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Description generated with very high confidence

**Course Plan**

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| **Department :** | Computer Science and Engineering |
| **Course Name & code :** | Advanced Data Structures and Algorithms & CSE 5113 |
| **Semester & branch :** | i & M.Tech CSE & CSIS |
| **Name of the faculty :** | **Mr. GURURAJ** |
| **No of contact hours/week:** | |  |  |  |  | | --- | --- | --- | --- | | **L** | **T** | **P** | **C** | | 3 | 1 | 0 | 4 | |

**Course Outcomes (COs)**

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|  | ***At the end of this course, the student should be able to:*** | **No. of Contact Hours** | **Marks** |
| CO1: | Make use of sequence of different types of data structure operations and their cost finding techniques | 6 | 13 |
| CO2: | Demonstrate various advanced data structures such as B-tree, Binomial heaps, Fibonacci heaps | 22 | 46 |
| CO3: | Utilize disjoint sets and van Emde Roas Tree | 12 | 25 |
| CO4: | Discover shortest paths for all pairs of vertices and from single source to all other vertices. | 4 | 8 |
| CO5: | Understand the concept of maximum flow networks and to design and analyze Multi-Threading algorithms | 4 | 8 |
|  | **Total** | 48 | 100 |

**Assessment Plan**

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| **Components** | **Assignments** | **Sessional Tests** | **End Semester/**  **Make-up Examination** |
| **Duration** | 20 to 30 minutes | 60 minutes | 180 minutes |
| **Weightage** | 20 % (4 X 5 marks) | 30 % (2 X 15 Marks) | 50 % (1 X 50 Marks) |
| **Typology of Questions** | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation | Knowledge/ Recall; Understanding/ Comprehension; Application | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation |
| **Pattern** | Answer one randomly selected question from the problem sheet (Students can refer their class notes) | MCQ: 10 questions (0.5 marks)  Short Answers: 5 questions (2 marks) | Answer all 5 full questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks |
| **Schedule** | 4, 7, 10, and 13th week of academic calendar | Calendared activity | Calendared activity |
| **Topics Covered** | Quiz 1 (L 1-9& T 1-2) **(CO1)** | Test 1  (L 1-20& T 1-6)  **(CO1&2)** | Comprehensive examination covering full syllabus. Students are expected to answer all questions **(CO1-5)** |
| Quiz 2 (L **10-17**& T 3-5) **(CO2 &3)** |
| Quiz 3 (L 18-27& T 6-9) **(CO3&4)** | Test 2  (L 21-33& T 7-10)  **(CO3&4)** |
| Quiz 4 (L 28-35& T 10-11) **(CO5)** |

