Objectives: The main objective of the course is for students to learn some classical theorems and algorithms in the field. It is expected that students will be able to demonstrate their knowledge of algorithms by solving concrete problems. In addition, students will learn some proofs of the discussed theorems and prove simple facts about graphs and graph algorithms.

Typical topics include:

- Tree search in graphs and digraphs. Breadth-first search and depth-first search.
- Introduction to graphs: undirected graphs, directed graphs, weighted graphs, graph representation and special classes of graphs (trees, planar graphs etc.).
- Algorithmic problems on graphs: minimum spanning trees, shortest path problems, matching problems.
- Planar graphs and their properties. Euler's formula, planar separator theorem and their algorithmic applications.
- Optimization problems on graphs including graph colouring and graph questions in distributed systems. Matching and maximal matching algorithms. Approximation algorithm for vertex cover problem. Approximation algorithms for the metric traveling salesman problem.
- Discussing practical applications of graphs and efficient algorithms for such practical problems. Approximation algorithms and heuristic algorithms. Applications to searching in massive graphs (e.g. page ranking); use of structural properties and algebraic properties.

Text / Reference books:

1. Algorithmic Graph Theory, Alan Gibbons.
2. Introduction to Algorithms, Cormen, Leiserson, Rivest.
5. Introduction to Graph Theory, Douglas B. West, 2nd Ed.