

## **CSCI 5310 - 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.  
**CROSS LISTING:** CSCI 4321

### **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.

NOTE: Students taking CSCI 5310 will be expected to complete additional requirements, including but not limited to special projects, class presentations, relevant research including literature review and current research topics from professional journals, and supplemental evaluation (i.e., additional questions, quizzes, tests). Students taking CSCI 5310 are expected to perform at a higher level than undergraduates taking CSCI 4321. Students should contact the course instructor early in the semester (i.e., before the end of the add/drop period) to determine the specific additional requirements.

### **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.
7. Develop skills in research literature reviews and research presentations.

### **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.

<b>CONTENT</b>	<b>Hours</b>
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, 5<sup>th</sup> 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, 5<sup>th</sup> Ed. Macmillan Publishing Co., New York, 1992.