| Course Type | CourseCode | Name of the Course | L | T | P | Credits |
|---|---|---|---|---|---|---|
| DP | NCSC511 | **Algorithmic Graph Theory Lab** | 0 | 0 | 3 | 1.5 |

| **CourseObjective** |
|---|
| • This lab plan provides a hands-on approach to learning algorithmic graph theory, allowing students to implement and experiment with various algorithms and concepts discussed in the lectures. The labs are designed to reinforce theoretical knowledge through practical implementation and experimentation. |
| **LearningOutcomes** |
| • At the end of the course, the students will be well-versed in practically implementing graph-related algorithms and their applications to solve real-world problems. |

| Unit No. | Topicsto beCovered | Labs | LearningOutcome |
|---|---|---|---|
| 1 | Implement graph using adjacency list and adjacency matrix.<br>Implementing depth-first search (DFS) and breadth-first search (BFS) algorithms. | 3 | Gain practical experience in graph implementation, manipulation and traversal. |
| 2 | Implement Prim's algorithm and Kruskal's algorithm to find MST.<br>Implementing algorithms to find connected components in graphs. | 6 | Explore the relationship between spanning trees and graph connectivity. |
| 3 | ImplementDFS-based planarity testing.<br>Testing the implemented algorithms on planar and non-planar graphs. | 3 | Implement planarity testing algorithms.<br>Understand the properties of planar graphs. |
| 4 | Implement the Ford-Fulkerson algorithm and Edmonds-Karp algorithm to find maximum flow. | 6 | Apply flow algorithms to solve network optimization problems.<br>Analyze the efficiency and effectiveness of flow algorithms. |
| 5 | Implement an augmenting path algorithm tofind maximum cardinality matching.<br>Implementing Hungarian algorithm for finding maximum weight matching | 6 | Explore applications of matching algorithms inreal-world scenarios (e.g., assignment problems).<br>Analyze the properties and performance of matching algorithms. |
| 6 | Implement algorithms to find Euler tours and Hamiltonian cycles in graphs. | 6 | Explore the properties and understand the applications of Euler tours and Hamiltonian cycles. |
| 7 | Implement algorithms for vertex and edge coloring of graphs.<br>Implementing algorithms for face coloring in planar graphs. | 6 | Apply graph coloring algorithms to solve practical problems. |

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|---|---|---|---|
| 8 | Implement algorithms for vertex covering and independent sets in graphs. | 6 | Learn algorithms for vertex covering andindependent sets. |
| **Total** | | **42** | |

**Reference Books:**


- Algorithmic Graph Theory by Alan Gibbons, Cambridge University Press
- Algorithmic Graph Theory and Perfect Graphs by Martin Charles Golumbic, North Holland
- Graph Theoretic Algorithms, Therese Biedl, U of Waterloo
- Advanced Topics in Graph Algorithms, Ron Shamir, Tel Aviv U.