



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



**3<sup>rd</sup> Semester Syllabus for BCA Admission Batch 2025**

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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: **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](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:**

## 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) | <b>Academia:</b> MIT OCW – <a href="https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006">https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006</a><br><b>Industry:</b> 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) | <b>Academia:</b> Stanford Algorithms Course - <a href="https://www.coursera.org/specializations/algorithms">https://www.coursera.org/specializations/algorithms</a><br><b>Industry:</b> 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)         | <b>Academia:</b> <a href="https://www.cs.princeton.edu/~gu/na/226/info.html">https://www.cs.princeton.edu/~gu/na/226/info.html</a>                                                                                                                                         | 3             |

|                 |                               |                                                                                               |                                   |                                                                                                                                                                                                                                                                               |   |
|-----------------|-------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                 |                               |                                                                                               |                                   | <b>Industry:</b> Image processing, divide & conquer algorithms in libraries like OpenCV                                                                                                                                                                                       |   |
| <b>Module 2</b> | Divide-and-Conquer Algorithms | Strategy overview, Merge Sort, Quick Sort, Selection algorithms, Matrix Chain Multiplication  | Cormen (Ch. 4, 15)                | <b>Academia:</b><br><a href="https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/">https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/</a><br><b>Industry:</b> 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) | <b>Academia:</b><br><a href="https://www.youtube.com/watch?v=EcT-Jt5WStw">https://www.youtube.com/watch?v=EcT-Jt5WStw</a><br><b>Industry:</b> Data compression (ZIP), deadline-based CPU scheduling                                                                           | 3 |
|                 | Minimum Spanning Trees        | Kruskal's Algorithm, Prim's Algorithm, Disjoint Set Union (DSU)                               | Cormen (Ch. 23)                   | <b>Academia:</b> Stanford Algorithms<br><b>Industry:</b> Network design, cable layout, spanning tree in routing protocols                                                                                                                                                     | 2 |
| <b>Module 3</b> | Dynamic Programming           | Strategy, 0/1 Knapsack, Multistage Graphs                                                     | Horowitz (Ch. 5), Cormen (Ch. 15) | <b>Academia:</b><br><a href="https://www.udacity.com/course/data-structures-and-algorithms-nanodegree--nd256">https://www.udacity.com/course/data-structures-and-algorithms-nanodegree--nd256</a><br><b>Industry:</b> 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)               | <b>Academia:</b><br><a href="https://onlinecourses.nptel.ac.in/noc24_cs92/preview">https://onlinecourses.nptel.ac.in/noc24_cs92/preview</a><br><b>Industry:</b> Path-finding (Google Maps), dynamic routing in traffic systems                                                | 5 |

|                 |                                          |                                                                            |                                   |                                                                                                                                                                                                                                                                                                                        |   |
|-----------------|------------------------------------------|----------------------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                 | Graph Traversal                          | DFS, BFS, Connected and Biconnected components                             | Cormen (Ch. 22)                   | <b>Academia:</b> Georgia Tech CS1332 - <a href="https://www.edx.org/certificates/professional-certificate/gtx-data-structures-and-algorithms">https://www.edx.org/certificates/professional-certificate/gtx-data-structures-and-algorithms</a><br><b>Industry:</b> Friend suggestions in Facebook, recommender systems | 5 |
| <b>Module 4</b> | Backtracking Algorithms                  | General strategy, 8-Queens, Subset Sum, Graph Coloring, Hamiltonian Cycles | Horowitz (Ch. 6), Aho et al.      | <b>Academia:</b> Princeton Recursive Problem Solving<br><b>Industry:</b> Constraint satisfaction in scheduling, puzzle solvers                                                                                                                                                                                         | 5 |
|                 | Branch and Bound                         | Strategy, bounding functions, solving TSP, upper/lower bounds              | Horowitz (Ch. 6)                  | <b>Academia:</b> <a href="https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006">https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006</a><br><b>Industry:</b> Logistics & delivery optimization (e.g., Amazon, FedEx)                                               | 4 |
| <b>Module 5</b> | Introduction to Computational Complexity | Classes P, NP, NP-Hard, NP-Complete, tractability concepts                 | Cormen (Ch. 34), Horowitz (Ch. 7) | <b>Academia:</b> <a href="https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006">https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/6.006</a> Complexity Theory<br><b>Industry:</b> 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.      | <b>Academia:</b> CMU Theoretical CS <a href="https://www.cs.cmu.edu/~15251/course-info.html">https://www.cs.cmu.edu/~15251/course-info.html</a><br><b>Industry:</b> Logic solvers, secure protocol verifiers                                                                                                           | 3 |
|                 | Intractability and Lower Bound Theory    | Introduction to intractability, lower bound techniques, implications       | Horowitz (Ch. 7)                  | <b>Academia:</b> edX Complexity Classes<br><b>Industry:</b> Feasibility study for real-world NP-Hard scenarios                                                                                                                                                                                                         | 3 |

