Elective B – Global Elective		
Course Title: GRAPH THEORY		
Course Code:16G5B04		CIE Marks: 100
Credits: L:T:P:S: 4:0:0:0		SEE Marks: 100
Hours: 45		SEE Duration: 3 Hrs

Course Learning Objectives: The students will be able to	
1	Understand the basics of graph theory and their various properties.
2	Model problems using graphs and to solve these problems algorithmically.
3	Apply graph theory concepts to solve real world applications like routing, TSP/traffic control, etc.
4	Optimize the solutions to real problems like transport problems etc.,

UNIT-I	
Introduction to graph theory Introduction, Mathematical preliminaries, definitions and examples of graphs, degrees and regular graphs, sub graphs, directed graphs, in degrees and out degrees in digraphs. **Basic concepts in graph theory** Paths and cycles, connectivity, homomorphism and isomorphism of graphs, connectivity in digraphs.	09 Hrs
UNIT-II	
Graph representations, Trees, Forests Adjacency matrix of a graph, Incidence matrix of a graph, Adjacency lists, Trees and properties of trees, Characterization of trees, Centers of trees, Rooted trees, Binary threes, Spanning trees and forests, Spanning trees of complete graphs, An application to electrical networks, Minimum cost spanning trees.	09 Hrs
UNIT-III	
Fundamental properties of graphs and digraphs Bipartite graphs, Eulerian graphs, Hamiltonian graphs, Hamiltonian cycles in weighted graphs, Eulerian digraphs. **Planar graphs, Connectivity and Flows** Embedding in surfaces, Euler's formula, Characterization of planar graphs, Kuratowski's theorem, Dual of a planar graphs.	09 Hrs
UNIT-IV	
Matchings and Factors Min-Max theorem, Independent sets and covers, Dominating sets, maximum bipartite matching. **Coloring of graphs** The chromatic number of a graph, Results for general graphs, The chromatic polynomial of a graph, Basic properties of chromatic polynomial, chordal graphs, powers of graphs, Edge coloring of graphs	09 Hrs
UNIT-V	
Graph algorithms Graph connectivity algorithms, Breadth first search and Depth first search, Shortest path algorithms, Dijikstra's shortest path algorithm, Minimum cost spanning tree algorithms, Algorithm of Kruskal's and Prim's.	09 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1.	Understand and explore the basics of graph theory.
CO2.	Analyse the significance of graph theory in different engineering disciplines
CO3.	Demonstrate algorithms used in interdisciplinary engineering domains.
CO4.	Evaluate or synthesize any real world applications using graph theory.

Reference Books	
1.	Douglas B. West, "Introduction to graph theory", 2nd Edition, PHI, 2001, ISBN- 9780130144003, 0130144002.
2.	Geir Agnarsson, Raymond Greenlaw, "Graph Theory, modeling, Applications and Algorithms", Pearson Education, 1st Edition,2008, ISBN- 978-81-317-1728-8.
3.	Cormen T.H., Leiserson C. E, Rivest R.L., Stein C., Introduction to Algorithms, 3rd Edition, PHI 2010, ISBN:9780262033848

Note: The faculty teaching the course may adapt additional methods for evaluation within the total maximum marks.

		What	To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100 %	90%
		Test		Three	60				
		Assignment		2 phases	10	Reports / Record Books			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment		Course End Survey	Students	End of course		Questionnaire Based on COs	10%		

Note: Individual faculty may adopt various methods for conducting effective quizzes and evaluate the same. The frequency of quizzes may be more than three also.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	-	-	-	1	1	-	-
CO2	2	3	2	1	-	-	-	-	2	2	-	1
CO3	2	2	3	2	-	-	-	-	2	2	-	1
CO4	2	2	3	2	-	1	-	-	2	2	-	1
Course - PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	2	2	2	1	-	1	-	-	2	2	-	1