ΠY	Year	Π	Semester	
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Code:20CS4617

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.