## **Module 1:** Introduction analysis of algorithms:

2<sup>nd</sup> Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)

2<sup>nd</sup> Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

2<sup>nd</sup> Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

| <b>Working Day</b> | <b>Lesson Plan Description</b>                                            |
|--------------------|---------------------------------------------------------------------------|
| 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

2<sup>nd</sup> Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)

2<sup>nd</sup> Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

2<sup>nd</sup> Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

| <b>Working Day</b> | <b>Lesson Plan Description</b>                           |
|--------------------|----------------------------------------------------------|
| 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:

2<sup>nd</sup> Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)

2<sup>nd</sup> Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

2<sup>nd</sup> 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:**

2<sup>nd</sup> Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)

2<sup>nd</sup> Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

2<sup>nd</sup> Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

| <b>Working Day</b> | <b>Lesson Plan Description</b>                                       |
|--------------------|----------------------------------------------------------------------|
| 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:**

2<sup>nd</sup> Year, Sec A (Faculty Name – Prof. Bisweswar Thakur, Prof. Raimoni Hansda)

2<sup>nd</sup> Year, Sec B (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

2<sup>nd</sup> Year, Sec C (Faculty Name – Prof. Kaustav Sarkar, Prof. Bisweswar Thakur)

| <b>Working Day</b> | <b>Lesson Plan Description</b>                               |
|--------------------|--------------------------------------------------------------|
| 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    | <a href="#">Download eBook</a> |
| Cormen, Leiserson, Rivest, Stein | Introduction to Algorithms                     | 4th Edition       | MIT Press/McGraw-Hill | <a href="#">Download eBook</a> |
| Reference Books:                 |                                                |                   |                       |                                |
| Aho, Hopcroft, Ullman            | The Design and Analysis of Computer Algorithms | Addison Wesley    | Aho, Hopcroft, Ullman | <a href="#">Download eBook</a> |

## QUESTION PAPER PATTERN AND DATES

| EXAMINATION | Dates                               | PART – A                                                                      | PART – B                                                                     | PART – C                                                                       | TOTAL MARKS |
|-------------|-------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------|
| Mid Term 1  | August 10, 2026-<br>August 18, 2026 | Attempt 5 out of 10 questions; Each question carries 2 marks ( $2 \times 5$ ) | Attempt 2 out of 4 questions; Each question carries 5 marks ( $5 \times 2$ ) | Attempt 1 out of 2 questions; Each question carries 10 marks ( $10 \times 1$ ) | 30          |

|                                 |                                                |                                                                                 |                                                                              |                                                                                |            |
|---------------------------------|------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------|
| <b>Mid Term 2</b>               | <b>October 6, 2026-<br/>October 13, 2026</b>   | Attempt 5 out of 10 questions; Each question carries 2 marks ( $2 \times 5$ )   | Attempt 2 out of 4 questions; Each question carries 5 marks ( $5 \times 2$ ) | Attempt 1 out of 2 questions; Each question carries 10 marks ( $10 \times 1$ ) | <b>30</b>  |
| <b>End Semester Examination</b> | <b>November 17, 2026-<br/>December 4, 2026</b> | Attempt 10 out of 15 questions; Each question carries 2 marks ( $2 \times 10$ ) | Attempt 6 out of 9 questions; Each question carries 5 marks ( $5 \times 6$ ) | Attempt 5 out of 8 questions; Each question carries 10 marks ( $10 \times 5$ ) | <b>100</b> |

**Examination Rules & Regulations:**

[https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe\\_office\\_iem\\_edu\\_in/EXrcoe3d6oxlogHKO074XeUBC9qm3XNaf\\_qUeSiVTNh5OQ?e=MMQn40](https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxlogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40)



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## **Syllabus and Lesson Plan for BCA Admission Batch 2024**

