NIRMA UNIVERSITY
Institute of Technology
B. Tech. Computer Science and Engineering
Semester- VI
Department Elective-I

L	T	P	C
2	0	2	3

Course Code	2CSDE56
Course Title	Graph Theory

Course Outcomes :

At the end of the course, students will be able to –

1. explain the concept of formal graph-theoretic definitions and notations
2. apply basic theoretical concepts in solving real-life problems and address optimization issues
3. analyse real-life problems to match with applications in computer science

Syllabus

Teaching Hours: 30

Unit I **08**

Introduction to Graph Theory: Discovery of graphs, Definitions, Set Operations on Graphs: Union, Sum, Complement, Difference, Cartesian Product, Composition, and Fusion. Sub-graphs, Isomorphic graphs, Matrix representations of graphs, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Graphic sequences, Graph-theoretic model of the LAN problem, Havel-Hakimi criterion, Realization of a graphic sequence.

Unit II **07**

Connected Graphs and Shortest paths: Connected graphs, Distance, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs, and shortest paths, Weighted graphs, Djkstra's shortest path algorithm, Floyd-Warshall's shortest path algorithm.

Unit III **05**

Trees: Properties, Pendant Vertices, Distance and Canters in a tree, Rooted and Binary Trees, Counting Trees, Spanning Trees and Fundamental Circuits, Number of Spanning Trees.

Unit IV **05**

Planar and Dual Graphs: Combinatorial Vs Geometric Graphs, Planar Graphs, Kuratwoski Graphs, Theorems, Detection of Planarity, Geometric and Combinatorial Dual, Thickness and Crossings.

Unit V **05**

Coloring, Covering and Partitioning: Basic definitions, Cliques and

chromatic number, Chromatic Polynomials, Mycielski's theorem, Greedy coloring algorithm, Coloring of chordal graphs, Brooks theorem, Edge Colorings, Matchings, Coverings, The four-color conjecture and five-color theorem.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings^:

1. NarsinghDeo, Graph theory with applications to engineering and computer science. Courier Dover Publications
2. JA Bondy and USR Murty, Graph theory with applications. Bulletin of the American Mathematical Society, The Macmillian Press Ltd.
3. Doughlous B. West, Introduction to graph theory (Vol. 2). Upper Saddle River, NJ: Prentice hall.
4. Gary Chartard and Ping Zhang, A First Course in Graph Theory, Courier Corporation.
5. GeirAgnarsson and Raymond Greenlaw, Graph Theory: Modelling, Applications, and Algorithms, Pearson/Prentice Hall.

L=Lecture, T=Tutorial, P=Practical, C=Credit

^this is not an exhaustive list