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 2026

(Tentative)

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 P lan

Subject Name: **Design & Analysis of Algorithms** Credit: 4 Lecture Hours: 48
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, problem-solving steps, algorithm representation	Horowitz & Sahni (Ch. 1), Cormen (Ch. 2)	**Academia**: MIT OCW – https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006 **Industry**: HackerRank, LeetCode problem-solving frameworks	3
	Performance Analysis & Asymptotic Notation	Time & space complexity, best/average/worst case, Big-O, Omega, Theta, time-space tradeoffs	Horowitz & Sahni (Ch. 1), Cormen (Ch. 3)	**Academia**: Stanford Algorithms Course - https://www.coursera.org/specializations/algorithms **Industry**: Runtime estimation in web search, ML model optimization	4
	Recursion and Recurrence Relations	Substitution method, recursion tree method, Master's theorem	Cormen (Ch. 4), Horowitz (Ch. 2)	**Academia**: https://www.cs.princeton.edu/~guna/226/info.html	3

				Industry: Image processing, divide & conquer algorithms in libraries like OpenCV	
Module 2	Divide-and-Conquer Algorithms	Strategy overview, Merge Sort, Quick Sort, Selection algorithms, Matrix Chain Multiplication	Cormen (Ch. 4, 15)	**Academia**: https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/ **Industry**: Sorting/search in DBMS, compiler optimizations	2
	Greedy Algorithms	Strategy overview, Fractional Knapsack, Huffman Coding, Job Sequencing with deadlines	Horowitz (Ch. 3), Cormen (Ch. 16)	**Academia**: https://www.youtube.com/watch?v=EcT-Jt5WStw **Industry**: Data compression (ZIP), deadline-based CPU scheduling	3
	Minimum Spanning Trees	Kruskal's Algorithm, Prim's Algorithm, Disjoint Set Union (DSU)	Cormen (Ch. 23)	**Academia**: Stanford Algorithms **Industry**: Network design, cable layout, spanning tree in routing protocols	2
Module 3	Dynamic Programming	Strategy, 0/1 Knapsack, Multistage Graphs	Horowitz (Ch. 5), Cormen (Ch. 15)	**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 (all pairs), Dijkstra (single source), negative weights, adjacency matrix/list	Cormen (Ch. 24, 25)	**Academia**: https://onlinecourses.nptel.ac.in/noc24_cs92/preview **Industry**: Path-finding (Google Maps), dynamic routing in traffic systems	5

	Graph Traversal	DFS, BFS, Connected and Biconnected components	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	5
Module 4	Backtracking Algorithms	General strategy, 8-Queens, Subset Sum, Graph Coloring, Hamiltonian Cycles	Horowitz (Ch. 6), Aho et al.	**Academia**: Princeton Recursive Problem Solving **Industry**: Constraint satisfaction in scheduling, puzzle solvers	5
	Branch and Bound	Strategy, bounding functions, solving TSP, upper/lower bounds	Horowitz (Ch. 6)	**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	Introduction to Computational Complexity	Classes P, NP, NP-Hard, NP-Complete, tractability concepts	Cormen (Ch. 34), Horowitz (Ch. 7)	**Academia**: https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006Complexity Theory **Industry**: Complexity understanding in AI systems, database optimization	3
	Reductions and NP-Complete Problems	Polynomial-time reductions, Subset Sum, SAT, 3-CNF-SAT, Clique problem	Horowitz (Ch. 7), Aho et al.	**Academia**: CMU Theoretical CS https://www.cs.cmu.edu/~15251/course-info.html **Industry**: Logic solvers, secure protocol verifiers	3
	Intractability and Lower Bound Theory	Introduction to intractability, lower bound techniques, implications	Horowitz (Ch. 7)	**Academia**: edX Complexity Classes **Industry**: Feasibility study for real-world NP-Hard scenarios	3

