II Year II Semester	**L**	**T**	**P**	**C**
Code:20CS4617	**3**	**0**	**0**	**3**

ADVANCED GRAPH THEORY (Honors)

Course Objectives:

The course objectives of Advanced Graph Theory are to discuss and make student familiar with the

1. Introduce the basic concepts of graph theory to the learners.
2. Learn different types of special graphs.
3. Learn the fundamental concepts in graph theory in view of its applications in modern science.

Course Outcomes:

By the end of the course, the student will:

1. Demonstrate the knowledge of fundamental concepts in Graph theory.
2. Write precise and accurate mathematical definitions of basics concepts in graph theory.
3. Provide appropriate examples and counter examples to illustrate the graph concepts.
4. Understand and apply various proof techniques in proving theorems in graph theory.
5. Acquire mastery in using graph drawing tools.

UNIT I

Introduction to Graphs: Definition and introductory concepts, Graphs as Models, Matrices and Isomorphism, Decomposition and Special Graphs, Connection in Graphs, Bipartite Graphs, Eulerian Circuits.

UNIT II

Vertex Degrees and Directed Graphs: Counting and Bijections, Extremal problems, Graphic Sequences, Directed Graphs, Vertex degrees, Eulerian Digraphs, Orientations and Tournaments.

UNIT III

Trees and Distance: Properties of Trees, Distance in Trees and Graphs, Enumeration of Trees, Spanning Trees in Graphs, Decomposition and Graceful Labellings, Minimum Spanning Tree, Shortest Paths.

UNIT IV

Connectivity and Paths: Connectivity, Edge - Connectivity, Blocks, 2 - connected Graphs, Connectivity in Digraphs, k - connected and k-edge-connected Graphs, Maximum Network Flow, Integral Flows.

UNIT V

Coloring of Graphs: Introduction, coloring of graphs, vertex coloring, chromatic number, chromatic index, chromatic polynomial, chromatic partitioning, five color theorem (with proof), four color theorem (without proof). Edge coloring of graphs.

Text Books:

1. D.B. West, Introduction to Graph Theory, New Delhi: Prentice-Hall of India, 2011.

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Reference Books:

1. Graph Theory-Modeling, Applications and Algorithms, Geir Agnarsson & Raymond Greenlaw, Pearson Education, 2008, ISBN: 978-81-317-1728-8.
2. F. Harary, Graph Theory, New Delhi: Narosa, 2001.
3. G. Chartrand and P.Chang, Introduction to Graph Theory, New Delhi: Tata McGraw-Hill, 2006.
4. G. Chatrand and L. Lesniak, Graphs and Digraphs, Fourth Edition, Boca Raton: CRC Press, 2004.
5. J. A. Bondy and U.S.R. Murty, Graph Theory, Springer, 2008.
6. J. Clark and D.A. Holton, A First Look At Graph Theory, Singapore: World Scientific, 2005.
7. R. Balakrishnan and K Ranganathan, A Text Book of Graph Theory, New Delhi: Springer, 2008.