian Circuit, Vertex Cover Problem	Horowitz (Ch. 6), Aho et al.	**Academia**: Princeton Recursive Problem Solving **Industry**: Constraint satisfaction in scheduling, puzzle solvers	4
	Computational Complexity	Non-deterministic Algorithms, Complexity Classes (P, NP, NP-Complete, NP-Hard)	Cormen (Ch. 34), Horowitz (Ch. 7)	**Academia**: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006 **Industry**: Logistics & delivery optimization (e.g., Amazon, FedEx)	4
Module 5	Algorithms Behind Everyday Technology	Search ranking and complexity intuition; GPS/Maps pathfinding walkthrough; social-feed ordering logic	Cormen (Ch. 22, 24–25) – applied refresher; Guest Lecture and Seminar Notes	**Academia:** Stanford Algorithms Course – https://www.coursera.org/specializations/algorithms **Industry:** Google Search, Google Maps, Uber/Ola routing	2
	Graph-Based Route Optimization	Implementing a Dijkstra/greedy-based shortest-path route finder on a small city-map dataset	Cormen (Ch. 24–25) – lab application	**Academia:** NPTEL Graph Algorithms – https://onlinecourses.nptel.ac.in/noc24_cs92/preview **Industry:** Navigation and logistics apps (Maps, ride-hailing, delivery routing)	2
	Dynamic Programming in Emerging Domains	DNA sequence alignment (Needleman-Wunsch/BLAST); greedy/similarity-based recommendation engines	Horowitz (Ch. 5), Cormen (Ch. 15) – applied refresher	**Academia:** NPTEL/Coursera Bioinformatics Algorithms **Industry:** Genome sequencing tools, Netflix/Spotify-style recommenders	2
	NP-Hardness and Approximation in Industry-Scale Problems	Cryptographic hashing, VLSI design, scheduling; approximation and heuristic approaches	Cormen (Ch. 34), Horowitz (Ch. 7) – applied refresher	**Academia:** CMU Theoretical CS – https://www.cs.cmu.edu/~15251/course-info.html **Industry:** Blockchain, EDA/VLSI tools, airline and exam-timetable scheduling	2

Module 1: Introduction analysis of algorithms:

2nd Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)
2nd Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)
2nd Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

Working Day	Lesson Plan Description
Day 1	Introduction to algorithms, characteristics and problem-solving methodology
Day 2	Performance analysis; time and space complexity; primitive operations
Day 3	Asymptotic notations (Big-O, Big-Ω and Big-Θ) with examples
Day 4	Complexity analysis of Sequential Search, Bubble Sort and Selection Sort
Day 5	Complexity analysis of Insertion Sort and Matrix Multiplication
Day 6	Introduction to recursion and recursive algorithm analysis
Day 7	Recurrence relations and solving using substitution and recursion-tree methods
Day 8	Master's Theorem and applications in recursive algorithm analysis

Module 2: Divide-&-Conquer and Greedy Method

2nd Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)
2nd Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)
2nd Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

Working Day	Lesson Plan Description
Day 9	Divide and Conquer strategy; Binary Search algorithm
Day 10	Finding Maximum-Minimum; Merge Sort algorithm and analysis
Day 11	Quick Sort: partition strategy and complexity analysis
Day 12	Strassen's Matrix Multiplication and Lower Bound for sorting
Day 13	Greedy strategy and Fractional Knapsack Problem
Day 14	Minimum Spanning Trees: Prim's Algorithm
Day 15	Minimum Spanning Trees: Kruskal's Algorithm
Day 16	Dijkstra's Single Source Shortest Path Algorithm and applications

Module 3: Dynamic Programming and Graph Algorithms:

2nd Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)
2nd Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)
2nd Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

Working Day	Lesson Plan Description
Day 17	Dynamic Programming: principles, optimal substructure and overlapping sub problems
Day 18	Fibonacci sequence and Binomial Coefficients using Dynamic Programming
Day 19	0/1 Knapsack Problem using Dynamic Programming
Day 20	Floyd-Warshall Algorithm for All-Pairs Shortest Paths
Day 21	Graph representation; Breadth First Search (BFS)
Day 22	Depth First Search (DFS) and Connected Components
Day 23	DFS of Directed Graphs and Topological Sorting
Day 24	Graph algorithm practice and real-world applications

