Course: OE
Graph Theory

Semester: II	Credits: 2	Subject Code: OE2-22308	Lectures: 30

Course Outcomes:

At the end of this course, the learner will be able to:
- CO1 - Know about the new branch of mathematics - Graph Theory and its applications.
- CO2 - Define trees and demonstrate different traversal methods for trees.
- CO3 - Classify different types of digraphs and identify the areas of their applications.
- CO4 - Describe and apply some important and useful algorithms for graphs.

Unit 1: Connected Graphs and Eulerian and Hamiltonian Graphs	15

- Introduction to Graphs - Elementary Terminologies and Results, Handshaking lemma, Corollary of Handshaking lemma, Adjacency Matrix of a graph
- Types of graphs
- Walk, Trail, Path- Definition, Examples and Properties
- Connected graphs – Definition and Properties
- Distance between two vertices, Eccentricity, centre, radius and diameter of a graph
- Isthmus, Cut Vertex- Definition, Examples and Properties, Edge connectivity, Vertex connectivity
- Dijkstra's Algorithm
- Konigsberg Bridges Problem
- Eulerian Graphs- Definition, Examples, Necessary and Sufficient Condition (with proof)
- Hamiltonian Graphs- Definition, Examples and Theorems (2 without Proof)
- Chinese Postman Problem, Travelling Salesman Problem
- Activity

Unit 2: Trees, Directed Graphs and Planarity	15

- Definition, Properties of Trees, Theorems on Trees (with proof)
- Spanning tree: Definition, Properties , Shortest spanning tree- Kruskal's Algorithm
- Binary Tree – Definition and Properties.
- Tree Traversals - Preorder traversal, In order traversal and Post order traversal
- Directed Graphs: Definition, Examples, Elementary terminologies and Properties.
- Connectedness of digraphs.
- Networks and Flow, Ford Fulkerson Algorithm
- Planarity and coloring in graphs
- Assignment

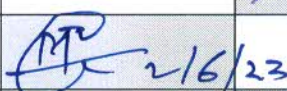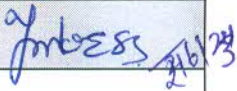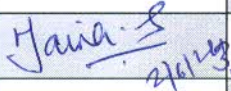| Board of Studies	Department	Name	Signature
Chairperson (HoD)	B.Sc. Computer Science	Gitanjali Phadnis	G.M.Phadnis 02/06/2023

Recommended Text Books:
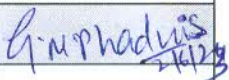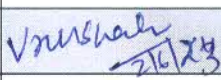
- Kenneth Rosen, *Discrete Mathematics and its applications*, Tata McGraw Hill, Seventh Edition.
- John Clark and Derek Holton, *A first look at Graph theory*, Allied Publishers.

Reference Books:

- Kolman, Busby, Rehman, *Discrete Mathematical Structures*, Prentice Hall
- C. L. Liu, *Elements of Discrete Mathematics*, Tata McGraw Hill
- Narsingh Deo, *Graph Theory with applications to computer science and Engineering*, Prentice Hall.
- Harary, *Graph Theory*, Narosa Publishing House Pvt. Ltd., New Delhi, 2013.

Websites:

- https://www.tutorialspoint.com/discrete_mathematics/index.htm for Unit 1 to Unit 5
- https://nptel.ac.in
- https://swayam.gov.in

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