

**Learning Outcomes:**

After learning the course the students should be able to

- Solve problems using basic graph theory
- Identify induced subgraphs, cliques, matchings, covers in graphs
- Determine whether graphs are Hamiltonian and/or Eulerian
- Solve problems involving vertex and edge connectivity, planarity and crossing numbers
- Solve problems involving vertex and edge coloring
- Model real world problems using graph theory

**SYLLABUS**

<b>Unit No.</b>	<b>Topics</b>	<b>Lectures (Hours)</b>
<b>1</b>	<b>Basics</b> Graphs, degree sequences, distance in graphs, complete, regular and bipartite graphs, basic properties	<b>5</b>
<b>2</b>	<b>Structure and Symmetry</b> Cut vertices, bridges and blocks, automorphism groups, reconstruction problem	<b>6</b>
<b>3</b>	<b>Trees and connectivity</b> Properties of trees, Arboricity, vertex and edge connectivity, Mengers theorem	<b>7</b>
<b>4</b>	<b>Eulerian and Hamiltonian graphs</b> Characterization of Eulerian graphs - Sufficient conditions for Hamiltonian graphs	<b>6</b>
<b>5</b>	<b>Colouring and planar graphs</b> vertex and edge colouring, perfect graphs, planar graphs, Euler's theorem, Kuratowski's theorem, Colouring of planar graphs, Crossing number and thickness	<b>7</b>
<b>6</b>	Matching, factors, decomposition and domination	<b>6</b>
<b>7</b>	<b>Extremal Graph theory</b> Turan's theorem, Ramsay's theorem, Szemerédi's regularity lemma, applications	<b>8</b>

**Text Books:**

1. Graph Theory, by J. A. Bondy and U. S. R. Murthy, Springer Verlag (2008.)
2. Introduction to Graph Theory, by D. B. West, PHI, 2004.

**Reference Books:**

- 1 Graph Theory, by R. Diestel : Springer Verlag (Free Download available).(2003)