Module 4: Backtracking and Computational Complexity:

2nd Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)
2nd Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)
2nd Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

Working Day	Lesson Plan Description
Day 25	Backtracking strategy, state-space tree and pruning
Day 26	N-Queen Problem using Backtracking
Day 27	Sum of Subsets and Hamiltonian Circuit Problems
Day 28	Vertex Cover Problem and applications
Day 29	Computational Intractability and Non-deterministic Algorithms
Day 30	Complexity Classes: P, NP, NP-Hard and NP-Complete

Day 31	Introduction to NP-Complete Problems and computational limitations
Day 32	Comprehensive problem solving and complexity analysis

Module 5: Applications of Algorithms in Modern Computing

2nd Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)
2nd Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)
2nd Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

Working Day	**Lesson Plan Description**
Day 33	Algorithms behind Google Search, social media ranking and GPS navigation systems
Day 34	Graph-Based Route Optimization using Dijkstra's Algorithm on city-map datasets
Day 35	Route optimization laboratory using shortest-path algorithms
Day 36	Dynamic Programming in Bioinformatics: DNA sequence alignment and genome analysis
Day 37	Recommendation systems using Dynamic Programming and Greedy techniques (Netflix/Spotify case studies)
Day 38	NP-Hard Problems in Blockchain, VLSI Design, Scheduling and Cryptography
Day 39	Approximation Algorithms, Heuristics and Industry Case Studies
Day 40	Competitive Programming, Industry-oriented problem solving and comprehensive course revision

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	2	2	2	–	–	–	–	1	–	2
CO2	2	**3**	**3**	**3**	**3**	1	–	–	1	2	1	2
CO3	**3**	**3**	**3**	2	**3**	–	–	–	1	2	–	2
CO4	**3**	**3**	2	**3**	2	–	–	–	–	1	–	2

- 3 – High
- 2 – Moderate
- 1 – Low
- – No Significant Correlation

Learning Resources:

Text Books:				
Name of Author	Title of the Book	**Edition/ISSN/ISBN**	**Name of the Publisher**	
Horowitz, Sahni, Rajasekaran	Computer Algorithms	2nd Edition	Universities Press	Download eBook
Cormen, Leiserson, Rivest, Stein	Introduction to Algorithms	4th Edition	MIT Press/McGraw-Hill	Download eBook
Reference Books:				
Aho, Hopcroft, Ullman	The Design and Analysis of Computer Algorithms	Addison Wesley	Aho, Hopcroft, Ullman	Download eBook

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	**September 07, 2026- September 11, 2026**	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2	**October 30, 2026- November 05, 2026**	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination	**November 30, 2026- December 16, 2026**	Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
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University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for BCA Admission Batch 2025

Subject Name: **Operating Systems** Credit: 4 Lecture Hours: 40
Subject Code: **BCACC302**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Dr. Goldina Ghosh
2. Dr. Priti Deb

Pre-requisite: Proficiency in programming, data structures, computer architecture, and discrete mathematics.

Relevant Links:

1. Link for Study Material:
BCACC302_Operating System Study Material.pdf

2. Link for Coursera Course:
https://www.coursera.org/specializations/codio-introduction-operating-systems

3. Link for LinkedIn Learning Course:
https://www.linkedin.com/learning/iot-foundations-operating-systems-fundamentals/welcome?u=229219690

4. Link for Infosys Springboard Course:
https://infyspringboard.onwingspan.com/web/en/login?ref=%2Fapp%2Ftoc%2Flex_auth_013501567713411072995 0%2Foverview

COURSE OBJECTIVES:

1. To deliver a detailed knowledge of integral software in a computer system –Operating System.
2. To understand the working of operating system as a Process manager and a Resource manager.
3. To familiarize the students with Process, Threads, Deadlock Handling and Memory management.
4. To describe the problem of Process Scheduling and Process Synchronization and its solution.

