DISCRETE MATHEMATICS

Course No: **MM24201CR** Total Credits: **04**
Semester: **M.A/M.Sc 2nd Semester** Total Marks: **100**
Continuous Assessment: **Marks 20**, **Theory Marks: 80** Time Duration: **2½ Hrs Course**

Course objectives: To expose the students to the theory of graphs and combinatorics and to make them aware of their applications in different branches of science.
Course Outcomes: After the completion of this course, students shall be able to understand the principles of graph theory, including graph terminology, graph representations, connectivity, Eulerian and Hamiltonian paths, and planarity.

UNIT -I
Graphs, traversibility and degrees
Introduction of graphs, paths and cycles, operations on graphs, bipartite graphs and Konigs theorem, Euler graphs and Euler's theorem, Konigsberg bridge problem, Hamiltonian graphs and Dirac's theorem, degree sequences, Wang-Kleitman theorem, Havel-Hakimi theorem, Hakimi's theorem, Erdos- Gallai theorem, degree sets.

UNIT -II
Trees and Signed graphs
Trees and their properties, centres in trees, binary and spanning trees, degrees in trees, Cayley's theorem, fundamental cycles, generation of trees, Helly property, signed graphs, balanced signed graphs and characterizations.

UNIT -III
Connectivity and Planarity
Cut-sets and their properties, vertex connectivity, edge connectivity, Whitney's theorem, Menger's theorem (vertex and edge form), properties of a bond, block graphs, planar graphs, Kuratowski's two graphs, embedding on a sphere, Euler's formula, Kuratowski's theorem, geometric dual, Whitney's theorem on duality, regular polyhedras.

UNIT -IV
Matrices and Digraphs
Incidence matrix $A(G)$, modified incidence matrix A_f, cycle matrix $B(G)$, fundamental cycle matrix B_f , cut-set matrix $C(G)$, fundamental cut set matrix C_f, relation between A_f , B_f and C_f , path matrix, adjacency matrix, matrix tree theorem, types of digraphs, types of connectedness. Euler digraphs, Hamiltonian digraphs, arborescence, matrices in digraphs, Camions theorem in tournaments, characterisation of score sequences, Landau's theorem, oriented graphs and Avery's theorem.

Recommended Books:

1. R. Balakrishnan, K. Ranganathan, A Text Book of Graph Theory, Springer-Verlag, New York.
2. B. Bollobas, Extremal Graph Theory, Springer (2002).
3. F. Harary, Graph Theory, Narosa (2001).
4. Narsingh Deo, Graph Theory with Applications to Eng. and Comp. Sci, PHI. (1979).
5. S. Pirzada, An Introduction to Graph Theory, Universities Press, Orient Blackswan, 2012.