10B1WCI733: Graph Algorithms and Applications

Course Credit: 3
Semester: VII

Introduction

This course fills a need for a thorough introduction to graph theory that features both the understanding and writing of proofs about graphs. Verification that algorithms work is emphasized more than their complexity. An effective use of examples, and huge number of interesting exercises, demonstrate the Topics of trees and distance, matchings and factors, connectivity and paths, graph coloring, edges and cycles, and planar graphs. For those who need to learn to make coherent arguments in the fields of mathematics and computer science.

Course Objectives (Post-conditions)

Knowledge objectives:

1. You will became aware of basic concepts and terminology.
2. You will become aware of the representation techniques.
3. You will broaden your knowledge of applications to theoretical Computer Science .
4. You will acquire the background for understanding reliable communication network design
5. You will learn concepts associated with optimal tours and minimum cost constructions.
6. You will acquire the background for understanding optimal assignment and geometric problems.
7. You will learn concepts associated with schedules and Planarity detection.
8. You will learn how to handle project scheduling and transportation problems.

Application objectives:

1. to develop, implement, and demonstrate the learning through a project that meet stated specifications.
2. to understand and be able to apply applications of connectivity, traversability, trees, and matchings .
3. to understand and be able to apply applications of covering, colourability, planarity, digraphs, and flows.

Expected Student Background (Preconditions)

Topics Outline:

S NO	Topics	Hrs
1	Scope, Basic concepts and terminology	2
2	Adjacency Matrix, Incidence Matrix, Cycle Matrix, Cut-set Matrix, Path Matrix, etc.	2
3	Determining lower bounds, Adversary arguments, Problem reductions, NP-completeness, etc.	2
4	Reliable communication network design, Cycle	4

	detection, Searches, etc.	
5	Shortest paths, Optimal tours, TSP, etc.	4
6	Spanning trees, Minimum cost constructions, Coding theory, Phylogeny construction, etc.	4
7	Personnel assignment, Optimal assignment, Territory demarcation, etc.	4
8	Geometric problems, etc.	4
9	Storage management, Timetable schedules, etc.	4
10	Planarity detection, PCB design, Facilities layout and floor plan design, Software testing, Defense strategies, etc.	4
11	Circuit theory and electrical network analysis, Transport networks, Job sequencing, Disk scheduling, Participant rankings in tournaments, Choice consistency, Project planning, etc.	4
12	Max-flow min-cut, Feasible flows, Transportation problems, etc.	4
	Total	42

References

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall, 1974.
2. Douglas B. West, Introduction to Graph Theory, PHI, second edition, 2001.
3. Thomas H Cormen, Charles E Leiserson, Ronald L. Rivest, and Cliff Stein, Introduction to Algorithms, 2e, MIT Press, 2001.
4. Kenneth H. Rosen, Discrete Mathematics and its Applications, 6e, McGraw-Hill, 2007.
5. Reinhard Diestel, Graph Theory, 3e, Springer-Verlag, 2005.

Evaluation Scheme:

S.No	Examination	Marks
1	T-1	15
2	T-2	25
3	T-3	35
4	*Internal Marks	25

*Internal Marks Breakdown:

Assignments 9 marks (3x3)

Quizzes 12 marks (3x4)

Regularity 4 Marks