COURSE OUTCOMES:

CO1: Students will develop the concept in understanding the principles and tasks of operating systems.
CO2: They will be able to apply CPU scheduling algorithms to manage tasks and also learn the different concepts of deadlock handling.
CO3: They will also develop initiation into the process of applying memory management methods and allocation policies.
CO4: Finally the students will also have knowledge in file system management.

Module number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1	**Introduction** **Operating-System Structures** **Processes** **Threads**	What is an Operating system, Mainframe system, Desktop system, Multiprocessor system, Distributed system, Clustered Systems, Real-time systems System Components, OS Services, System calls, System Programs, System Structure Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, Communication in Client–Server Systems Overview, Multithreading Models, Threading Issues	**Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 1,Chapter 2,Chapter 3, Chapter 4)**	***International Academia:*** (https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/) ***Industry Mapping:*** Docker, Microsoft Azure	6

2	**CPU Scheduling** **Process Synchronization** **Deadlocks**	Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time CPU Scheduling Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	**Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 5,Chapter 6,Chapter 7,Chapter 8)**	***International Standards:*** (https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/) (https://ocw.mit.edu/courses/6-829-computer-networks-fall-2002/resources/l0singlelink/) ***IndustryMapping:*** Docker, Microsoft Azure	10
3	**Memory Management** **Virtual Memory** **Mass-Storage Structure**	Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table, Segmentation with paging Background, Demand Paging, Page Replacement, Allocation of Frames, Thrashing Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure	**Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 9,Chapter 10,Chapter 11,Chapter 12)**	***International Standards:*** (https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/ ***Industry Mapping :*** AWS, VxWorks	10

4	**File-System Interface** **File-System Implementation**	File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance	**Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 13,Chapter 14,Chapter 15)**	***International Standards: (*** https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/) ***Industry Mapping: Industry Mapping:*** AWS, VxWorks	10
5	**Linux/UNIX Operating System Commands**	Basic Linux commands Shell programming File permissions	**Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 21)**	***International Standards: (*** https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/) ***Industry Mapping: Industry Mapping:*** AWS, VxWorks	4

Module 1: Introduction

2nd Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

Working Days	Lesson Plan Description
Day 1	Introduction to OS: What is an OS, Mainframe, Desktop systems
Day 2	Multiprocessor, Distributed, Clustered, Real-time systems
Day 3	System Components, OS Services
Day 4	System Calls, System Programs
Day 5	System Structure
Day 6	Process Concept
Day 7	Process Scheduling
Day 8	Operations on Processes
Day 9	Interprocess Communication
Day 10	Communication in Client–Server Systems
Day 11	Threads: Overview, Multithreading Models
Day 12	Threads: Threading Issues

Module 2: CPU Scheduling, Process Synchronization, Deadlocks

2nd Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

Working Days	Lesson Plan Description
Day 13	CPU Scheduling: Basic Concepts, Scheduling Criteria
Day 14	Scheduling Algorithms
Day 15	Multiple-Processor Scheduling
Day 16	Real-Time CPU Scheduling
Day 17	Process Synchronization: Background, Critical-Section Problem
Day 18	Peterson's Solution, Synchronization Hardware
Day 19	Mutex Locks, Semaphores
Day 20	Classic Problems of Synchronization
Day 21	Monitors
Day 22	Deadlocks: System Model, Deadlock Characterization
Day 23	Methods for Handling Deadlocks
Day 24	Deadlock Prevention, Deadlock Avoidance
Day 25	Deadlock Detection, Recovery from Deadlock

Module 3: Memory Management, Virtual Memory, Mass-Storage Structure

2nd Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

Working Days	Lesson Plan Description
Day 26	Memory Management: Background, Swapping
Day 27	Contiguous Memory Allocation
Day 28	Segmentation and paging
Day 29	Structure of the Page Table
Day 30	Segmentation with Paging
Day 31	Virtual Memory: Background, Demand Paging

