SECOND SEMESTER 2022-2023
Course Handout Part II

16-01-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : *MATH F243*
Course Title : *Graphs & Networks*
Instructor-in-charge : *A. Michael Alphonse*
Instructors : A. Michael Alphonse, Faiz Imam, Hirendra Kumar Garai

Scope and Objective of the Course: The applications of graph theory are ranging from social sciences to electrical engineering and computer science to management. Every graph theoretic model is supported by a strong mathematical scheme. The objective of the course is, in addition to apply the graph theoretic model to different applications; students can develop a strong concept on the logical foundations, and can develop of a standard mathematical formulation for different real life problems.

Textbooks:

1. Gary Chartrand & Ping Zhang: Introduction to Graph Theory, Mcgraw-hill, Indian Edition 2006.

Reference books

1. E. G. Goodaire & M. M. Parmenter : Discrete Mathematics with graph theory, 3rd edition, Pearson, 2002.
2. Narsingh Deo: Graph theory with applications to engineering & computer science, PHI 1974.
3. G. Agnarsson and R. Greenlaw: Graph Theory Modeling, Applications and Algorithms, Pearson, 2007.

Course Plan:

Lecture No.	Learners objective	Topics to be covered	Chapter in the Text Book
1-4	To introduce the concept of graph and its representation. Distinguish between multigraphs and digraphs.	Graphs and Graph Models, Connected Graphs, Classes of graphs, Multigraphs and Digraphs.	Chapter 1.1-1.4
5-8	Understanding the graphs through the degree of the vertices, order and Size. Relationship between the graphs and matrices.	Degree of a vertex, Regular graphs, Degree Sequence, Graphs and Matrices, Irregular graphs.	Chapter 2.1-2.5
9-12	Understanding when two graphs are equal	Isomorphic Graphs, Definition of isomorphism, Isomorphism as a relation	Chapter 3.1-3.3

13-16	Studying a specific class of graphs called Trees and their uses in Optimization	Bridges, Trees, equivalent definitions, spanning tree, Minimal spanning tree, Prim's & Kruskal Algorithm Binary trees, Distance between spanning tree, eccentricity, Centre(s), diameter of tree & connected graph.	Chapter 4.1-4.4
17-20	How spanning tree is connected with concept of special type of cut set & circuit in a connected graph	Cut vertices, Blocks, Connectivity, Menger's Theorem	Chapter 5.1-5.4
21-23	To appreciate the difference between edge traversal & vertex traversal	Eulerian Graphs, Hamiltonian Graphs, Hamiltonian walk and numbers	Chapter 6.1-6.3
24-26	To determine the matching number, covering number.	Matchings, Factorization	Chapter 8.1-8.2
27-30	To study the Planar Graphs, Surface Graphs and their Properties	Planar Graphs, Euler identity, Detection of planarity, Embedded graphs on surface. Graph Minors	Chapter 9.1-9.3
31-34	To study the Graph coloring Problems and their applications	The four color problem, vertex coloring, edge coloring, chromatic number, chromatic partitioning	Chapter 10.1-10.3
35-36	To study the Digraphs	Directed graph, Euler digraph, Strongly connected & weakly connected digraphs,	Chapter 7.1
37- 40	Directed weighted network, relevance of maximum flow	Network flow, Max Flow- Min Cut theorem, Fulkerson Algorithm for Maximum flow, Shortest path problem & Dijkstara Algorithm.	Chapters in R1 : 15.1, 15.2 and 10.4.1-10.4.3

Evaluation Scheme:

Evaluation Component	Duration	Weightage	Date & Time	Nature of Component
Mid-semester Examination	90 Minutes	30%	14/03 9.30 - 11.00AM	Open book
Quiz 1		7%	Details will be announced in the class	Closed book
Quiz 2		7%		
Assignment 1		6%		Open Book
Assignment 2		5%		
Comprehensive Examination	3 Hours	45%	10/05 FN	Closed Book

Total Marks: 100

Chamber Consultation Hour: To be announced in the class.

Notices: All notices about the course will be put up in the CMS Notice Board.

Make-up Policy: Make up will be granted only in genuine cases. Permission must be taken in advance.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE