

Title (Units): SCI7560 HEURISTIC AND STRUCTURED PROBLEMS IN OPERATIONAL RESEARCH (2,2,0)

Syllabus Reviewed by: Michael Ng

Prerequisite and Co-requisite: None

Objectives: This subject introduces model building and solution techniques for practical problems in mathematical programming, and the methods in the design and analysis of algorithms for solution to large size practical real-life problems.

Calendar Description: This subject introduces model building and solution techniques for practical problems in mathematical programming, and the methods in the design and analysis of algorithms for solution to large size practical real-life problems.

References:

- 1) Model Building in Mathematical Programming, by H.P. Williams, Wiley, 1990.
- 2) Model Solving in Mathematical Programming, by H.P. Williams, Wiley, 1993.
- 3) Operations Research: Applications and Algorithms, by W.L. Winston, PWS-Kent, 1993.
- 4) Integer Programming, by L.A. Wolsey, Wiley, 1998.
- 5) Integer and Combinatorial Optimization, by G.L. Nemhauser, L.A. Wolsey, Wiley, 1998.
- 6) Modern Heuristic Techniques for Combinatorial Problems, by C.R. Reeves, Blackwell Scientific Publisher, 1992.
- 7) Tabu Search, by F. Glover and M. Laguna, Kluwer Academic Publisher, 1997.

Assessment: Continuous assessment (20%) and Final examination (80%)

Subject Content in Outline:

- I. Introduction to Combinatorial Optimization Problems (COP) and Justification for course.  
(1 hours of teaching)
- II. Formulation of Integer Programming Problems  
(2 hours of teaching)
- III. Formulation and applications of COP models (2 hours of teaching)
  - A. Set Covering and Packing Problems
  - B. Knapsack Problem
  - C. Generalized Assignment Problem
  - D. Travelling Salesman Problem
  - E. Capacitated Clustering Problem
  - F. Vehicle Routing Problems, and others
- IV. Exact Solution Techniques for COP models (6 hours of teaching)
  - A. Branch and Bound
  - B. Cutting Plane Method
- V. Heuristic Techniques for COP models (4 hours of teaching)

- A. Construction heuristics
  - B. Mathematical Programming based heuristics
  - C. Improvement heuristics, and others
- VI. Lagrangean Relaxation Techniques (6 hours of teaching)
- A. Lagrangean relaxation
  - B. Lagrangian heuristics
  - C. Problem reduction
  - D. Subgradient optimization
  - E. Multiplier adjustment