OFFICIAL SYLLABUS
OR 440 – Operations Research: Deterministic Models

Adopted - Spring 2004 (Committee: Drs. M. Agustin, M. Cooper, E. Sewell)
Prerequisites changed Fall 2015 by department consent.

Course Description. (Same as IE 415) Linear programming, problem formulation, simplex algorithm, transportation and network problems, duality theory, sensitivity theory. Prerequisite: MATH 250 with a grade of C or better and knowledge of a programming language.

Textbook. Operations Research: Applications and Algorithms, Forth Edition, by Wayne L. Winston.

Course Outline and Topics

Chapter 1: Introduction to Operations Research
- 1.1 The Methodologies of Operations Research
- 1.2 Successful Applications of Operations Research (Optional)

Chapter 3: Introduction to Linear Programming
- 3.1 What Is a Linear Programming Problem?
- 3.2 The Graphical Solution of Two-Variable Linear Programming Problems
- 3.3 Special Cases
- 3.4 A Diet Problem
- 3.5 A Work-Scheduling Problem
- 3.6 A Capital Budgeting Problem
- 3.7 Short-Term Financial Planning
- 3.8 Blending Problems
- 3.9 Production Process Models
- 3.10 Using Linear Programming to Solve Multiperiod Decision Problems: An Inventor model
- 3.11 Multiperiod Financial Models (Optional)
- 3.12 Multiperiod Work Scheduling (Optional)

Chapter 4: The Simplex Algorithm
- 4.1 How to Convert LP to Standard Form
- 4.2 Preview of the Simplex Algorithm
- 4.3 The Simplex Algorithm
- 4.4 Using the Simplex Algorithm to Solve Minimization Problems
- 4.5 Alternative Optimal Solutions
- 4.6 Unbounded LPs
- 4.7 The LINDO Computer Package (Optional)
- 4.9 Degeneracy and the Convergence of the Simplex Algorithm
- 4.10 The Big M Method
- 4.11 The Two-Phase Simplex Method
- 4.12 Variables That Are Unrestricted in Sign
- 4.14 Solving LPs with Spreadsheets (Optional)

Chapter 6: Sensitivity Analysis and Duality
- 6.1 A Graphical Introduction to Sensitivity Analysis
- 6.2 Some Important Formulas
- 6.3 Sensitivity Analysis
- 6.4 Sensitivity Analysis When More Than One Parameter Is Changed: The 100% Rule
- 6.5 Finding the Dual of an LP
- 6.6 Economic Interpretation of the Dual Problem
- 6.7 The Dual Theorem and Its Consequences
- 6.8 Shadow Prices
- 6.9 Duality and Sensitivity Analysis
- 6.10 Complementary Slackness
- 6.11 The Dual Simplex Model
- 6.12 An Application of Dual Prices: Data Envelopment Analysis (DEA) (Optional)

Chapter 7: Transportation, Assignment, and Transshipment Problems
- 7.1 Formulating Transportation Problems
- 7.2 Finding Basic Feasible Solutions for Transportation Problems
- 7.3 The Transportation Simplex Method
- 7.4 Sensitivity Analysis for Transportation Problems (Optional)
- 7.5 Assignment Problems
- 7.6 Transshipment Problems (Optional)

Chapter 8: Network Models
- 8.1 Basic Definitions
- 8.2 Shortest Path Problems
- 8.3 Maximum Flow Problems
- 8.4 CPM and PERT (Optional)
- 8.5 Minimum Cost Network Flow Problems (Optional)
- 8.6 Minimum Spanning Tree Problems

Chapter 9: Integer Programming (Optional)
- 9.1 Introduction to Integer Programming
- 9.2 Formulating Integer Programming Problems
- 9.3 The Branch-and-Bound Method for Solving Pure Integer Programming Problems
- 9.4 The Brand-and-Bound Method for Solving Mixed Programming Problems
- 9.5 Solving Knapsack Problems by the Branch-and-Bound Method
- 9.6 Solving Combinatorial Optimization Problems by the Branch-and-Bound Method

Any instructor should cover all of the material specified; any additional sections are optional.