Subject Name: **Operating Systems**  
Subject Code: **BCACC302**

Credit: 4

Lecture Hours: 40

**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\\_0135015677134110729950%2Foverview](https://infyspringboard.onwingspan.com/web/en/login?ref=%2Fapp%2Ftoc%2Flex_auth_0135015677134110729950%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             | <b>Introduction</b><br><br><b>Operating-System Structures</b><br><br><b>Processes</b><br><br><b>Threads</b> | What is an Operating system, Mainframe system, Desktop system, Multiprocessor system, Distributed system, Clustered Systems, Real-time systems<br><br>System Components, OS Services, System calls, System Programs, System Structure<br><br>Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, Communication in Client–Server Systems<br><br>Overview, Multithreading Models, Threading Issues | <b>Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 1,Chapter 2,Chapter 3, Chapter 4)</b> | <b>International Academia:</b><br>( <a href="https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/">https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/</a> )<br><b>Industry Mapping:</b> Docker, Microsoft Azure | 12            |

|   |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|---|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 2 | <b>CPU Scheduling</b><br><br><b>Process Synchronization</b><br><br><b>Deadlocks</b>        | <p>Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time CPU Scheduling</p> <p>Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors</p> <p>System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock</p> | <b>Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 5,Chapter 6,Chapter 7,Chapter 8)</b>    | <p><b>International Standards:</b><br/> <a href="https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/">(https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/)</a><br/><br/> <a href="https://ocw.mit.edu/courses/6-829-computer-networks-fall-2002/resources/10singlelink/">(https://ocw.mit.edu/courses/6-829-computer-networks-fall-2002/resources/10singlelink/)</a></p> <p><b>IndustryMapping:</b> Docker, Microsoft Azure</p> | 14 |
| 3 | <b>Memory Management</b><br><br><b>Virtual Memory</b><br><br><b>Mass-Storage Structure</b> | <p>Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table, Segmentation with paging</p> <p>Background, Demand Paging, Page Replacement, Allocation of Frames, Thrashing</p> <p>Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure</p>                                                                                                     | <b>Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 9,Chapter 10,Chapter 11,Chapter 12)</b> | <p><b>International Standards:</b><br/> <a href="https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/">(https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/)</a></p> <p><b>Industry Mapping :</b> AWS, VxWorks</p>                                                                                                                                                                                                                | 16 |

|   |                                   |                                                                                                                                                    |                                                                                                                     |                                                                                                                                                                                                                                                                      |   |
|---|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 4 | <b>File-System Interface</b>      | File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection                                         | <b>Operating System Concepts, Silberschatz, Galvin, Gange, Wiley Publication (Chapter 13,Chapter 14,Chapter 15)</b> | <b>International Standards:</b> ( <a href="https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/">https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/</a> )<br><br><b>Industry Mapping: Industry Mapping:</b> AWS, VxWorks | 6 |
|   | <b>File-System Implementation</b> | File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance |                                                                                                                     |                                                                                                                                                                                                                                                                      |   |

## Module 1: Introduction

2<sup>nd</sup> Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> 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

2<sup>nd</sup> Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

| <b>Working Days</b> | <b>Lesson Plan Description</b>                                |
|---------------------|---------------------------------------------------------------|
| 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**

2<sup>nd</sup> Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> Year, Sec C (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

| <b>Working Days</b> | <b>Lesson Plan Description</b>            |
|---------------------|-------------------------------------------|
| 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

2<sup>nd</sup> Year, Sec A (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> Year, Sec B (Faculty Name – Dr. Goldina Ghosh, Dr. Priti Deb)

2<sup>nd</sup> 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**

|                                                       |                                                                                                                                                                                                                                                |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PSO1 – Technical Knowledge and Problem-Solving</b> | Apply fundamental concepts of computer applications, programming languages, data structures, algorithms and database management to analyse and solve computational problems effectively.                                                       |
| <b>PSO2 – Software Design and Development</b>         | 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. |
| <b>PSO3 – Professional Skills and Ethics</b>          | 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-<br>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-<br>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-<br>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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[my.sharepoint.com/:b:/g/personal/iemcoe\\_office\\_iem\\_edu\\_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf\\_qUeSiVTNh5OQ?e=MMQn40](https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXrcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MMQn40)



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**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**

**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<br>1.2 The Underlying Assumption<br>1.3 What is an AI Technique<br>1.4 The level of the Model<br>1.5 Criteria for Success<br>1.6 Some General References    | <i>International Academia:</i> ( <a href="#">Vertex AI with Gemini 1.5 Pro and Gemini 1.5 Flash   Google Cloud</a> )<br><i>Industry Mapping:</i> Vertex AI                                                                                                             | 5             |
| 2             | Heuristic Search Techniques     | Part 1:Chapter3, Artificial Intelligence (Third Edition) <u>Elaine Rich, Kevin Knight, Shivashankar B. Nair</u> | 3.1 Generate-and-Test<br>3.2 Hill Climbing<br>3.3 Best- first Search<br>3.4 Problem Reduction                                                                                   | <i>International Academia:</i> ( <a href="#">Vertex AI with Gemini 1.5 Pro and Gemini 1.5 Flash   Google Cloud</a> )<br><i>Industry Mapping:</i> 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<br>18.2 Learning in Neural Networks<br>18.3 Applications of Neural Networks<br>18.4 Recurrent Networks<br>18.5 Distributed Representations | <i>International Standards:</i> ( <a href="#">AI &amp; Machine Learning Products &amp; Services   Google Cloud</a> )<br><br><i>Industry Mapping : AI and machine learning products:</i> Gemini 1.5 models, the latest and most advanced multimodal models in Vertex AI |               |

