Engineering Faculty Document No. 45-02
February 25, 2003

TO: The Engineering Faculty
FROM: The Faculty of the School of Civil Engineering
DATE: February 25, 2003
RE: New Undergraduate-Level Course

The faculty of the School of Civil Engineering has approved the following new undergraduate course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

CE 398 INTRODUCTION TO CIVIL ENGINEERING SYSTEMS DESIGN

Sem. 1 and 2. Class 3, cr. 3

Prerequisite: MA 261

An introduction to engineering economy and systems analysis. A systematic approach to the engineering method of design and problem solving.

Reason: Civil Engineering students are exposed to elements of design in various courses in their curriculum. However, instructors of the capstone senior design course have had to familiarize students with the formal design process before beginning the semester project. This course will provide each Civil Engineering undergraduate with a common basis for entering the senior design course. This course will ensure that Civil Engineering undergraduate students are exposed to constrained design, to economic analysis methods that facilitate the comparison of alternative projects, and to systems analysis techniques that assist decision-making in the engineering context. The course is intended to be the first of a three-course package, including CE 399, a course in technical communication, and culminating with CE 498, a final design project.

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Fred L. Mannering, Head
School of Civil Engineering

Supporting Documentation

Course objectives. By the completion of CE398, students will be able to:

1. Explain the Systems Approach and the Engineering Method.
2. Apply engineering economics procedures to evaluate projects and compare alternatives.
3. Solve basic optimization problems, including constraints.
4. Implement systems analysis methods to support design and decision-making.

Text. The textbooks for the course will be "Fundamentals of Systems Engineering with Economics, Probability, and Statistics" by Khisty and Mohammadi, published by Prentice Hall, 2001, and "Introduction to Engineering Design and Problem Solving", second edition, by Eide, Jenison, Mashaw, and Northup, published by McGraw-Hill, 2002.

Instructor. By virtue of their educational backgrounds, research interests, and teaching experience, several members of the Civil Engineering faculty are well qualified to teach this course. Most likely, the instructor will be drawn from the Transportation and Infrastructure Systems Engineering Group.

Draft syllabus

1. The Systems Approach (first class session)
2. Problem Solving and Design in Engineering (1 week)
3. Basic Engineering Economics and Evaluation (5 weeks)
    - Cash Flow Equivalence
    - Future Worth or Value
    - Present Worth
    - Annual Cost
    - Consumer Surplus
    - Benefit-Cost Analysis
    - Breakeven Analysis
    - Valuation and Depreciation
    - Replacement Analysis
    - Economic Analysis in Public Sector
    - Taxation and Inflation

4. Basic "Hard" Systems Engineering (5 weeks)
    - Problem Solving and Design
    - Resource Allocation
    - Optimization under Constraints
    - Decision Analysis
    - Choosing a Design Alternative
    - Sensitivity Analysis

5. “Soft” Systems Analysis and Decision Tools (5 weeks)
    - Needs assessment
    - Structuring the Problem
    - Structuring the Solution Search
    - Abstraction and Modeling
    - Synthesis
    - Ethics and Liability
    - Hazards and Failure Analysis
    - Design Analysis
    - Implementation
    - Case Studies and Examples