**Lesson Plan**

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| **L. No.** | **Topics** | **Course Outcome Addressed** |
| **L0** | Introduction | CO1 |
| **L1** | Amortized Analysis , Aggregate analysis | CO1 |
| **L2** | Problems on Aggregate analysis | CO1 |
| **L3** | The accounting method | CO1 |
| **T1** | Tutorial on Amortized Analyss | CO1 |
| **L4** | The potential method, Problems on potential method, | CO1 |
| **L5** | Dynamic Tables, Definition of B-Trees, The Height of B-tree | CO1 |
| **L6** | Basic operations on B-Trees: Searching a B-tree, Analysis, Creating an empty B-tree | CO2 |
| **T2** | Tutorial on B-tree Construction | CO2 |
| **L7** | Splitting a node in a B-tree | CO2 |
| **L8** | Inserting a key into a B-tree and its Analysis. | CO2 |
| **L9** | Deleting a key from a B-Tree, | CO2 |
| **T3** | Tutorial on deletion of a key from B-Trees | CO2 |
| **L10** | Properties of Binomial trees, | CO2 |
| **L11** | Representation of Binomial heaps, Operations on Binomial Trees: Finding the minimum Key, Uniting the Binomial heaps | CO2 |
| **L12** | Inserting a node into Binomial heap, Extracting the node with minimum key, Decrease a key, Deleting a key in Binomial heap. | CO2 |
| **T4** | Tutorial on Binomial Trees | CO2 |
| **L13** | Structure of Fibonacci heaps, potential function | CO2 |
| **L14** | Merge able heap operations: Inserting a node, Finding the minimum node | CO2 |
| **L15** | Extracting the minimum node and its Analysis, Decreasing a key in Fibonacci Heap and its cost involved | CO2 |
| **T5** | Tutorial on Fibonaccii heap construction, extraction of a node and decrease key | CO2 |
| **L16** | Deleting a node in Fibonacci Heap and its cost involved | CO2 |
| **L17** | The van Emde Roas Tree | CO2 |
| **L18** | Preliminary approaches, Recursive structure | CO2 |
| **T6** | Tutorial on van Emde Roas Tree | CO2 |
| **L19** | Disjoint-set operations | CO2 |
| **L20** | Linked-list representation of disjoint sets | CO2 |
| **L21** | Disjoint set forests. | CO2 |
| **T7** | Tutorial on Disjoint set forests. | CO2 |
| **L22** | Optimal substructure of shortest path , Negative weight edges, Relaxation method | CO3 |
| **L23** | The Bellman-Ford algorithm, Analysis and Problems on Bellman-Ford algorithm | CO3 |
| **L24** | Topological sorting, Algorithm on directed acyclic graphs and its analysis | CO3 |
| **T8** | Tutorial on directed acyclic graphs | CO3 |
| **L25** | Difference constraints | CO3 |
| **L26** | The structure of a shortest path | CO3 |
| **L27** | A recursive solution to the all-pairs shortest-paths problem, Computing the shortest-path weights bottom up | CO3 |
| **T9** | Tutorial on shortrst path | CO3 |
| **L28** | Matrix multiplication | CO3 |
| **L29** | Algorithm Faster-All-Pairs-Shortest-Paths | CO3 |
| **L30** | Problems on Slow and Faster-All-Pairs-Shortest-Paths and its analysis. | CO3 |
| **T10** | Tutorial o all pairs shortest path | CO3 |
| **L31** | Johnson’s algorithm for sparse graphs , The Floyd-Warshall algorithm , Problems on Floyd-Warshall algorithm | CO3 |
| **L32** | Flow Networks | CO4 |
| **L33** | The Ford-Fulkerson method | CO4 |
| **T11** | Tutorial on Flow of networks | CO4 |
| **L34** | Maximum bipartite matching ,Problems on Maximum Bipartite Matching | CO4 |
| **L35** | The basics of dynamic multithreading | CO5 |
| **L36** | Multithreaded matrix multiplication, Multithreaded merge sort | CO5 |
| **T12** | Tutorial on Multithreaded matrix multiplication | CO5 |
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**References:**

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| 1. | Cormen Thomas H., Leiserson Charles E, Rivest Ronald L. and Stein Clifford, “Introduction to Algorithms” (3e), MIT Press, 2009 |
| 2. | Cormen Thomas H., Leiserson Charles E, Rivest Ronald L. and Stein Clifford, “Introduction to Algorithms” (2e), Prentice-Hall India, 2001 |
| 3. | Lawrence C. Washington, “Elliptic curves: number theory and cryptography”, Chapman & Hall/ CRC Second Edition, 2008 |
| 4. | Baase Sara and Gelder A.V., “Computer Algorithms -Introduction to Design and Analysis”, (3e), Pearson Education, 2000 |
| 5. | Anany Levitin, “Introduction to the Design and Analysis of Algorithms “, (3e), Pearson Education, 2011. |
| 6. | Aaron M. Tenenbaum,Yedidyah Langsam,Moshe J. Augeustein, ”Data Structures using C”, Pearson Education, 1998 |
| 7. | Click or tap here to enter text. |

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| **Submitted by:** | **Mr. GURURAJ** |

**(Signature of the faculty)**

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| **Date:** | **07-09-2023** |

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| **Approved by:** | **Dr. KRISHNAMOORTHI MakkiThaya** |

**(Signature of HOD)**

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| **Date:** | **07-08-2023** |

**Faculty members teaching the course (IF MULTIPLE sections EXIST):**

|  |  |  |  |
| --- | --- | --- | --- |
| **FACULTY** | **Section** | **FACULTY** | **Section** |
| Mr Gururaj | MTech-CSE |  |  |
| Mr. Prakash K Aithal | M.Tech-CSIS |  |  |
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