ADVANCED GRAPH THOERY

Course No: **MM24305DCE** Total Credits: **04**
Semester: **M.A/M.Sc 3rd Semester** Total Marks: **100**
Continuous Assessment: **Marks 20**, **Theory Marks: 80** Time Duration: **2½ Hrs**

Course objectives: To expose the student to the various concepts of graph theory in order to model many types of relations and processes in physical, biological, social and information systems.

Course Outcomes: Course outcomes for an Advanced Graph Theory course focuses on developing students' understanding of advanced graph theory concepts and their applications in various fields.

UNIT I

Colorings: Vertex coloring, chromatic number $\chi(G)$, bounds for $\chi(G)$, Brooks theorem, edge coloring, Vizing's theorem, map coloring, six color theorem, five color theorem, every graph is four colourable iff every cubic bridgeless plane map is 4-colorable, every planar graph is 4-colorable iff $\chi'(G) = 3$. Heawood map coloring theorem, uniquely colorable graphs

UNIT - II

Matchings: Matchings and 1-factors, Berge's theorem, Hall's theorem, 1-factor theorem of Tutte, antifactor sets, f-factor theorem, f-factor theorem implies1-factor theorem, Erdos- Gallai theorem follows from f-factor theorem, degree factors, *k*-factor theorem, factorization of K_n.

UNIT - III

Edge graphs and eccentricity sequences: Edge graphs, Whitney's theorem on edge graphs, Beineke's theorem, edge graphs of trees, edge graphs and traversibility, total graphs, eccentricity sequences and sets, Lesniak theorem for trees, construction of trees, neighbourhoods, Lesniak theorem graphs.

UNIT -IV

Groups in graphs and graph spectra: Automorphism groups of graphs, graph with a given group, Frucht's theorem, Cayley digraph, spectrum of a graph, spectrum of some graphs-regular graph, compliment of a graph, edge graph, complete graph, complete bipartite, cycle and path, Laplacian spectrum, energy of a graph, Laplacian energy.

Recommended Books:

1. R. Balakrishnan, K. Ranganathan, A Text Book of Graph Theory, Springer-Verlag, New York (2012).
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).
6. W. T. Tutte, Graph Theory, Cambridge University Press. (2016).
7. D. B. West, Introduction to Graph Theory, Pearson (2022).