



NOC:Advanced Graph Theory

COURSE LAYOUT:

- Week 1 : Introduction to Graphs & its Applications, Basics of Paths, Cycles, and Trails, Connection, Bipartite Graphs, Eulerian Circuits, Vertex Degrees and Counting, Degree-sum formula, The Chinese Postman Problem and Graphic Sequences.
- Week 2 : Trees and Distance, Properties of Trees, Spanning Trees and Enumeration, Matrix-tree computation, Cayley's Formula, Prufer code.
- Week 3 : Matchings and Covers, Hall's Condition, Min-Max Theorem, Independent Sets, Covers and Maximum Bipartite Matching, Augmenting Path Algorithm, Weighted Bipartite Matching, Hungarian Algorithm.
- Week 4 : Stable Matchings and Faster Bipartite Matching, Factors & Perfect Matching in General Graphs, Matching in General Graphs: Edmonds' Blossom Algorithm
- Week 5 : Connectivity and Paths: Cuts and Connectivity, k-Connected Graphs, Network Flow Ford-Fulkerson Labeling Algorithm, Max-Flow Min-cut Theorem, Menger's Proof using Max-Flow Min-Cut Theorem.
- Week 6 : Vertex Coloring and Upper Bounds, Brooks' Theorem and Color-Critical Graphs, Counting Proper Colorings.
- Week 7 : Planar Graphs, Characterization of Planar Graphs, Kuratowski's Theorem, Wagner's Theorem.
- Week 8 : Line Graphs and Edge-coloring, Hamiltonian Graph, Traveling Salesman Problem and NP-Completeness, Dominating Sets.

SUGGESTED READING MATERIALS:

- D.B. West, Introduction to Graph Theory, Prentice Hall, 2001
Jon Kleinberg and Eva Tardos, Algorithm Design, Addison-Wesley, 2005
J.A.Bondy and U.S.R.Murty: Graph Theory, Springer, 2008.
R.Diestel: Graph Theory, Springer(low price edition) 2000.
F.Harary: Graph Theory, Narosa, (1988)
C. Berge: Graphs and Hypergraphs, North Holland/Elsevier, (1973)