Day 32	Page Replacement
Day 33	Allocation of Frames and Thrashing
Day 34	Disk Scheduling
Day 35	Disk Management
Day 36	Swap-Space Management and RAID Structure

Module 4: File-System Interface and Implementation

2nd Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

Working Days	Lesson Plan Description
Day 37	File-System Interface: File Concept, Access Methods
Day 38	Directory and Disk Structure, File-System Mounting
Day 39	File Sharing, Protection
Day 40	File-System Implementation: Structure and Implementation
Day 41	Directory Implementation, Allocation Methods
Day 42	Free-Space Management, Efficiency, and Performance

Module 5: Linux/UNIX Operating System Commands

2nd Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)
2nd Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

Working Days	Lesson Plan Description
Day 43	Introduction to Linux Operating System
Day 44	Basic Linux Commands: (cat, more, less, head, tail), and searching using find and grep.
Day 45	Shell Programming – Fundamentals
Day 46	Shell Programming – Control Structures
Day 47	Linux File Permissions
Day 48	Summary of Linux OS

TEXTBOOK:

1. **Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter -1,2,3,4,5,6,7,8,9,10,11,12,13,14,15)**

REFERENCEBOOKS:

1. **Operating Systems**, W. Stallings, Pearson Education

CO –PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BCAC302 CO1	2	3	3	3	2	1	1	2	2	1	1	1
BCAC302 CO2	3	2	2	3	2	1	1	2	3	1	1	1
BCAC302 CO3	2	3	3	3	2	1	1	2	3	1	1	1
BCAC302 CO4	3	2	2	3	2	1	1	2	3	1	1	1

3: Strong correlation
2: Medium correlation
1: Weak correlation

PSO1 – Technical Knowledge and Problem-Solving	Apply fundamental concepts of computer applications, programming languages, data structures, algorithms and database management to analyse and solve computational problems effectively.
PSO2 – Software Design and Development	Demonstrate the ability to design, develop, test and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3 – Professional Skills and Ethics	Exhibit effective communication, teamwork, leadership and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	**September 7, 2026-September 11,2026**	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2	**October 30,2026-November 05, 2026**	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination	**November 30,2026-December 16,2026**	Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for BCA Admission Batch 2025

Subject Name: **Artificial Intelligence using Python** Credit: 4 Lecture Hours: 40
Subject Code: **BCACC303**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Prof. Ankan Bhowmik
2. Prof. Pritam Chakraborty

Pre-requisite: Knowledge of basic mathematics and programming languages.

Relevant Links:

Study Materials Coursera LinkedIn MATLAB

COURSEOBJECTIVES:

1. To deliver comprehensive view of Artificial Intelligence
2. To enable the students to understand the Neural Network, Fuzzy Logic and Genetic Algorithms
3. To understand the design issues and working of each components of AI.
4. To familiarize with the benefits and issues regarding AI.

COURSEOUTCOMES:

CO1: To provide a strong foundation of fundamental concepts in Artificial Intelligence
CO2: To provide a basic exposition to the goals and methods of Artificial Intelligence
CO3: To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
CO4: Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

Module number	Topic	Chapter and Book Name	Sub-topics	Mapping with Industry and International Academia	Lecture Hours
1	**What is Artificial Intelligence**	**Part 1:Chapter1, Artificial Intelligence (Third Edition) Elaine Rich,Kevin Knight,Shivashankar B. Nair)**	1.1 The AI Problems 1.2 The Underlying Assumption 1.3 What is an AI Technique 1.4 The level of the Model 1.5 Criteria for Success 1.6 Some General References	***International Academia:*** (Vertex AI with Gemini 1.5 Pro and Gemini 1.5 Flash | Google Cloud) ***Industry Mapping:*** Vertex AI	8
2	**Heuristic Search Techniques**	**Part 1:Chapter3, Artificial Intelligence (Third Edition) Elaine Rich,Kevin Knight,Shivashankar B. Nair**	3.1 Generate-and-Test 3.2 Hill Climbing 3.3 Best- first Search 3.4 Problem Reduction	***International Academia:*** (Vertex AI with Gemini 1.5 Pro and Gemini 1.5 Flash | Google Cloud) ***Industry Mapping:*** Vertex AI	8
3	**Connectionist Models**	**Part 3:Chapter 18, Artificial Intelligence (Third Edition) Elaine Rich,Kevin Knight,Shivashankar B. Nair**	18.1 Introduction: Hopfield Networks 18.2 Learning in Neural Networks 18.3 Applications of Neural Networks 18.4 Recurrent Networks 18.5 Distributed Representations	***International Standards:*** (AI & Machine Learning Products & Services | Google Cloud) ***Industry Mapping : AI and machine learning products:*** Gemini 1.5 models, the latest and most advanced multimodal models in Vertex AI	8

