

1. Department, Course Number, and Course Title:

MECHANICAL ENGINEERING

ME 422 OPTIMIZATION OF MECHANICAL SYSTEMS

2. Designation: Required Elective
Lower Division Upper Division

3. Course Description: Design consideration of mechanical engineering systems; optimization techniques; application analytical methods and computer-aided analysis and design software to optimization of engineering systems

4. Prerequisites: ME 319, Computer-aided Problem Solving in Mechanical Engineering; ME323, Machine Design I

5. Text and Materials: Design of thermal Systems, 3rd Ed., W. F. Stoecker, McGraw-Hill, 1989
References
Arora, J.S., Introduction to Optimal Design, McGraw-Hill, New York, 1989
Venkataraman, P., Applied Optimization with MATLAB Programming, John Wiley & Sons, Inc., New York, 2002

6. Course Objectives: To introduce the concept of engineering design, optimization criteria and objective function in the decision making process. The student will learn how to formulate and include feasibility considerations and engineering, economical, and environmental constraints. Student will learn how to apply optimization techniques to design better performing engineering systems, decision making process, and engineering project management.

Course Outcomes

- an understanding of engineering design and interactive decision making process and selection of optimization criteria.
- the ability to develop mathematical models and perform simulation studies for simple systems.
- an understanding of, and the ability to develop, meaningful optimization criteria.
- an understanding of, and the ability to develop engineering, economical, and environmental constraints.
- an understanding of, and the ability to apply analytical and computer-aided methods to search for, the extrema of functions of several variables subject to constraints
- the ability to apply linear, nonlinear, and dynamic programming techniques to the solution of optimization problems.
- an ability to apply optimization techniques to engineering project management problems.
- An appreciation of how optimization can be employed to improve economic life and lessen the adverse impact of technology on environment.
- an ability to communicate effectively.
- a desire to be a flexible and adaptable team player in systems engineering.

7. Topics Covered: (in Order of Presentation)

- Engineering Design (Ch. 1)
- Designing a Workable System Optimization, Economic Aspects (Ch.2)
- Economics
- Equation Fitting (Ch. 4)
- Modeling Thermal systems (Ch. 5)
- Systems Simulation (Ch. 6)
- Optimization (Ch. 7)
- Lagrange Multipliers (Ch 8)
- Calculus-based Optimization Techniques and Search Methods (Ch.9 & Ch 16)
- Dynamic Programming (Ch. 10)
- Linear Programming (Ch. 12)
- Comercial Software (MATLAB & GMAS)

8. Class Schedule: Number of Sessions per week: 2

Duration of each session: 1 hour 40 minutes

9. Contribution of course to meeting the professional component:

This course is part of the 24 units of technical electives required for the mechanical engineering program.

Engineering Science	2 units
Engineering Design	2 units

10. Relationship of course to program objectives:

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- a knowledge of computer aided design and simulation
- a knowledge of how mechanical engineering integrates into inter-disciplinary systems

Skill outcomes:

- an ability to function on multidisciplinary teams (abet e)
- an ability to communicate effectively (abet g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to think in a logical sequential process

Attitudes Outcome:

- an understanding of professional and ethical responsibility (abet f)
- a recognition of the need for an ability to engage in lifelong learning (abet i)
- a desire to be a flexible and adaptable team player (collaborative attitude)

11. Prepared by: Maj Mirmirani

01/2006