|   |                    |                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                              |                                                                                                                                             |    |
|---|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----|
| 4 | Python Programming | <p><b>Chapter 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 20</b></p> <p><b>Python Programing, S.Sridhar, J. Indumathi, V.M. Hariharan</b></p> <p><b>Chapter 1, 2, 3, 4, 5, 7, 8, 9, 10, 13, 15, 16 18, 20</b></p> <p><b>Python Programing, Anurag Gupta, G P Biswas</b></p> | <p>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.</p> | <p><b>. International Standards: (<a href="#">AI &amp; Machine Learning Products &amp; Services</a>   <a href="#">Google Cloud</a>)</b></p> | 10 |
|---|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|----|

## Module 1: What is Artificial Intelligence

2<sup>nd</sup>Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>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

2<sup>nd</sup>Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>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

2<sup>nd</sup>Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>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

2<sup>nd</sup>Year, Sec A (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>Year, Sec B (Prof.Ankan Bhowmik,Prof.Pritam Chakraborty)

2<sup>nd</sup>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.Vijayalakshmi 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 | <b>Technical Knowledge and Problem-Solving:</b> Apply fundamental concepts of computer applications, programming languages, data structures, algorithms, and database management to analyse and solve computational problems effectively.                                               |
| PSO2 | <b>Software Design and Development:</b> 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 | <b>Professional Skills and Ethics:</b> 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**

| <b>EXAMINATION</b>              | <b>Dates</b>                                 | <b>PART – A</b>                                                                 | <b>PART – B</b>                                                              | <b>PART – C</b>                                                                | <b>TOTAL MARKS</b> |
|---------------------------------|----------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------|
| <b>Mid Term 1</b>               | <b>August 10, 2026-<br/>August 18,2026</b>   | Attempt 5 out of 6 questions; Each question carries 2 marks ( $2 \times 5$ )    | Attempt 2 out of 3 questions; Each question carries 5 marks ( $5 \times 2$ ) | Attempt 1 out of 2 questions; Each question carries 10 marks ( $10 \times 1$ ) | <b>30</b>          |
| <b>Mid Term 2</b>               | <b>October 6,2026-<br/>October 13,2026</b>   | Attempt 5 out of 6 questions; Each question carries 2 marks ( $2 \times 5$ )    | Attempt 2 out of 3 questions; Each question carries 5 marks ( $5 \times 2$ ) | Attempt 1 out of 2 questions; Each question carries 10 marks ( $10 \times 1$ ) | <b>30</b>          |
| <b>End Semester Examination</b> | <b>November 17,2026-<br/>December 4,2026</b> | Attempt 10 out of 15 questions; Each question carries 2 marks ( $2 \times 10$ ) | Attempt 6 out of 9 questions; Each question carries 5 marks ( $5 \times 6$ ) | Attempt 5 out of 8 questions; Each question carries 10 marks ( $10 \times 5$ ) | <b>100</b>         |

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## **Syllabus and Lesson Plan for BCA Admission Batch 2025**

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 | <b>Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 1)</b><br><br><b>Dr. Debapriya De &amp; Dr. Debashish De, Fundamentals of Environment &amp; Ecology (Chapter 1)</b> | <b>International Academia:</b><br><a href="https://ocw.mit.edu/collections/environment/">https://ocw.mit.edu/collections/environment/</a><br><br><b>Industry Mapping:</b><br>The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National Environmental Engineering Research Institute (NEERI) | 6             |

