



Course Title: Graph Theory and Combinatorics

Course Level:PG

Course Code: CSIT722

Credit Units: 3

| L | T | P/S | SW/FW | TOTAL CREDIT UNITS |
|---|---|-----|-------|--------------------|
| 3 | - | - | - | 3 |

Course Objectives: The objective of the course is to

- Explain basic concepts in combinatorial graph theory
- Define how graphs serve as models for many standard problems
- discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.
- See the applications of graphs in science, business and industry.

Pre-requisites:

Fundamentals of IT and C Language

Course Contents/Syllabus:

| | Weightage (%) |
|--|---------------|
| Module I: Introduction of Graph Theory | |
| Basic Terminology, Walks, paths, circuits, connectedness, Handshaking Lemma, Isomorphism, Sub graphs, Reach ability, Union and Interaction of Graphs, Euler Graph, Shortest path problem, Hamiltonian graph, Traveling Salesman Problem, Bipartite graphs. | 25 |
| Module II: Trees | 25 |

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|--|----|
| Introduction to trees, Rooted trees, path length in rooted trees, spanning trees, Fundamental circuits, spanning trees of a weighted graph, cut sets and cut vertices, Fundamental cut set, Minimum spanning tree. | |
| Module III: Directed Graph | |
| Directed graphs and connected ness, directed trees, Network Flows, Max Flow-MinCut Theorem, Matrix representation of a graph, Planar graphs: Combinational and Geometric Duals, Kuratowski's graphs, Detection of planarity, thickness and crossing. | 25 |
| Module IV: Combinatorics | |
| Partitions, counting functions, number of partitions into odd or unequal parts. Necklaces, Euler's function, set of symmetries, enumeration in the odd and even cases. | 25 |

Student Learning Outcomes:

After completion of the course, the student will be able to:

- Explain the basic concepts of graph theory.
- apply the basic concepts of mathematical logic
- describe and solve some real time problems using concepts of graph theory .

Pedagogy for Course Delivery:

The course will be taught in theory based mode. The course instructor will also give presentations to the students for better understanding of the concepts of Graphs and Trees.

Assessment/ Examination Scheme:

| Theory L/T (%) | Lab/Practical/Studio (%) | End Term Examination |
|----------------|--------------------------|----------------------|
| 100 | - | 100 |

Theory Assessment (L&T):

| Continuous Assessment/Internal Assessment | | | | | End Term Examination |
|---|---------------|-------------|-------------|------------|----------------------|
| Components (Drop down) | Mid-Term Exam | Assignments | Performance | Attendance | |
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|----------------------|----|----|---|---|----|
| Weightage (%) | 10 | 10 | 5 | 5 | 70 |
|----------------------|----|----|---|---|----|

Text:

- C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill, 2nd Edition, 2000.
- N. Deo, Graph Theory with Applications to Engineering and Computer Science, PHI publication, 3rd edition, 2009

References:

- Harikishan, Shivraj Pundir and Sandeep Kumar, Discrete Mathematics, Pragati Publication, 7th Edition, 2010.
- Colmun, Busby and Ross, Discrete Mathematical Structure, PHI Publication, 6th Edition, 2009