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**UNIVERSITY OF PETROLEUM & ENERGY STUDIES**

**College of Engineering Studies**

**Dehradun**

**COURSE PLAN**

Programme : B. Tech (CSE) , B.Tech(CSE+CSF)

Course : Design and Analysis of Algorithms

Subject Code :

No. of credits : 4

Semester : III

Session : 2020 (July-Dec’20)

Batch : 2019-23

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**Approved By**

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**COURSE PLAN**

1. **PREREQUISITE:**
   1. Basic Knowledge Mathematics.
   2. Programming and Data Structure
   3. Advanced Data Structure

1. **PROGRAM OUTCOMES (POs) for Ecommerce, Retail and Automation:**

After completion of the program the students will be able to:

1. **OBJECTIVES OF COURSE:-**

The objectives of this course are to:

1. Able to understand the necessity of the algorithm design.
2. Able to write the algorithm to solve a problem.
3. Able to analyze the performance of the algorithm.
4. Able to implement the algorithm in C/C++.

1. **COURSE OUTCOMES FOR DESIGN AND ANALYSIS OF ALGORITHMS: At the end of this course student should be able to**

CO1. Apply mathematical techniques to find the Complexity of an algorithm design

CO2. . Learn how to analyze algorithms and and estimate their worst and average case behavior.

CO3. Learn good principles of algorithm designs

CO4. Pick an appropriate data structure to reduce the complexity of an algorithms.

CO5. Implement an algorithms in a Programming language.

CO6. Learn about P,NP hard and NP Complete

**Table: Correlation of POs v/s COs**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO1 |  |  |  |  |  |  |  |  |  |  | - |
| CO2 |  |  |  |  |  |  |  |  |  |  | - |
| CO3 |  |  |  |  |  |  |  |  |  |  | - |
| CO4 |  |  |  |  |  |  |  |  |  |  | - |
| CO5 |  |  |  |  |  |  |  |  |  |  | - |
| CO6 |  |  |  |  |  |  |  |  |  |  | - |
| CO7 |  |  |  |  |  |  |  |  |  |  | - |

1. WEAK 2. MODERATE 3. STRONG
2. **COURSE OUTLINE**

***UNIT- 1: Introduction and Asymptotic Analysis Techniques***

***UNIT- 2: Divide and Conquer Method and its application***

***UNIT- 3: Greedy Method and its application***

***UNIT -4: Dynamic Programming Method and its application***

***UNIT- 5: Backtracking Methods and its application***

***UNIT- 6: Brach and Bound Method and Computational Complexity***

1. **PEDAGOGY**
2. **Class Test**
3. **Assignments/ Tutorials**
4. **Digital and analog Presentations**
5. **COURSE COMPLETION PLAN**

|  |  |
| --- | --- |
| **Total Class room sessions** | 58 |
| **Total Test** | 02 |
| **Total Assignment** | 02 |
| **Total Quiz** |  |

One Session =60 minutes

1. **EVALUATION & GRADING**

Students will be evaluated based on the following 3 stages.

* 1. Internal Assessment - 30%

5.2 Mid-term Examination - 20%

* 1. End term Examination - 50%

**H1. INTERNAL ASSESSMENT: WEIGHTAGE – 30%**

Internal Assessment shall be done based on the following:

|  |  |  |
| --- | --- | --- |
| Sl. No. | Description | % of Weightage out of 30% |
| 1 | Class Tests | 50% |
| 2 | Assignments (Problems/Presentations) | 20% |
| 3 | Attendance and conduct in the class and concept diary | 30% |

**H2*. Internal Assessment Record Sheet (including Mid Term Examination marks)*** *will be displayed online at the end of semester i.e. last week of regular classroom teaching.*

**H3. CLASS TESTS/QUIZZES:** Two Class Tests based on descriptive type theoretical & numerical questions will be held; one class test at least ten days before the Mid Term Examination and second class test at least ten days before the End Term Examination. Those who do not appear in Viva-Voce and quiz examinations shall lose their marks.