|    |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                               |    |
|----|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 2. | <b>Air, Water &amp; Land Pollution</b> | <p>Atmosphere structure, Earth's radiation balance, Global atmospheric change<br/> Green House effect, Global warming and its consequences, Atmospheric stability,<br/> Atmospheric dispersion, Stack and Plume, Temperature inversion Chlorofluorocarbons,<br/> Ozone, Toxic chemical in the environment, Carbon monoxide (CO), Sulphur dioxide,<br/> oxides of Nitrogen, Smog, Control of air pollution, Hydrosphere, hydrological cycle,<br/> pollutants in water, biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Oil<br/> pollution in marine environment, Water quality, Eutrophication, Ground Water, Hydraulic<br/> gradients, Darcy's Law, Flow Velocity, Water treatment Operation, Hardness of water,<br/> Lithosphere, Solid waste pollution, Classification of solid wastes, Solid waste<br/> Management, Hazardous wastes, Hazardous waste management, Soil.</p> | <p><b>Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 4,5,6)</b></p> <p><b>Dr. Debapriya De &amp; Dr. Debashish De, Fundamentals of Environment &amp; Ecology (Chapter 2,3,5)</b></p> | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/collections/environment/">https://ocw.mit.edu/collections/environment/</a></p> <p><b>Industry Mapping:</b><br/> The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National</p> | 14 |
| 3. | <b>Ecology</b>                         | <p>Ecology, Classification of Ecology, Ecological pyramids, Components of Ecosystem, Food chain, Food Web, Types of Food chain, Biogeochemical cycles</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 2,3)</b></p> <p><b>Dr. Debapriya De &amp; Dr. Debashish De, Fundamentals of Environment &amp; Ecology (Chapter 4)</b></p>       | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/collections/environment/">https://ocw.mit.edu/collections/environment/</a></p> <p><b>Industry Mapping:</b><br/> The Energy and Resources Institute (TERI), Centre for Science and Environment (CSE), and the National</p> | 10 |

|    |                                    |                                                                                                                                          |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                    |    |
|----|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 4. | <b>Noise Pollution and Control</b> | Sound and its general features, Measurement of noise level, Noise classification, Noise measurements, Harmful effects of noise pollution | <b>Basic Environmental Engineering and Elementary Biology, Gourikrishna Dasmohapatra (Chapter 7)</b><br><br><b>Dr. Debapriya De &amp; Dr. Debashish De, Fundamentals of Environment &amp; Ecology (Chapter 6)</b> | <b>International Academia:</b><br><a href="https://ocw.mit.edu/collections/environment/">https://ocw.mit.edu/collections/environment/</a><br><br><b>Industry Mapping:</b><br>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, ,<br>, 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, 2<sup>nd</sup> 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

| EXAMINATION              | Dates                                 | PART – A                                                                        | PART – B                                                                     | PART – C                                                                       | TOTAL MARKS |
|--------------------------|---------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------|
| Mid Term 1               | August 10, 2026 to August 18, 2026    | Attempt 5 out of 10 questions; Each question carries 2 marks ( $2 \times 5$ )   | Attempt 2 out of 4 questions; Each question carries 5 marks ( $5 \times 2$ ) | Attempt 1 out of 2 questions; Each question carries 10 marks ( $10 \times 1$ ) | 30          |
| Mid Term 2               | October 6, 2026 to October 13, 2026   | Attempt 5 out of 10 questions; Each question carries 2 marks ( $2 \times 5$ )   | Attempt 2 out of 4 questions; Each question carries 5 marks ( $5 \times 2$ ) | Attempt 1 out of 2 questions; Each question carries 10 marks ( $10 \times 1$ ) | 30          |
| End Semester Examination | November 17, 2025 to December 4, 2025 | Attempt 10 out of 15 questions; Each question carries 2 marks ( $2 \times 10$ ) | Attempt 6 out of 9 questions; Each question carries 5 marks ( $5 \times 6$ ) | Attempt 5 out of 8 questions; Each question carries 10 marks ( $10 \times 5$ ) | 100         |

### Examination Rules & Regulations:

[https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe\\_office\\_iem\\_edu\\_in/EXRcoe3d6oxIogHKO074XeUBC9qm3XNaf\\_qUeSiVTNh5OQ?e=MQn40](https://iemcollege-my.sharepoint.com/:b:/g/personal/iemcoe_office_iem_edu_in/EXRcoe3d6oxIogHKO074XeUBC9qm3XNaf_qUeSiVTNh5OQ?e=MQn40)

### 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

| <b>PSO</b>  | <b>PSO Description</b>                                                                                                                                                                                                                                                                 |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PSO1</b> | <b>Technical Knowledge and Problem-Solving:</b> Apply fundamental concepts of computer applications, programming languages, data structures, algorithms and database management to analyse and solve computational problems effectively.                                               |
| <b>PSO2</b> | <b>Software Design and Development:</b> 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. |
| <b>PSO3</b> | <b>Professional Skills and Ethics:</b> Exhibit effective communication, teamwork, leadership and ethical practices while adapting to emerging IT trends, thereby contributing responsibly to societal and organizational development.                                                  |