4	**Python Programming**	**Chapter 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 20** **Python Programing, S.Sridhar, J. Indumathi, V.M. Hariharan** **Chapter 1, 2, 3, 4, 5, 7, 8, 9, 10, 13, 15, 16 18, 20** **Python Programing, Anurag Gupta, G P Biswas**	Introduction to Python, Decision Structures, Looping Statements, Introduction to Functions, List, Tuples, Sets and Dictionaries, Strings, Advanced Functions, Object Oriented Programing, File Handling, Python Exceptions, Pandas, Numpy, Introdution to Data Analytics with Python.	. ***International Standards:*** (AI & Machine Learning Products & Services | Google Cloud)	8
5	Fuzzy Logic and Genetic Algorithms	**Chapter 7,8,9,10,11,12** **Neural Networks, Fuzzy Systems, and Evolutionary Algorithms: Synthesis and Applications — S. Rajasekaran, G.A. Vijayalakshmi Pai (PHI) Second Edition**	Introduction to Fuzzy Logic and Fuzzy Sets Fuzzy Set Operations and Properties Membership Functions Applications of Fuzzy Logic Introduction to Genetic Algorithms and Biological Background Selection, Crossover and Mutation Operators Fitness Function and Genetic Algorithm Applications	International Academia: MATLAB Fuzzy Logic Toolbox; DEAP (Distributed Evolutionary Algorithms in Python) Industry Mapping: Fuzzy control systems in consumer electronics and industrial automation; Genetic Algorithms/Evolutionary Computation used in AutoML and Neural Architecture Search	8

Module 1: **What is Artificial Intelligence**

2nd Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec C (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 1	Introduction to AI
Day 2	The AI Problems
Day 3	The Underlying Assumption
Day 4	What is an AI Technique
Day 5	The level of the Model
Day 6	Criteria for Success
Day 7	Some General References
Day 8	Examples of Problem Solving Using AI.

Module 2: **Heuristic Search Techniques**

2nd Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec C (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 9	Introduction to Heuristic Search Techniques
Day 10	Generate-and-Test
Day 11	Hill Climbing
Day 12	Hill Climbing-Examples
Day 13	Best- first Search
Day 14	Best- first Search-Examples
Day 15	A* Algorithm, Simulated Annealing
Day 16	A* Algorithm-Examples, Simulated Annealing-Examples

Module 3: Connectionist Models

2nd Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec C (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 17	Introduction
Day 18	Hopfield Networks
Day 19	Learning in Neural Networks
Day 20	Learning in Neural Networks
Day 21	Learning in Neural Networks
Day 22	Applications of Neural Networks
Day 23	Recurrent Networks
Day 24	Distributed Representations

Module 4: Python Programming

2nd Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec C (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 25	Introduction to Python, Decision Structures,
Day 26	Decision Structures, Looping Statements,
Day 27	List, Tuples, Sets and Dictionaries, Strings,
Day 28	List, Tuples, Sets and Dictionaries, Strings,
Day 29	Introduction to Functions, Advanced Functions,
Day 30	Object Oriented Programing,
Day 31	File Handling, Python Exceptions
Day 32	Pandas, Numpy, Introdution to Data Analytics with Python.

