CSCI 4321 - APPLIED OPERATIONS RESEARCH

CREDIT HOURS: 3
PREREQUISITES: CSCI 3302; MATH 1325 or 2313; MATH 1342
GRADE REMINDER: Must have a grade of C or better in each prerequisite course.

CATALOG DESCRIPTION

Quantitative techniques for resource management, decision making and system analysis with emphasis on development and use of computer implementations of mathematical models.

PURPOSE OF COURSE

To provide the student with an understanding of quantitative approaches to problem solving using methods of operations research. Deterministic models, including linear, integer, network, and nonlinear programming, and stochastic methods, including decision analysis, Markov models, and queuing systems, are applied to problems in constrained resource management, system analysis, and system optimization.

EDUCATIONAL OBJECTIVES

Upon successful completion of the course, students should be able to:

1. Create mathematical models for analyzing or optimizing a variety of resource management problems.
2. Develop mathematical programming models for certain systems having deterministic parameters.
3. Develop models for systems that exhibit stochastic behavior.
4. Identify algorithms for optimizing deterministic models, and methods for quantitatively describing the behavior and characteristics of probabilistic systems.
5. Demonstrate familiarity with commercial software that is available to support the quantitative decision techniques and analysis methods studied.
6. Select existing software or develop new software for specific applications.

COURSE CALENDAR

This course meets for a minimum of 37.5 lecture contact hours during the semester. Students have significant weekly reading assignments. Students are expected to complete weekly homework/programming assignments, and 2-3 periodic exams in addition to the final exam. Students are expected to prepare for any class assignments or quizzes over the material covered in class or in the reading material. Successful completion of these activities requires at a minimum six additional hours of outside of classroom work each week.

CONTENT **Hours**

Overview of Operations Research 4
- Historical development of the discipline
- Mathematical modeling
- Applications

Linear Programming 12
- Problem Formulation
- Graphical Solutions
- Simplex Method
- Interior and barrier methods
- Implementation of algorithms and use of computer programs
- Interpretation of computational results and sensitivity analysis

Network Analysis.....8
- Maximum flow
- Shortest path
- Transportation models
- Assignment and matching problems
- Critical path analysis
- Dynamic programming
- Implementation of algorithms and use of computer programs

Integer Programming 6
- Problem complexity
- Branch and bound methods
- Scheduling models
- Implementation of algorithms and applications

Markov Analysis.....6
- Transition probabilities
- First passage times and first passage probabilities
- Steady state analysis
- Software for solution of systems of steady state equations

Queuing Models 4
- Arrival and departure distributions
- Computation of performance characteristics of queuing systems

Decisions Analysis.....2
- Decision trees
- Game Theory

Exams (plus final).....3

TOTAL 45

REFERENCES

Carter, M.W., and Price, C. C., Operations Research: A Practical Introduction, CRC Press, Boca Raton, Fl., 2001.

Hillier, F.S. and Lieberman, G. J. Introduction to Operations Research, 5th Ed. McGraw-Hill Publishing Co., New York, 1990.

Winston, W.L. Operations Research: Applications and Algorithms, Duxbury Press, Boston, 1987.

Taha, H.A. Operations Research: An Introduction, 5th Ed. Macmillan Publishing Co., New York, 1992.