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	Characteristics of algorithms; steps of algorithm design
Day 2	Importance of algorithms in computing and real-world applications
Day 3	Time and space complexity; concept of input size and primitive operations
Day 4	Big-O notation; analyzing simple iterative algorithms
Day 5	Best, worst, and average-case complexity with examples
Day 6	Theta and Omega notations; asymptotic comparison among algorithms
Day 7	Introduction to recursion; recurrence relations with simple examples
Day 8	Substitution method for solving recurrences
Day 9	Recursion tree method and visual recurrence solving
Day 10	Master's Theorem and its applications to divide-and-conquer 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 11	Divide-and-conquer strategy and algorithm design pattern
Day 12	Merge Sort: algorithm, analysis, and implementation

Day 13	Quick Sort: pivot selection, complexity in different cases
Day 14	Selection problem (Median of Medians) and Matrix Chain Multiplication
Day 15	Greedy Strategy: conceptual introduction and problem patterns
Day 16	Fractional Knapsack: algorithm and correctness
Day 17	Huffman Coding: binary trees and prefix encoding
Day 18	Job sequencing with deadlines: greedy scheduling
Day 19	Prim's Algorithm: MST using priority queues
Day 20	Kruskal's Algorithm and Disjoint Set Union structure

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 21	Introduction to Dynamic Programming: overlapping subproblems and optimal substructure
Day 22	0/1 Knapsack: problem, table filling, and reconstruction of solution
Day 23	Multistage Graphs: optimal path determination using DP
Day 24	Floyd-Warshall Algorithm: all-pairs shortest path
Day 25	Dijkstra's Algorithm: single-source shortest path
Day 26	Introduction to Graphs: representations (adjacency list/matrix)
Day 27	DFS: implementation and applications (topological sort, cycle detection)
Day 28	BFS: implementation and shortest path in unweighted graphs
Day 29	Connected and Biconnected Components using DFS
Day 30	Graph practice: lab discussion on shortest paths and traversals

Module 4: Back Tracking and Branch-&-Bound:

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 31	Backtracking: strategy, space tree, pruning
Day 32	8-Queens problem using backtracking
Day 33	Sum of Subsets problem and subset enumeration
Day 34	Graph Colouring problem: colouring using recursive backtracking
Day 35	Hamiltonian Cycle: path validation using backtracking
Day 36	Introduction to Branch and Bound
Day 37	Travelling Salesman Problem: bounding functions and cost matrix
Day 38	State-space tree analysis in BnB
Day 39	Lab application: backtracking vs BnB comparison and complexity study

Module 5: Lower Bound Theory and NP-Completeness:

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 40	Complexity Classes: P, NP, NP-Hard, NP-Complete definitions
Day 41	Polynomial-time verifiability and decision problems
Day 42	Polynomial reductions: theory and strategy
Day 43	Example: Subset Sum to 0/1 Knapsack reduction
Day 44	SAT and 3-CNF SAT reductions; introduction to Cook’s Theorem

Day 45	Other NP-Complete problems: Clique, Vertex Cover, TSP
Day 46	Intractability, approximation, and heuristic approaches
Day 47	Industry relevance: problems that remain NP-Complete in real systems
Day 48	Comprehensive wrap-up: summary, problem-solving practice, revision

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	**August 10, 2026- August 18, 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 6, 2026- October 13, 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 17, 2026- December 4, 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

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University of Engineering & Management, Jaipur

Syllabus and Lesson Plan

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

Maximum: 100 marks (Internal: 30 marks; External: 70 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	12

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	14
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	16

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	6

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
Day 26	Summary and Recap of Module 2

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 27	Memory Management: Background, Swapping
Day 28	Contiguous Memory Allocation
Day 29	Segmentation
Day 30	Paging
Day 31	Structure of the Page Table
Day 32	Segmentation with Paging
Day 33	Virtual Memory: Background, Demand Paging
Day 34	Page Replacement
Day 35	Allocation of Frames
Day 36	Thrashing

Day 37	Mass-Storage Structure: Overview, Disk Structure
Day 38	Disk Scheduling
Day 39	Disk Management
Day 40	Swap-Space Management
Day 41	RAID Structure
Day 42	Summary and Recap of Module 3