Module 5: Fuzzy Logic and Genetic Algorithms

2nd Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)
2nd Year, Sec C (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

Working Days	Lesson Plan Description
Day 33	Introduction to Fuzzy Logic and Fuzzy Sets
Day 34	Fuzzy Set Operations and Properties
Day 35	Membership Functions and their types
Day 36	Applications of Fuzzy Logic

Day 37	Introduction to Genetic Algorithms and Biological Background
Day 38	Encoding Schemes, Selection, Crossover and Mutation Operators
Day 39	Fitness Function
Day 40	GA Applications

TEXTBOOK:

1. Artificial Intelligence (Third Edition) Elaine Rich, Kevin Knight, Shivashankar B. Nair
2. Python Programing, S.Sridhar, J. Indumathi, V.M. Hariharan
3. Python Programing, Anurag Gupta, G P Biswas

REFERENCEBOOKS:

1. Neural Networks,Fuzzy Systems,and Evolutionary Algorithms,Synthesis and Applications,S.Rajasekaran.G.A.Vijayalakhsmi Pai, PHI
2. Python Programing, Ritika Mehra, Cengage

CO- PO Mapping:

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	**3**	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
CO2:	**3**	**3**	**3**	**0**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**1**
CO3:	**3**	**2**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**0**	**0**	**1**
CO4:	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**0**	**0**	**1**	**1**	**1**

3: Strong correlation 2: Medium correlation 1: Weak correlation

PSO	PSO Description
PSO1	**Technical Knowledge and Problem-Solving:** Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyse and solve computational problems effectively.
PSO2	**Software Design and Development:** Demonstrate the ability to design, develop, test, and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	**Professional Skills and Ethics:** Exhibit effective communication, teamwork, leadership, and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	**September 7, 2026 to September 11, 2026**	Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
Mid Term 2	**October 30, 2026 to November 5, 2026**	Attempt 5 out of 6 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 3 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination	**November 30, 2026 to December 16, 2026**	Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

Examination Rules & Regulations:
https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus and Lesson Plan for BCA Admission Batch 2025

Subject Name: **Environmental Studies** Credit: 4 Lecture Hours: 40
Subject Code: **BCAAE301**

Maximum: 100 marks (Internal: 50 marks; External: 50 marks)

List of Faculty Members handling the Subject –

1. Prof. Shramana Dutta

Pre-requisite: Knowledge of Class X standards of Biology, Chemistry.

Relevant Links:

1. Link for Study Material:

https://drive.google.com/drive/folders/1TrdLf-13xzh09LDeDonMA-XcC0PKApep

2. Link for Coursera Course:

https://www.coursera.org/learn/sustainability
https://www.coursera.org/learn/global-environmental-management
https://www.coursera.org/learn/environmental-science

3. Link for LinkedIn Learning Course:

https://www.linkedin.com/learning/introduction-to-esg-environmental-social-and-governance https://www.linkedin.com/learning/climate-change-a-top-esg-concern

COURSE OBJECTIVES:

1. **To create awareness about environmental issues.**
2. **To nurture the curiosity of students particularly in relation to natural environment.**
3. **To develop an attitude among students to actively participate in all the activities regarding environment protection**
4. **To develop an attitude among students to actively participate in all the activities regarding environment protection**

COURSE OUTCOMES:

CO1: To enable critical thinking in relation to environmental affairs and recall the terms involved in pollution.
CO2: Understand the different sources and effects of air pollution.
CO3: Understand various sources, types of pollutants causing water pollution.
CO4: Know Soil, Noise, Thermal and Radioactive Pollutants and their effects. Study of various pollution control measures.

