**COURSE PLAN**

|  |  |
| --- | --- |
| Target | 50% (marks) |
| Level-1 | 40% (population) |
| Level-2 | 50% (population) |
| Level-3 | 60% (population) |

1. **Method of Evaluation**

|  |  |
| --- | --- |
| **UG** | **PG** |
| Quizzes/Tests, Assignments (30%) | Quizzes/Tests, Assignments, seminar (50%) |
| Mid Examination (20%) | End semester (50%) |
| End examination (50%) |  |

1. **Passing Criteria**

|  |  |  |
| --- | --- | --- |
| **Scale** | **PG** | **UG** |
| **Out of 10 point scale** | SGPA – “6.00” in each semester  CGPA – “6.00”  Min. Individual Course Grade  –  “C”  Course Grade  Point –  “4.0” | SGPA – “5.0” in each semester  CGPA – “5.0”  Min. Individual Course Grade  –  “C”  Course Grade  Point –  “4.0” |

\*for PG, passing marks are 40/100 in a paper

\*for UG, passing marks are 35/100 in a paper

1. **Pre-requisites:** Basic knowledge of Mathematics and data structure
2. **Course Objectives:**
3. Apply mathematical techniques to find the complexity of an algorithm.
4. Analyze algorithms and express asymptotically different case behavior.
5. Demonstrate good principles of algorithm designs.
6. Design appreciate data structures to reduce the complexity of an algorithm.
7. Differentiate among P, NP Hard and NP Complete problems.
8. **Pedagogy**

* Presentations
* Flipped Classroom sessions
* Think-Pair-Share Activities
* Video Lectures

1. **References:**

|  |  |
| --- | --- |
| Text Books | 1. Thomas H. Cormen (2009) Introduction to Algorithm (Third Edition), The MIT Press. ISBN: 978-0-262- 03384-8  2. John Kleinberg and Eva Tardos (2005), Algorithm Design, ISBN: 0-321-29535-8 |
| Web resources |  |
| Journals |  |
| Reference books | 1. Rajesh K. Shukla (2015) Analysis and Design of Algorithms: A Beginner's Approach, Wiley, ISBN10: 8126554770 2. S.Sridhar (2014), Design and Analysis of Algorithms 1st Edition, Publisher: Oxford University Press ISBN: 9780198093695, 0198093691 |

**GUIDELINES TO STUDY THE SUBJECT**

**Instructions to Students:**

1. Go through the 'Syllabus' in the Black Board section of the web-site(https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section.  These are our lecture notes. Make sure you use them during this course.
4. Check your blackboard regularly
5. Go through study material
6. Check mails and announcements on blackboard
7. Keep updated with the posts, assignments and examinations which shall be conducted on the blackboard
8. Be regular, so that you do not suffer in any way
9. C**ell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail [to](mailto:abc@ddn.upes.ac.in) your concerned faculty. Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

**RELATED OUTCOMES**

1. **The expected outcomes of the Program are:**

|  |  |
| --- | --- |
| PO1 | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3 | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| PO4 | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| PO6 | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| PO7 | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice. |
| PO9 | **Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| PO11 | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12 | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

1. **The expected outcomes of the Specific Program are:**

|  |  |
| --- | --- |
| PSO1 | Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques |
| PSO2 | Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms. |
| PSO3 | Ability to design, develop and manage scalable IT Infrastructure. |

1. **The expected outcomes of the Course are:**

|  |  |
| --- | --- |
| CO 1 | Apply mathematical Techniques to find the complexity of algorithm |
| CO 2 | Analyze algorithms and express asymptotically different case behavior |
| CO 3 | Demonstrate good principles of algorithm designs |
| CO 4 | Design appropriate data structures to reduce the complexity of an algorithm. |
| CO 5 | Differentiate among about P, NP-Hard and NP-Complete problems. |

1. **Co-Relationship Matrix**

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Program**  **Outcomes**  **Course Outcomes** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO 1** | 3 | 3 | 1 | 2 |  |  |  |  |  |  |  |  | 3 | 1 |  |
| **CO 2** | 3 | 3 | 2 | 2 |  |  |  |  |  |  |  |  | 3 | 1 |  |
| **CO 3** | 2 | 2 | 2 | 1 |  |  |  |  |  |  |  |  | 3 | 1 |  |
| **CO 4** | 2 | 3 | 2 | 1 |  |  |  |  |  |  |  |  | 3 | 1 |  |
| **CO 5** | 3 | 2 | 1 | 3 |  |  |  |  |  |  |  |  | 3 | 1 |  |
| **Average** | **2.6** | **2.6** | **1.6** | **1.8** |  |  |  |  |  |  |  |  | **3** | **1** |  |