*The marks obtained by the students will be displayed on iCos a week before the start of Mid Term and End Term Examinations respectively.*

**H4. ASSIGNMENTS:** After completion of two units there will be home assignments based on theory and numerical problems. Those who fail to submit the assignments by the due date shall lose their marks.

**H5. GENERAL DISCIPLINE:** Based on student’s regularity, punctuality, sincerity and behavior in the class.

*The marks obtained by the students will be displayed on LMS at the end of semester.*

**H6. MID TERM EXAMINATION: WEIGHTAGE – 20%**

Mid Term examination shall be Two Hours duration and shall be a combination ofShort and Long theory Questions.

***Date of showing Mid Term Examination Answer Sheets: Within a week after completion of mid Sem examination.***

**H7. END TERM EXAMINATION: WEIGHTAGE – 50%**

End Term Examination shall be Three Hours duration and shall be a combination of Short and Long theory/numerical Questions.

**H8. GRADING:**

The overall marks obtained at the end of the semester comprising all the above three mentioned shall be converted to a grade.

1. **DETAILED SESSION PLAN**

|  |  |  |  |
| --- | --- | --- | --- |
| **SESSION** | **TOPIC** | **Course Outcomes Addressed** | **Assignment(s)/Quizzes/ Tests** |
| **9** | **UNIT -1** | CO1. Apply mathematical techniques to find the Complexity of an algorithm design  CO2. . Learn how to analyze algorithms and and estimate their worst and average case behavior. |  |
| **L1** | **Introduction**: |  |
| **L2,3** | Performance Analysis- Space complexity, Time complexity. |  |
| **L4** | Asymptotic Notation- Big oh notation, Omega notation, Theta notation |  |
| **L**5 | Asymptotic Notation- Big oh notation, Omega notation, Theta notation with numerical, |
| **L6** | different algorithm design techniques, recurrence relation |  |
| **L7,8** | solving methods: substitution , |
| **L9** | solving methods: recursion tree |
| **L10** | Master theorem with numerical. |
| **L11** | master theorem with numerical | **Quizz-1** |
|  |  |
| **6** | **UNIT 2:** | CO3. Learn good principles of algorithm designs  CO4. Pick an appropriate data structure to reduce the complexity of an algorithms.  CO5. Implement an algorithms in a Programming language. |  |
| **L12,13** | Divide and conquer: Binary search  Quick sort: best case & worst case analysis |  |
| **L14** | Divide and conquer: Binary search  Quick sort: best case & worst case analysis | Assignment – 1 |
| **L15** | Quick sort: best case & worst case analysis |
| **L16** | Merge sort |
| **L17** | Strassen’s matrix multiplication |
| **L18** | Powering Numbers, Fibonacci Number, ,. |
| **L19** | Maximum contiguous subarray problem |  |  |
| **L20** | **TEST 01** | CO3. Learn good principles of algorithm designs  CO4. Pick an appropriate data structure to reduce the complexity of an algorithms.  CO5. Implement an algorithms in a Programming language. |  |
| **8** | **UNIT-3:** |
| **L21** | Greedy method: activity selection problem |  |
| **L22** | Interval Scheduling and Interval Partitioning. |
| **L23,24** | knapsack problem(fractional) |
| **L25,26** | Minimum cost spanning trees: Prims, kruskal,. |  |
| **L27** | Minimum cost spanning trees: Applications | **Test-01** |
| **L28,29** | Single source shortest path problem: dijkstra’s |  |
| **L30,31** | Single source shortest path problem: Bellman ford |  |
| **L32** | Huffman codes. |
| **L33** | Doubt class before mid sem |  |
| **L34** | **Mid Sem** |  |
| **L35** | Mid-term solution discussion |  |
|  | **UNIT-4:** |  |
| **L36** | Dynamic Programming: Matrix chain multiplication | CO3. Learn good principles of algorithm designs  CO4. Pick an appropriate data structure to reduce the complexity of an algorithms.  CO5. Implement an algorithms in a Programming language. |
| **L37** | Dynamic Programming: Matrix chain multiplication |  |
| **L38** | 0/1 knapsack problem |
| **L39** | 0/1 knapsack problem |
| **L40** | All pairs shortest path problem |  |
| **L41** | All pairs shortest path problem examples |  |
| **L42** | largest common subsequence |
| **L43** | largest common subsequence examples |  |
|  | **UNIT-5:** | Assignment – 2 |
| **L44** | Sorting in linear time: lower bounds for sorting, counting sort, radix sort | CO3. Learn good principles of algorithm designs  CO4. Pick an appropriate data structure to reduce the complexity of an algorithms.  CO5. Implement an algorithms in a Programming language. |
| **L45** | bucket sort |
| **L46** | N-queen problem |
| **L47** | sum of subsets problem | **Quizz-2** |
| **L48** | sum of subsets problem, example |
| **L49** | graph coloring |
| **L50** | graph coloring, example |
| **L51** | Hamiltonian cycles |
| **L52** | **Test-02** |  |  |
|  | **UNIT-6:** |  |  |
| **L53,54** | Branch and Bound method knapsack problem | CO6. Learn about computer complexity (NP hard, NP Completeness) |  |
| **L55** | Branch and Bound method :  knapsack problem |
| **L56-57** | NP-Hard and NP-Complete problem and concepts |
| **L58** | NP-Hard and NP-Complete problem example |  |  |
| **L59-60** | Doubt discussion |  |  |