Module Number	Topic	Sub-topics	Chapter Name and Book	Mapping with Industry and International Academia	Lecture Hours
1.	**Environment**	Environmental science, Environmental segment, Nomenclature, Basic concept related to environmental perspective, Objective of environmental education Mathematics of population growth, Environmental degradation, Acid rain, Toxic Elements, Particulates, Pollution prevention, Environmental problems and sustainable development, Environmental Impact Assessment.	**Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 1)** **Dr. Debapriya De & Dr. Debashish De, Fundamentals of Environment & Ecology (Chapter 1)**	***International Academia: https://ocw.mit.edu/collections/environment/*** ***Industry Mapping:*** The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National Environmental Engineering Research Institute (NEERI)	7

2.	**Air & Water Pollution**	Atmosphere structure, Earth's radiation balance, Global atmospheric change, Green House effect, Global warming and its consequences, Atmospheric stability, Atmospheric dispersion, Stack and Plume, Temperature inversion Chlorofluorocarbons, Ozone, Toxic chemical in the environment, Carbon monoxide (CO), Sulphur dioxide, oxides of Nitrogen, Smog, Control of air pollution, Hydrosphere, hydrological cycle, pollutants in water, biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Oil pollution in marine environment, Water quality, Eutrophication, Ground Water, Hydraulic gradients, Darcy's Law, Flow Velocity, Water treatment Operation, Hardness of water.	**Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 4,5,6)** **Dr. Debapriya De & Dr. Debashish De, Fundamentals of Environment & Ecology (Chapter 2,3,5)**	***International Academia:*** ***https://ocw.mit.edu/collections/environment/*** ***Industry Mapping:*** The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National	10
3.	**Land Pollution & Noise Pollution and Control**	Lithosphere, Solid waste pollution, Classification of solid wastes, Solid waste Management, Hazardous wastes, Hazardous waste management, Soil, Sound and its general features, Measurement of noise level, Noise classification, Noise measurements, Harmful effects of noise pollution.	**Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 2,3)** **Dr. Debapriya De & Dr. Debashish De, Fundamentals of Environment & Ecology (Chapter 4)**	***International Academia:*** ***https://ocw.mit.edu/collections/environment/*** ***Industry Mapping:*** The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National	7

4.	**Ecology**	Ecology, Classification of Ecology, Ecological pyramids, Components of Ecosystem, Food chain, Food Web, Types of Food chain, Biogeochemical cycles.	**Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 7)** **Dr. Debapriya De & Dr. Debashish De, Fundamentals of Environment & Ecology (Chapter 6)**	***International Academia:*** ***https://ocw.mit.edu/collections/environment/*** ***Industry Mapping:*** The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National	10
5.	**Emerging Technologies, Corporate Responsibility & Climate Action**	Green Computing and E-Waste, Ways Businesses Can Go Green, Challenges of switching to green energy, Smart Cities and Smart Homes, Weather apps and google Earth, The 5 R's, Water harvesting at home, Famous Indian movements, Climate Change and Human Displacement.	**Environmental Studies and E-Waste Management, Girish Vittal Badiger.**	***International Academia:*** ***https://ocw.mit.edu/collections/ environment/*** ***Industry Mapping:*** The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National	6

Lesson Plan:

Module 1: Environment

2nd Year, Sec A, B, C (Faculty Name- Prof. Shramana Dutta)

Working Days	Lesson Plan Description
Day 1	Environmental science, Environmental segment, Nomenclature
Day 2	Basic concept related to environmental perspective, Objective of environmental education Mathematics of population growth
Day 3	Environmental degradation, Acid rain, Toxic Elements, Particulates
Day 4	Pollution prevention, Environmental problems
Day 5	Atmosphere structure, Earth's radiation balance
Day 6	Global atmospheric change, Green House effect
Day 7	Global warming and its consequences.

Module 2: Air & Water Pollution

2nd Year, Sec A, B, C (Faculty Name – Prof. Shramana Dutta)

Working Days	Lesson Plan Description
Day 8	Atmospheric stability, Atmospheric dispersion, Hazardous waste management, Soil
Day 9	Stack and Plume, Temperature inversion Chlorofluorocarbons, Ozone, Toxic chemical in the environment
Day 10	Carbon monoxide (CO), Sulphur dioxide, oxides of Nitrogen, Smog, Control of air pollution
Day 11	Hydrosphere, hydrological cycle, pollutants in water, biochemical oxygen demand (BOD),
Day 12	Chemical oxygen demand (COD), Oil pollution in marine environment,
Day 13	Water quality, Ground Water
Day 14	Eutrophication
Day 15	Hydraulic gradients, Darcy's Law
Day 16	Flow Velocity
Day 17	Water treatment Operation, Hardness of water

