Bachelors with Mathematics as Minor

6th Semester

MMT622N: Mathematics/Applied Mathematics: GRAPH THEORY

Credits: 3 THEORY + 1 TUTORIAL **Theory: 45 Hours & Tutorial: 15 Hours**

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 outcome: After the completion of degree, students shall be able to understand graph theoretical concepts, and discrete structures and their applications in other disciplines.

Theory: 4 Credits

Unit- I

Graphs and trees: Graphs- types and properties, walks, paths and cycles, bipartite graphs and Konigs theorem, graph operations, distance and eccentricity, Eulerian graphs and Euler's theorem, Konigsberg bridge problem, Hamiltonian graphs, Dirac's theorem, Ore's theorem, Degree sequences, Wang-Kleitman theorem, Havel Hakimi theorem, Hakimi's theorem, Erdos-Gallai theorem (statement only), degree sets, trees and their properties, binary and spanning trees, Cayley's theorem on number of labeled trees, fundamental cycles, directed, signed and line graphs (definitions and examples only).

Unit – II

Connectivity and planarity of graphs: Cut vertex and cut edge, their properties, vertex connectivity, edge connectivity, cut of a graph, Whitney's theorem, 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, theorem on existence of five regular polyhedras, graph coloring and matching-only definitions and examples.

Unit – III

Matrices of graphs: Incidence matrix A(G), reduced incidence matrix A f , cycle matrix B(G), cut-set matrix C(G), fundamental cycle and cut set matrices B f and C f , relation between A f , B f and C f , adjacency matrix X(G), determination of number of different edge sequences, characteristic polynomial of a graph, structure theorem-statement and examples only, spectrum of a graph, Laplacian matrix, matrix tree theorem

Tutorials: 1 Credits

Unit – IV

Problems based on Unit I, II and III

Recommended Books;

1. R. Balakrishnan, K. Ranganathan, A Text Book of Graph Theory, Springer-Verlag, New York, 2012
2. F. Harary, Graph Theory, Addison-Wesley, 1969.
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, PHI, 1974.
4. S. Pirzada, An Introduction to Graph Theory, Universities Press, Orient Blackswan, 2012.
5. 5. D. B. West, Introduction to Graph Theory, Prentice Hall, 2000.