

1. ES461 Quantitative Methods for Management
2. 3 credit hours, 3 recitation hours
3. Course coordinator: Professor Kiriakos Kiriakidis  
Additional instructors: CDR Tracie Severson, USN
4. Textbook: Introduction to Operations Research (Tenth Edition), Hillier and Lieberman, 2015
  - a. Supplemental materials: Thinking Fast and Slow, Kahneman, Farrar, Straus, and Giroux, 2011
5. Specific course information
  - a. An introduction to Operations Research and its application to engineering. Topics include: optimization of engineering systems, game theory, sensitivity analysis, project management with PERT/CPM, and decision analysis. [fall]
  - b. Prerequisite: ESE/ESEH major, or approval of department chair.
  - c. Elective course
6. Specific goals for the course
  - a. At the conclusion of the course, students will be able to:
    - Apply the Six Phases of Operations Research (OR) study to Engineering Management problems
    - Apply the OR modeling approach, the Linear Program (LP) to resource allocation problems
    - Apply the Graphical Method to find the optimal solution for low-dimension LPs
    - Understand the Simplex Method for optimal solution of general LPs
    - Apply commercial spreadsheet solvers to general LPs
    - Apply sensitivity analysis to address “what if” questions in resource allocation
    - Understand the comparative advantage of solving the Dual Problem to a given LP
    - Apply the OR modeling approach to Network Optimization problems
    - Understand the Two-Player Zero-Sum (TPZS) game
    - Apply techniques of pure and mixed strategies to solve the TPZS game
    - Analyze decision-making using game-theoretic and Bayesian reasoning techniques

- Contrast Bayesian with human decision-making according to Prospect Theory
- b. This course addresses the following student outcomes:
- (a) an ability to apply knowledge of mathematics, science, and engineering
  - (b) an ability to design and conduct experiments, as well as to analyze and interpret data
  - (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - (e) an ability to identify, formulate, and solve engineering problems
  - (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

7. Topics covered:

- Overview OR Modeling Approach
- Linear Programming
- Simplex Method
- Duality Theory and Sensitivity Analysis
- Transportation and Assignment Problems
- Network Optimization Models
- Game Theory
- Decision Analysis
- Fourfold pattern and Prospect Theory