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 43	File-System Interface: File Concept, Access Methods
Day 44	Directory and Disk Structure, File-System Mounting
Day 45	File Sharing, Protection
Day 46	File-System Implementation: Structure and Implementation
Day 47	Directory Implementation, Allocation Methods
Day 48	Free-Space Management, Efficiency, and Performance

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	**August 10, 2026-August 18,2026**	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 6,2026-October 13,2026**	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 17,2026-December 4,2026**	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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University of Engineering and Management

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University of Engineering & Management, Jaipur

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

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	5
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	10
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	

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)	10

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.
Day 9	Assignment
Day 10	Assignment

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 11	Introduction to Heuristic Search Techniques
Day 12	Generate-and-Test
Day 13	Hill Climbing
Day 14	Hill Climbing-Examples
Day 15	Best- first Search
Day 16	Best- first Search-Examples
Day 17	A* Algorithm
Day 18	A* Algorithm-Examples
Day 19	Simulated Annealing
Day 20	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 21	Introduction
Day 22	Hopfield Networks
Day 23	Learning in Neural Networks
Day 24	Learning in Neural Networks
Day 25	Learning in Neural Networks
Day 26	Applications of Neural Networks

Day 27	Recurrent Networks
Day 28	Distributed Representations
Day 29	Assignment
Day 30	Assignment

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 31	Introduction to Python, Decision Structures,
Day 32	Decision Structures, Looping Statements,
Day 33	List, Tuples, Sets and Dictionaries, Strings,
Day 34	List, Tuples, Sets and Dictionaries, Strings,
Day 35	Introduction to Functions, Advanced Functions,
Day 36	Object Oriented Programing,
Day 37	Object Oriented Programing,
Day 38	File Handling, Python Exceptions
Day 39	Pandas, Numpy,
Day 40	Introdution to Data Analytics with Python.

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	**August 10, 2026-August 18,2026**	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 6,2026-October 13,2026**	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 17,2026-December 4,2026**	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

Subject Name: **Environmental Studies** Credit: 4 Lecture Hours: 46
Subject Code: **BCAAE301**

Maximum: 100 marks (Internal: 30 marks; External: 70 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)	6

2.	**Air, Water & Land 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, Lithosphere, Solid waste pollution, Classification of solid wastes, Solid waste Management, Hazardous wastes, Hazardous waste management, Soil.	**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	14
3.	**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 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	10

4.	**Noise Pollution and Control**	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 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

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 & Land 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, Eutrophication, Ground Water, Hydraulic gradients, Darcy's Law,
Day 14	Flow Velocity, Water treatment Operation, Hardness of water,
Day 15	Lithosphere, Solid waste pollution,
Day 16	Classification of solid wastes, Solid waste Management, Hazardous wastes
Day 17	Soil

Module 3: Ecology

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

Working Days	Lesson Plan Description
Day 18	Ecology, Classification of Ecology, , ,
Day 19	Classification of Ecology, Ecological pyramids
Day 20	Ecological pyramids, Components of Ecosystem
Day 21	Components of Ecosystem
Day 22	Food chain, Types of Food chain
Day 23	Food chain, Types of Food chain
Day 24	Food Web
Day 25	Food Web, Biogeochemical cycles
Day 26	Biogeochemical cycles

Module 4: Noise Pollution and Control

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

Working Days	Lesson Plan Description
Day 27	Sound and its general features
Day 28	Sound and its general features
Day 29	Measurement of noise level
Day 30	Measurement of noise level, Noise classification,
Day 31	Noise classification, Noise measurements, Harmful effects of noise pollution
Day 32	Noise classification, Noise measurements, Harmful effects of noise pollution
Day 33	Noise classification, Noise measurements, Harmful effects of noise pollution
Day 34	Noise classification, Noise measurements, Harmful effects of noise pollution
Day 35	Noise measurements , Harmful effects of noise pollution
Day 36	Revision
Day 37	Revision
Day 38	Revision

TEXTBOOK:

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

REFERENCEBOOKS:

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

QUESTION PAPER PATTERN AND DATES

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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

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