

INDUSTRIAL AND MANAGEMENT ENGINEERING, IIT KANPUR

IME 639: ANALYTICS IN TRANSPORT AND TELECOM (3-0-0-0-9)

Sep 08, 2017

Course objectives:

This course is concerned with quantitative modeling for optimizing the design and operation of systems arising in Transportation and Telecommunication industries. From a modeling perspective Transport and Telecom share a number of common characteristics, as both are concerned with design of network like structures involving flow of either physical goods or information. The course includes a number of combinatorial optimization models, and heuristic algorithms for solving such models.

Course contents:

- Introduction. Commonality in modeling problems across Transport and Telecom
- Introduction to Graph Theory
- Review of linear and integer linear programming
- Introduction to Complexity Theory and NP-completeness
- Minimum Spanning Tree Problem
- Steiner Tree Problem
- Shortest Path Problem, Dijkstra's algorithm, Bellman Ford Algorithm
- All Pair Shortest Paths, Floyd's algorithm, Applications
- Network Flow Models, Max Flow Min Cut Problem, Minimum Cost Flows
- Knapsack Problem and applications
- Bin Packing Problem and applications
- Vehicle Routing Problem
- Large Scale Optimization, Column Generation, Hands on with CPLEX
- Set Covering/Partitioning/Packing Models and Applications
- Traveling Salesman Problem with applications
- Fixed Charge Transportation Problem
- Telecom Network Design, Access Networks, Backbone Networks
- Design of Survivable Networks
- Graph Coloring Model and applications
- Chinese Postman Problem with applications

Instructor: Dr. Faiz Hamid (fhamid@iitk.ac.in)

Class Room: C3, IME Building

Time: T (12:00 - 13:15), W (14:00 - 15:15)

Course Organization: All Notices for the course will be sent by email to the course email list.

Home Assignments:

At the end of every chapter or week, home assignments will be given. The students are strongly advised to solve and master the material of the home assignment, submission is optional.

Exams and Project:

- One mid-semester examination of two hours (weight: 30%)
- One end-semester examination of three hours (weight: 40%)
- One project involving coding of some algorithm (weight: 30%)

Attendance:

It goes without saying that 100% attendance is compulsory. Any student who is granted leave by the Convener, DPGC/DUGC also must inform the instructor regarding his/her absence.

Recommended Books:

This being a PG course there is no prescribed text. However, the following books are recommended:

- R.K. Ahuja, T.L. Magnanti, J.B. Orlin. Network Flows, Prentice Hall
- E. Lawler. Combinatorial Optimization: Networks and Matroids, Dover
- H.M. Salkin, K. Mathur. Foundations of Integer Programming, North Holland
- H.A. Eiselt, C.L. Sandblom. Integer Programming and Network Models, Springer
- W.L. Whinston. Operations Research: Applications and Algorithms, Cengage Learning