1. **Course outcomes assessment plan:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **components**  **Course Outcomes** | **Assignment** | **Test/Quiz** | **Mid Semester** | **End Semester** | **Any other** |
| **CO 1** | **□** | **□** | **□** | **□** | **□** |
| **CO 2** | **□** | **□** | **□** | **□** | **□** |
| **CO 3** | **□** | **□** | **□** | **□** | **□** |
| **CO 4** |  |  |  |  |  |
| **CO 5** |  |  |  |  |  |

**BROAD PLAN OF COURSE COVERAGE**

**Course Activities:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Unit** | **Description** | **Planned** | | | **Remarks** |
| **From** | **To** | **No. of Sessions** |
| **1** | Algorithm, Psuedo code, Performance Analysis- Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation with numerical, different algorithm design techniques, recurrence relation, solving methods: substitution, recursion tree, master theorem with numerical. |  |  |  | CO1 |
| **2** | Binary search, Quick sort: best case & worst case analysis, Merge sort, Strassen’s matrix multiplication |  |  |  | CO2 |
| **3** | Activity selection problem, knapsack problem, Minimum cost spanning trees: Prims and kruskal, Single source shortest path problem: Bellman ford, dijkstra’s, Huffman codes. |  |  |  | CO3 |
| **4** | Lower Bounds For Sorting, Counting Sort, Radix Sort, bucket sort  Backtracking: N-queen problem, sum of subsets problem |  |  |  | CO4 |
| **5** | Travelling salesman problem  NP-Hard and NP-Complete problem and concepts |  |  |  | CO5 |

Sessions: Total No. of Instructional periods available for the course

**SESSION PLAN**

**UNIT-I**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 1,2 | Algorithm, Pseudo code, Performance Analysis- Space complexity, Time complexity | CO1 |
| 3 | Asymptotic Notation- Big oh notation, Omega notation, Theta notation | CO1 |
| 4 | Asymptotic Notation- Big oh notation, Omega notation, Theta notation with numerical, | CO1 |
| 5 | different algorithm design techniques, recurrence relation | CO1 |
| 6,7 | solving methods: substitution | CO1 |
| 8,9 | solving methods: recursion tree | CO1 |
| 10 | Master theorem with numerical | CO1 |
| 11 | master theorem with numerical | CO1 |

**SESSION PLAN**

**UNIT-II**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 12,13 | Divide and conquer: Binary search and case analysis | CO2 |
| 16,17 | Merge sort & Analysis | CO2 |
| 18 | Strassen’s matrix multiplication | CO2 |

**SESSION PLAN**

**UNIT-III**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 19 | Greedy method: activity selection problem | CO3 |
| 20,21 | knapsack problem(fractional) | CO3 |
| 22,23 | Minimum cost spanning trees: Prims, kruskal. | CO3 |
| 24 | Minimum cost spanning trees: Applications | CO3 |
| 25 | Single source shortest path problem: dijkstra’s | CO3 |
| 26 | Single source shortest path problem: Bellman ford | CO3 |
| 27 | Huffman codes. | CO3 |

**SESSION PLAN**

**UNIT-IV**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 28 | Dynamic Programming: Matrix chain multiplication | CO4 |
| 29 | Dynamic Programming: Matrix chain multiplication | CO4 |
| 30 | 0/1 knapsack problem | CO4 |
| 31 | 0/1 knapsack problem | CO4 |
| 31 | All pairs shortest path problem | CO4 |
| 31 | All pairs shortest path problem examples | CO4 |
| 32 | largest common subsequence | CO4 |
| 32 | largest common subsequence examples | CO4 |

**SESSION PLAN**

**UNIT-V**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 33 | Sorting in linear time: lower bounds for sorting, counting sort, radix sort | CO4 |
| 33 | bucket sort | CO4 |
| 33 | N-queen problem | CO4 |
| 34 | sum of subsets problem | CO4 |
| 34 | sum of subsets problem, example | CO4 |

**SESSION PLAN**

**UNIT-VI**

|  |  |  |
| --- | --- | --- |
| **Lecture No.** | **Topics to be Covered** | **CO Mapped** |
| 35 | Branch and Bound method knapsack problem | CO5 |
| 35 | Branch and Bound method : knapsack problem | CO5 |
| 35 | NP-Hard and NP-Complete problem and concepts | CO5 |
| 36 | NP-Hard and NP-Complete problem example | CO5 |
| 37 | Doubt discussion | CO5 |