Course Code	MTH303
Course Name	Graph Theory
Credits	4
Course Offered to	UG/PG
Course Description	This course is aimed at giving students an introduction to the theory of graphs. The course will introduce concepts that are widely used such as matchings, colorings, etc and study relations between various graph parameters such as matching number, chromatic number, clique number, etc. The emphasis will be on common proof techniques, and applying them to prove properties of graphs in general and for specific families of graphs.

Pre-requisites

Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
None	Linear Algebra (MTH100), Discrete Mathematics (CSE121)	None
*Please insert more rows if required		

Post Conditions*(For suggestions on verbs please refer the second sheet)

CO1	CO2	CO3	CO4	CO5
Know elementary structural properties and some simple graph classes	Know about connectivity, matchings, cuts and flows, coloring, planarity	Know about fundamental graph parameters and be able to calculate them for graph classes	Write simple proofs based on the properties of the graphs and classic theorems	

Weekly Lecture Plan

Week Number	Lecture Topic	COs Met	Assignment/Labs/Tutorial
Weeks 1-2	Elementary notions: degree, directed, undirected, bipartite, complete, trees, cycles, paths, graphic sequence, isomorphism, spanning treesÂ etc.	CO1,CO4	Homework problems from the relevant textbook chapter
Weeks 3-4	Connectivity: Menger's theorem, notions such as strong connectivity, cut edges, cut vertices, bridges, finding blocks, etc.	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
Weeks 5-6	Matching (and covering): Hall's theorem, Konig's theorem, vertex cover, matching in bipartite graphs, matching in general graphs, factors	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
Weeks 7-8	Cuts and Flows: max-flow/min-cut: Ford-Fulkerson Theorem	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
Weeks 9-10	Coloring: vertex coloring- chromatic number, clique number, independence number, clique cover, Brook's theorem, d-degeracy, edge-coloring, Vizing's theorem, existence of triangle-free graphs with arbitrarily large chromatic number.	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
Week 11	Paths and cycles: Euler tours, Hamiltonian cycles and paths, Chinese Postman Problem, TSP	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
Week 12	Planarity: plane graphs, Kuratowski's theorem, duallilty, testing planarity, Euler's formula, 5-coloring planar graphs	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
Week 13	Ramsey theory: Ramsey numbers and generalizations (optional if time permits)	CO2,CO3,CO4	Homework problems from the relevant textbook chapter
*Please insert more rows if required			

Weekly Lab Plan - Not Applicable

Week Number	Laboratory Exercise	COs Met	Platform (Hardware/Software)
*Please insert more rows if required			

Assessment Plan

Type of Evaluation	% Contribution in Grade
Test	10
Mid-Semester Exam	20
Weekly submission, quiz	25
End-Semester Exam	45
*Please insert more row for other type of Evaluation	

Resource Material

Type	Title
Textbook	D. West: Introduction to Graph Theory, Prentice Hall
Reference Book	Chartrand & Ping Zhang: Introduction to Graph Theory, Tata McGraw-Hill
Reference Book	Bela Bollobas: Modern Graph Theory, Springer-Verlag
Reference Book	Bindy & Murty: Graph Theory, Springer Verlag