OFFICIAL SYLLABUS

OR 441 – Operations Research: Stochastic Models

Adopted - Spring 2004 (Committee: Drs. M. Agustin, M. Cooper, E. Sewell)

Course Description. (Same as IME 461) Probabilistic models, elementary queuing theory with single or multiple server systems, use of queues in facility designs, elementary decision theory. Markov processes and decision-making. Prerequisite: STAT 380 or STAT 480a.

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

Course Outline and Topics

Chapter 13: Decision Making Under Uncertainty
- 13.1 Decision Criteria
- 13.2 Utility Theory
- 13.3 Decision Trees
- 13.4 Bayes' Rule and Decision Trees
- 13.5 Decision Making with the Normal Distribution (Optional)

Chapter 14: Decision Making with Multiple Objectives (Optional)
- 14.1 Multiattribute Decision Making in the Absence of Uncertainty: Goal Programming
- 14.2 Multiattribute Utility Functions

Chapter 15: Game Theory (Optional)
- 15.1 Two-Person Zero-Sum and Constant-Sum Games: Saddle Points
- 15.2 Two-Person Zero-Sum Games: Randomized Strategies, Domination, and Graphical Solution
- 15.3 Linear Programming and Zero-Sum Games
- 15.4 Two-Person Non-Constant-Sum Games

Chapter 16: Deterministic EOQ Inventory Models
- 16.1 Introduction to Basic Inventory Models
- 16.2 The Basic Economic Order Quantity Model
- 16.3 Computing the Optimal Order Quantity When Quantity Discounts Are Allowed
- 16.4 The Continuous-Rate EOQ Model (Optional)
- 16.5 The EOQ Model with Back Orders Allowed
- 16.6 When to Use EOQ Models

Chapter 17: Probabilistic Inventory Models
- 17.1 Single-Period Decision Models
- 17.2 The Concept of Marginal Analysis
- 17.3 The News Vendor Problem: Discrete Demand
- 17.4 The News Vendor Problem: Continuous Demand
- 17.5 Other One-Period Models
- 17.6 The EOQ with Uncertain Demand: The *(r, q)* and *(s, S)* Models

Chapter 19: Markov Chains
- 19.1 What Is a Stochastic Process?
- 19.2 What Is a Markov Chain?
- 19.3 *n*-Step Transition Probabilities
- 19.4 Classification of States in a Markov Chain
- 19.5 Steady-State Probabilities and Mean First Passage Times
- 19.6 Absorbing Chains

Chapter 20: Deterministic Dynamic Programming (Optional)
- 20.1 Two Puzzles
- 20.2 A Network Problem
- 20.3 An Inventory Problem
- 20.4 Resource Allocation Problems
- 20.5 Equipment Replacement Problems
- 20.6 Formulating Dynamic Programming Recursions

Chapter 21: Probabilistic Dynamic Programming (Optional)
- 21.1 When Current Stage Costs Are Uncertain, but the Next Period's State Is Certain
- 21.2 A Probabilistic Inventory Model
- 21.5 Markov Decision Processes

Chapter 22: Queuing Theory
- 22.1 Some Queuing Terminology
- 22.2 Modeling Arrival and Service Processes
- 22.3 Birth-Death Processes
- 22.4 The $M/M/1/GD/\infty/\infty$ Queuing System and the Queuing Formula $L = \lambda W$
- 22.5 The $M/M/1/GD/c/\infty$ Queuing System
- 22.6 The $M/M/s/GD/\infty/\infty$ Queuing System
- 22.7 The $M/G/\infty/GD/\infty/\infty$ and $GI/G/\infty/GD/\infty/\infty$ Models
- 22.8 The $M/G/1/GD/\infty/\infty$ Queuing System
- 22.9 Finite Source Models: The Machine Repair Model
- 22.10 Exponential Queues in Series and Open Queuing Network
- 22.11 The $M/G/s/GD/s/\infty$ System (Blocked Customers Cleared) (Optional)
- 22.12 How to Tell Whether the Interarrival Times and Service Times Are Exponential
- 22.13 What to Do If Interarrival or Service Times Are Not Exponential
- 22.14 Priority Queuing Models (Optional)

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