Department of Mathematics
Faculty of Mathematics & Computer Science
M.Sc. (Applied Mathematics), 4th Semester

Course Code	AM 401
Course Title	Graph Theory and Networks
Course Credits	04

Course objectives:

Graph theory is a basic course needed in several areas not only in sciences but also in engineering disciplines such as Electrical & Electronics, Computer Science in networking and data structures, Mechanical in study of the properties of system, Biotechnology. Objective is not only to present concepts definitions & theorems in a mathematical manner, but as well to tell relevance of graphs in different context, ranging from puzzles & games to social science/engineering/ computer science. Relevance of the shortest paths & maximal flows in a network, travelling salesman problem, relevance of chromatic number to scheduling problem. Problem solving & learning algorithms is also an essential part of graph theory. Emphasis is put on that without doing away with usual mathematical presentation.

Minimum pre-requisites:

Basic Algebra

Course structure:

Review of Basic concepts of Graph Theory, Matrix Representation & Types of Graphs, Adjacency Matrix, Incidence matrix, Path Matrix, Circuit Matrix, Cutset Matrix, Minimal Spanning Trees, Prim's &Kruskal's Algorithms, Fleury's Algorithm,

Connectedness of Graphs, Cut-sets & Fundamental Cut-Sets, Blocks, 1-2-Isomorphisms

Edge & Vertex Connectivity, Separability and Menger's Theorem,

Planar Graphs, Euler's formula, Detection of Planarity, Dual Graphs.

Independent Sets, Coloring& Chromatic Number, Chromatic Polynomials, Map Coloring, Matching, Domination & Covering of Graphs, Chromatic partitioning, Map Coloring, Abstract and Combinatorial Dual

Directed Graphs (Digraphs), Isomorphism in Digraphs,Trees with Directed edges, Matrix Representation

Strongly Connected & Weakly Connected Digraphs, Tournaments, NetworksNetwork flows, Max-Min Theorem Ford-Fulkerson Algorithm, Edmond Karp Algorithm. Shortest Path Problems &Dijkastra's Algorithm, Depth First Search & Breadth First Search, Some Graph Theoretic Algorithm.

Applications of Graph Theory in Social Sciences, Economics, Social Networks, Computer Science, Bioinformatics, Molecular Biology, Chemistry, Electrical Engineering, Industrial Engineering etc.

Reading suggestions:

- G. Agnarsson and R. Greenlaw, Graph Theory: Modeling, Applications and Algorithms, Pearson Education, 2011.
- Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill Edition, 2006.
- Gary Chartrand and O.R. Oellermann, Applied Algorithmic Graph Theory, McGraw-Hill Inc. 1993.
- F. Harary, Graph Theory, Narosa Publishing House, 2009.

Evaluation and weightage:

- 10% 1st Test
- 20% Assignment
- 20% Mid Sem Exam
- 10% 2nd Test
- 40% End Sem Exam