RAMAIAH Institute of Technology

Department of MATHEMATICS

Applied Graph Theory

Course code:

Course Credits: 3:0:0

Course Coordinator: B. Azghar Pasha

Contact hours: 42

➢ Course Objectives:

The Student will learn

1. The basic definitions and types of graphs and the properties associated with them
2. The concepts of spanning trees and planarity
3. Matrix representation of graphs and properties
4. The concepts of Directed graphs, Euler digraphs, Hamiltonian digraphs and tournaments
5. The application of graph theory in Engineering and Science.

➢ Course Contents:

Unit-I
Introduction to Graph Theory

Basic concepts of graphs, standard definitions, types of graphs, graph isomorphism, connected & disconnected graphs, Operations on Graphs, Euler graphs, Hamiltonian Paths and Circuits. Trees, properties of trees, Rooted & Binary Trees.

Unit-II
Spanning trees, Connectivity and Planarity

Spanning trees, fundamental circuits, spanning trees in a weighted graph, Kruskal's and Prim's algorithm for minimal spanning tree. Cut Sets & properties, Fundamental circuits and Cut Sets, Connectivity and Separability. Planar graphs: basic concepts & detection of planarity. Four color problem and five color theorem.

Unit-III
Matrix Representation of Graphs

Incidence Matrix, Sub matrices of A(G), Circuit Matrix, Fundamental Circuit Matrix & rank of B, Application to Switching Network, Cut-Set matrix, Relationships among A_f, B_f ,C_f. Path Matrix, Adjacency Matrix.

Unit-IV
Directed Graphs

Basic concepts and types of directed graphs, Digraphs and binary relations, Directed paths and connectedness, Euler digraphs, trees with directed edges, fundamental circuits in digraphs, Matrices A, B and C of digraphs. Hamiltonian directed graphs and tournaments.

Unit-V
Application of Graph Theory

Graphs in switching and coding theory, electrical network analysis by graph theory, Graph theory in operations research, Graph theory in Markov Processes: Multi step Transition Probabilities, Asymptotic Behavior of a regular Markov process, Transient analysis of a Markov Process.

Text Books:

1. **Narsingh Deo**, Graph theory with Application to Engineering and Computer science, PHI Learning Private Limited (2010).
2. **Harary.F**, Graph Theory. Addison - Wesley, Reading, Mass (1969).

Reference Books:

1. **J. A. Bondy and U.S.R. Murty**, Graph theory, Springer (2008)
2. **R. Diestel**, Graph theory, 5th edition, Springer (2017)

➢ Course Outcomes

Students will be able to

1. Analyze various types of graphs and determine the existence of Euler line, Hamiltonian path & circuits.
2. Apply the graph theoretic algorithms to determine the minimal spanning tree
3. Analyze characteristics of a graph through its matrix representations
4. Determine strong connectedness of graphs using the properties of digraphs
5. Apply the concepts of graph theory to solve Engineering and Science problems.