Auburn University  
Samuel Ginn College of Engineering

**Department**  
Industrial & Systems Engineering

**Course Number**  
INEN 3410

**Course Title**  
Deterministic Operations Research

**Credits**  
3 (2-1)

**Prerequisites**  
ENGR 1110, MATH 2660

**Prerequisites by topic**  
Linear algebra, differential calculus, integral calculus

**Required Textbook**  

**References**  

**Catalog Description**  
Formulation, solution, interpretation, and implementation of mathematical models in operations research including linear programming, integer programming, and network flows.

**Course Outcomes**  
On completion of this course, the student will be able to develop linear programming and integer programming formulations for engineering and economic systems, determine optimal solutions to a variety of mathematical programming problems, and present managerial recommendations based on optimal solutions and sensitivity analysis.

**Course Objectives**  
1. Describe the origins and basic methodology of operations research.  
2. Give examples of applications of operations research in and outside of industrial engineering.  
3. Develop linear programming formulations to represent a variety of applied problems including transportation, assignment, and network models.  
4. Solve two-variable linear programming problems using the graphical method.  
5. Apply the simplex algorithm to solve linear programming problems.  
6. Use software to solve linear programming and integer programming problems.  
7. Interpret reports generated by software outputs.  
8. Explain the role of sensitivity analysis in linear programming.  
9. Apply sensitivity analysis to determine parameter ranges for which a solution to a linear programming problem remains optimal.  
10. Explain the role of duality in linear programming.  
11. Construct and interpret the dual of linear programming problems.  
12. Apply specialized algorithms to solve the transportation problem and its variants, and network flow problems.  
13. Develop integer programming formulations to represent a variety of scenarios.  
14. Solve integer programming problems “by hand” and using software.

**Topics**  
1. Operations research methodology and applications  
2. Linear programming models  
3. The simplex algorithm  
4. Duality and sensitivity analysis  
5. Transportation and assignment models  
6. Network models  
7. Integer programming  
8. Optimization software: LINGO and Excel Solver (Lab)
Class Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>2:00 - 4:50PM</td>
<td>Lab: 0015 Lowder</td>
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Contribution to Professional Component
By learning to solve typical real-world problems in many different industries, a student will develop a broad view of operations research and how it may be applied. Ethical considerations are discussed where solutions may have economic, environmental, or legal impact. Learning to interpret mathematical results for the specific problem, rather than to just obtain a solution, is a key skill developed.

Relationship to Program Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Description</th>
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<tbody>
<tr>
<td>a.</td>
<td>Apply knowledge of mathematics, science, and engineering (using the simplex algorithm to solve a linear programming problem)</td>
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<tr>
<td>e.</td>
<td>Identify, formulate, and solve engineering problems (formulating and using network models to solve complex engineering problems)</td>
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<td>k.</td>
<td>Use the techniques, skills, and modern engineering tools necessary for engineering practice (using the programming language LINGO to solve deterministic operations research problems)</td>
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Grade Evaluation

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
<th>Aggregate Percentage Range</th>
<th>Letter Grade</th>
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<tbody>
<tr>
<td>Exams</td>
<td>40%</td>
<td>90-100</td>
<td>A</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
<td>80-89</td>
<td>B</td>
</tr>
<tr>
<td>Quizzes(^1) and HW</td>
<td>20%</td>
<td>70-79</td>
<td>C</td>
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<tr>
<td>Lab Assignments</td>
<td>20%</td>
<td>60-69</td>
<td>D</td>
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<tr>
<td></td>
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<td>&lt;=59</td>
<td>F</td>
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Final Exam
Tuesday December 13, 2005, 11:00AM – 1:30PM.

Attendance
Attendance will be taken regularly. Good attendance will have a positive impact on your grade and poor attendance will have a negative impact on your grade.

Course Policies and Protocols
Please refer to the document entitled “Course Policies, Procedures, and Additional Information.”

Instructor
Dr. Emmett J. Lodree, Jr., Office Hours: 12:00PM-3:00PM.
Assistant Professor, Industrial & Systems Engineering Department, 310 Dunstan Hall
Telephone: (334) 844-1433, Fax: (334) 844-1381, E-Mail: elodree@auburn.edu

Teaching Assistant
Mr. Skylab Gupta, Office Hours: 1:00PM-1:45AM Mon, and 4:00PM-5:00PM Tuesday and Thursday.
Ph.D. Candidate, Industrial & Systems Engineering Department, 114 Thomas Walter Center for Technology Management, Telephone: 334-844-1408, Fax: (334) 844-1381, E-Mail: guptasr.auburn.edu

Date prepared
August 16, 2005

\(^1\) There could be unannounced quizzes