Course Type	Course Code	Name of Course	L	T	P	Credit
DE	**NMCD520**	Graph Theory	3	0	0	3

Course Objective

- The objective of the course is to introduce the concepts of graph theory in depth and different structural parameters of graphs.

Learning Outcomes

Upon successful completion of this course, students will:

- have a broad understanding of the concepts, applications of graph theory in detail.
- have an ability to think and model different practical problems as graph theoretic problems.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	**Introduction to graphs, trees and their properties**: Graphs, Representation of Graphs, Various Special Graphs, Walk, Path, Trail, Degree Sequence of Graphs, Graph Isomorphism, Trees and its characterizations, Spanning Trees, Counting Spanning trees, Algorithms for minimum weighted spanning trees.	12	Students will learn the basic definitions and concepts on graphs such as graphs, graph isomorphism, and trees.
2	**Matching and Cycles in Graphs:** Matching, Perfect matching, Augmenting path, Bipartite matching, Hall Marriage Theorem, Matching in general graphs, Tutte's Theorem, Min-Max Theorems, Konig-Egervary Theorem, Eulerian tour and Seven Bridges problem, Hamiltonian cycles and Travelling Salesman Problem, Necessary Conditions for Hamiltonian Graphs, Sufficient Conditions for Hamiltonian Graphs.	08	This unit will help the students in understanding the graph parameters such as matching, Hamiltonian cycles, Eulerian cycles with their necessary and sufficient conditions.
3	**Coloring and Connectivity in graphs:** Vertex Coloring, Edge Coloring, Brook's theorem, Vizing Conjecture. Vertex and Edge Connectivity, Vertex- and edge-disjoint paths, testing connectivity, decomposing connected graph into blocks, Tutte's decomposition, edge-connectivity, Menger's Theorem.	09	This will help in understanding coloring, connectivity, and important theorems such as Tutte's theorem and Menger's theorem.
4	**Network Flows:** Basic concepts on flows and networks, max-flow min-cut theorem, Ford-Fulkerson algorithm.	07	Students will learn the concepts of network flows.
5	**Planarity in graphs:** Planar graphs, Euler's Formula, Outer Planar Graphs, Kuratowski Theorem, Four Color Theorem.	06	Students will learn the famous Four Color Theorem along with the concepts used in Four Color Theorem.
Total		**42**	

Text Books:

1. D. B. West, Introduction to graph theory, 2nd Edition, Pearson Education, 2015.

Reference.

1. A. Bondy and U. S. R. Murthy, Graph Theory, Graduate Texts In Mathematics, Springer, 2008
2. R. Diestal, Graph Theory, Springer-Verlag, New York, 2000