Course No	Course Name	L-T-P-Credits
MA 531	**GRAPH THEORY**	**3-0-0: 3**

Prerequisite: NIL

Course Objectives: This course is intended to introduce the fundamental theory of graphs as part of mathematics and its diverse applications in many areas of computing, social and natural sciences.

Course Outcomes: After successful completion of the course, students will be able to:

- Understand the basic concept of graphs and its applications.
- Have the knowledge of graph connectivity, Eulerian and Hamiltonian graphs, tree and spanning tree.
- Find the shortest distance between two vertices in a connected graph.
- Understand planar and non-planar graphs and their duals.
- Have the idea to solve matching related problems.
- Use the concept of graph coloring to properly color a map.

SYLLABUS

Module	Contents	Hours
I	**Graphs:** Subgraphs, paths and cycles, isomorphism, cut vertex, bridge, block, bipartite graph, complement of a graph, line graph, degree sequence, graphic sequences, Havel-Hakimi theorem, trees, spanning trees, Cayley's theorem, metric in graph, matrix representation of graph	10
II	**Connectivity:** Vertex and edge connectivity, Whiteney's theorem, n-connected graphs Mengers' theorem. Traversability: Hamiltonian graphs, Euler graphs, planar graphs, Kuratowski's theorem, dual graphs, crossing numbers, Euler formula. Non planar graphs.	10
III	**Introduction to Matching:** Berge's theorem. Bipartite matching: Hall's Marriage theorem, Konig Egervary Theorem.	6
IV	Graph coloring, chromatic polynomials, the four color problem. Digraphs: connectedness - acyclic digraph, strong digraphs, tournaments, directed trees, binary trees, weighted trees and prefix codes, BFS, DFS, Kruskal's, Prim's, Dijkstra's and Floyd's algorithms.	10

Essential Readings:

1. D. B. West, "*Introduction to Graph Theory*", Pearson Education India; 2nd edition, 2015.
2. C. R. Foulds, "*Graph Theory Applications*", Springer, 1st edition, 1995.

Supplementary Readings:

1. N. Deo, "*Graph Theory with Applications to Engineering and Computer Science*", Prentice Hall India Learning Private Limited, New edition, 1979
2. F. Harary, "*Graph Theory*", Narosa Publishing House, 2001.
3. B. Bollobas, "*Modern Graph Theory*", Springer Verlag, 1st edition, 2002.