**GUIDELINES**

***Cell 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.

***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.

***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.

***Passing criterion:*** Student has to secure minimum 30%/40% marks of the “highest marks in the class scored by a student in that subject (in that class/group class)” individually in both the ‘End-Semester examination’ and ‘Total Marks’ in order to pass in that paper.

* Passing Criterion for B. Tech: minimum 30% of the highest marks in the class
* Passing Criterion for M. Tech: minimum 40% of the highest marks in the class

**Course outcome assessment:** To assess the fulfilment of course outcomes two different approaches have been decided. Degree of fulfillment of course outcomes will be assessed in different ways through direct assessment and indirect assessment. In Direct Assessment, it is measured through quizzes, tests, assignment, Mid-term and/or End-term examinations. It is suggested that each examination is designed in such a way that it can address one or two outcomes (depending upon the course completion). Indirect assessment is done through the student survey which needs to be designed by the faculty (sample format is given below) and it shall be conducted towards the end of course completion. The evaluation of the achievement of the Course Outcomes shall be done by analyzing the inputs received through Direct and Indirect Assessments and then corrective actions suggested for further improvement.

**Sample format for Indirect Assessment of Course outcomes**

|  |
| --- |
| NAME: |
| ENROLLMENT NO: |
| SAP ID: |
| COURSE: |
| PROGRAM: |

Please rate the following aspects of course outcomes of Design and Analysis of Algorithms.

Use the scale 1-4\*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl. No. |  | 1 | 2 | 3 | 4 |
| 1 | CO1. Apply mathematical techniques to find the Complexity of an algorithm design |  |  |  |  |
| 2 | CO2. . Learn how to analyze algorithms and and estimate their worst and average case behavior. |  |  |  |  |
| 3 | CO3. Learn good principles of algorithm designs |  |  |  |  |
| 4 | CO4. Pick an appropriate data structure to reduce the complexity of an algorithms. |  |  |  |  |
| 5 | CO5. Implement an algorithms in a Programming language. |  |  |  |  |
| 6 | CO6. Learn about P,NP hard and NP Complete |  |  |  |  |

3

Below Average

Good

1

**\***

Very Good

Average

4

2