SEMESTER S5

GRAPH THEORY

Course Code	PEEVT523	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To introduce fundamental concepts in Graph Theory, properties and characterisation of graph/trees and graph theoretic algorithms, which are widely used in Mathematical modelling and has applications in all branches of Engineering.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Graphs : Introduction- Basic definition – Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.	9
2	Eulerian and Hamiltonian graphs : Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation, Directed paths, Fleury's algorithm.	8
3	Trees and Graph Algorithms : Trees – properties, pendant vertex, Distance and centres in a tree - Rooted and binary trees, counting trees, spanning trees, Prim's algorithm and Kruskal's algorithm, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm.	8
4	Connectivity and Planar Graphs : Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits, Planar graphs, Kuratowski's theorem (proof not required), Different representations of planar graphs,	11

	Euler's theorem, Geometric dual. Graph Representations and Vertex Colouring : Matrix representation of graphs-Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix. Coloring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four color problem and Five color problem. Greedy colouring algorithm.	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain vertices and their properties, types of paths, classification of graphs and trees & their properties. (Cognitive Knowledge Level: Understand)	**K2**
CO2	Demonstrate the fundamental theorems on Eulerian and Hamiltonian graphs.	**K2**
CO3	Illustrate the working of Prim's and Kruskal's algorithms for finding minimum cost spanning tree and Dijkstra's and Floyd-Warshall algorithms for finding shortestpaths.	**K3**
CO4	Explain planar graphs, their properties and an application for planar graphs.	**K3**
CO5	Explain the Vertex Color problem in graphs and illustrate an example application for vertex coloring	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**							**2**		**2**
CO2	**3**	**3**	**3**	**3**						**2**		**2**
CO3	**3**	**3**	**3**	**3**						**2**		**2**
CO4	**3**	**3**	**3**	**3**						**2**		**2**
CO5	**3**	**3**	**3**			**3**				**2**		**2**

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Graph theory,	Narsingh Deo,	PHI	1979

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Graph Theory,	R. Diestel,	free online edition, 2016: diestel-graph-theory.com/ basic.html.	2016
2	Introduction to Graph Theory,	Douglas B. West	Prentice Hall India Ltd.,	2001
3	Introduction to Graph Theory,	Robin J. Wilson,	Longman Group Ltd	.,2010
4	Graph theory with Applications	A. Bondy and U.S.R. Murty		

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.nptel.ac.in/noc22_ma10/preview
2	https://archive.nptel.ac.in/courses/111/106/111106102/
3	https://nptel.ac.in/courses/128106001