Module 3: Land Pollution & Noise Pollution and Control

2nd Year, Sec A, B, C (Faculty Name – Prof. Shramana Dutta)

Working Days	Lesson Plan Description
Day 18	Lithosphere
Day 19	Solid waste pollution
Day 20	Classification of solid wastes
Day 21	Solid waste Management
Day 22	Soil, Sound and its general features
Day 23	Measurement of noise level, Noise measurements , Harmful effects of noise pollution
Day 24	Measurement of noise level.

Module 4: Ecology

2nd Year, Sec A, B, C (Faculty Name – Prof. Shramana Dutta)

Working Days	Lesson Plan Description
Day 25	Ecology, Classification of Ecology
Day 26	Classification of Ecology

Day 27	Ecological pyramids, Components of Ecosystem
Day 28	Components of Ecosystem
Day 29	Food chain, Types of Food chain
Day 30	Food chain, Types of Food chain
Day 31	Food Web
Day 32	Food Web, Biogeochemical cycles
Day 33	Biogeochemical cycles
Day 34	

Module 5: Emerging Technologies, Corporate Responsibility & Climate Action

2nd Year, Sec A, B, C (Faculty Name – Prof. Shramana Dutta)

Working Days	Lesson Plan Description
Day 35	Green Computing and E-Waste, Ways Businesses Can Go Green
Day 36	Challenges of switching to green energy
Day 37	Smart Cities and Smart Homes
Day 38	The 5 R's, Water harvesting at home
Day 39	Famous Indian movements
Day 40	Climate Change and Human Displacement.

TEXTBOOKS:

1. Gourikrishna Dasmohapatra, Basic Environmental Engineering and Elementary Biology, 2nd Edition, Vikas
2. Dr. Debapriya De & Dr. Debashish De, Fundamentals of Environment & Ecology, 1st edition, S.Chand

REFERENCE BOOKS:

1. Arvind Walia, Environment and Ecology, Kalyani Publishers, 2010.

QUESTION PAPER PATTERN AND DATES

EXAMINATION	Dates	PART – A	PART – B	PART – C	TOTAL MARKS
Mid Term 1	**September 7, 2026 to September 11, 2026**	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**

Mid Term 2	**October 30, 2026 to November 5, 2026**	Attempt 5 out of 10 questions; Each question carries 2 marks (2 × 5)	Attempt 2 out of 4 questions; Each question carries 5 marks (5 × 2)	Attempt 1 out of 2 questions; Each question carries 10 marks (10 × 1)	**30**
End Semester Examination	**November 12, 2026 to December 16, 2026**	Attempt 10 out of 15 questions; Each question carries 2 marks (2 × 10)	Attempt 6 out of 9 questions; Each question carries 5 marks (5 × 6)	Attempt 5 out of 8 questions; Each question carries 10 marks (10 × 5)	**100**

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https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2	1	1	3	3	3	3	2	2
CO2	1	3	3	2	2	2	2	3	2	2	2	2
CO3	1	3	3	2	2	1	3	2	3	3	3	3
CO4	1	3	3	3	3	1	3	2	1	3	2	3

3: Strong correlation
2: Medium correlation
1: Weak correlation

PSO	PSO Description
PSO1	**Technical Knowledge and Problem-Solving:** Apply fundamental concepts of computer applications, programming languages, data structures, algorithms and database management to analyse and solve computational problems effectively.
PSO2	**Software Design and Development:** Demonstrate the ability to design, develop, test and deploy software solutions by utilizing modern tools, technologies, and logical programming skills for real-world applications across domains such as web, mobile, and enterprise systems.
PSO3	**Professional Skills and Ethics:** Exhibit effective communication, teamwork, leadership and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.