



Mathematics Department

Syllabus

MATH 467: Graph Theory (3-0-3)

Course Catalog Description:

Graphs and digraphs. Degree sequences, paths, cycles, cut-vertices, and blocks. Eulerian graphs and digraphs. Trees, incidence matrix, cut-matrix, circuit matrix and adjacency matrix. Orthogonality relation. Decomposition, Euler formula, planar and nonplanar graphs. Menger's theorem. Hamiltonian graphs.

Course Objectives:

- 1.To introduce students to basic topics in graph theory
- 2.To use graph theory in solving real world problems; such as problems in network and scheduling

Course Learning Outcomes:

- CLO1. Define and describe basic concepts and graph theory terminology: induced subgraphs, cliques, matchings, covers in graphs, graph coloring.
- CLO2. Recognize different families of graphs and their properties such as Hamiltonian, Eulerian and planar Graphs.
- CLO3. Describe automorphism groups and different types of graph matrices and their use.
- CLO4. Solve problems involving vertex and edge connectivity, planarity and crossing numbers.
- CLO5. Construct spanning trees, matching, and different matrices.
- CLO6. Apply different proof techniques in theorems and exercises.
- CLO7. 7. Apply Graph theory to model and solve real world problems and networks.

Learning Resources:

- Graphs & Digraphs by G. Chartrand and L. Lesniak, 5th edition, 2011.
- Douglas West, Introduction to Graph Theory, Pearson; second edition (2002).
- Hand-out material
- Research papers for the projects

Classroom Etiquette:

Adhering to basic rules of decorum is vital for the academic atmosphere in the classroom and helps to establish a constructive learning environment. Moreover, behaving like a responsible well-mannered

adult is indispensable part of one's professional life. I expect you to attend class regularly and to refrain from disruptive behavior. In particular, I expect you to arrive on time and to abstain from private discussions and from using electronic devices during lecture time.

A student who misses **more than eight** classes without a valid excuse, or accumulates **fifteen** excused and unexcused absences in lectures, **will receive a DN grade.**

KFUPM List of Attributes and Associated Skills

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Attendance, Class Participation, Quizzes, Homework	15	40 %
Midterm	8	25 %
Final	16	35 %

Lecture Weekly Schedule:

Week#	Topics
1	Introduction to Graphs: Graphs Subgraphs
2	Introduction to Graphs: Connected graphs, distance, multigraphs, digraphs
3	Trees and Connectivity: Trees, Spanning trees
4	Trees and Connectivity: Connectivity, Edge Connectivity
5	Mengers Theorem, Eulerian graphs, Hamiltonian Graphs
6	Digraphs: Tournaments
7	Planar Graphs:
8	Review & Midterm October 15
9	Vertex coloring, Map coloring
10	Matchings, Factorization and Domination
11	Edge Coloring
12	Algebraic Graph Theory
13	Extremal Graph Theory
14	Extremal Graph Theory
15	Selected Topics, Review