# COURSE DESCRIPTION

## MEEG 304, Machine Design - Elements, 3 Credits, Required

**Spring Semester 2008**

**Catalog Description**: Aspects of machine design: statistical nature, theories of failure and design for strength and design of machine elements.

**Prerequisites**: MEEG 215, Mechanics of Materials, MEEG 301, Machine Design-Kinematics & Kinetics, & MEEG 321, Material Engineering.

**Textbook and/or other required material**: Budynas and Nisbett, Shigley's Mechanical Engineering Design, 8th Ed., McGraw Hill, 2008; Dym and Little, Engineering Design: a project-based introduction, 2nd Ed., Wiley, 2004.

**Course Objectives**: The primary objective of this course is to demonstrate how engineering design uses the many principles learned in previous engineering science courses and to show how these principles are practically applied. The emphasis in this course is on machine design: the design and creation of devices that consist of interrelated components used to modify force and/or motion. Along with traditional "one-answer" homework problems, the students will be presented with design challenges.

The type of design addressed in this course is that of detailed design, which is to define the shape, size and material of a particular machine element such that it will not fail under the expected load and operating conditions. The team design project for this semester was to design an ergonomic opener for vacuum sealed jars.

By the end of the course, each student should be able to:

- For a particular sub-set of machine elements and a given problem:
- Define failure,
- Decide on an appropriate failure model, and
- Design an appropriate machine element using:
- Allowable load (under the given operating conditions),
- Required element life,
- Manufacturing considerations, and
- Manage engineering projects.

**Topics Covered**:

Static failure review, Fatigue failure review, Shafts, Bearings (rolling element), Spur gears, Springs, Fastening, Project Management, and Senior Design Process (project).

**Class/Lab Schedule**: Three 50-minute periods per week.

**Contribution of course to meeting the professional component**: The design project in the course is a precursor to the Senior Design course, using as many of the same methods and procedures as possible. The main difference is that this course does not require the physical realization of the design.

**Relationship of course to program outcomes**: This course is most important to the demonstration of the design outcome. See Page 2 for standard Outcomes Matrix.

**Prepared by**: Robert M. Hartman, Ph.D., P.E. **Date:** January 22, 2008

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| The ABET Program Outcomes expected of all graduates are: | Course: MEEG 304, Machine Design – Elements (Hartman)<br>Course Elements Satisfying Indicated Program Outcome | Levels of Learning<br>K | C | Ap | An | S |
|---|---|---|---|---|---|---|
| a. an ability to apply knowledge of mathematics, science and engineering; | | | | | | |
| b. an ability to design and conduct experiments, as well as to analyze and interpret data; | | | | | | |
| c. an ability to design a system, component, or process to meet desired needs; | Project uses design methodology on system details, emphasizes detail design | | | | | |
| d. an ability to function in multidisciplinary teams; | Team Projects | | | | | |
| e. an ability to identify, formulate and solve engineering problems; | | | | | | |
| f. an understanding of professional and ethical responsibility; | | | | | | |
| g. an ability to communicate effectively; | Oral & Written reports with drawings | | | | | |
| h. the broad education necessary to understand the impact of engineering solutions in a global and societal context; | | | | | | |
| i. a recognition of the need for and an ability to engage in life-long learning; | Projects require specialized knowledge | | | | | |
| j. a knowledge of contemporary issues; | | | | | | |
| k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice; | Project Management | | | | | |
| M1. a knowledge of chemistry & calculus-based physics with depth in at least one of them. | | | | | | |
| M2. an ability to apply advanced mathematics through multivariate calculus and differential equations; | | | | | | |
| M3a. a familiarity with statistics; | | | | | | |
| M3b. a familiarity with linear algebra; | | | | | | |
| M4. an ability to work professionally in both thermal (M4a) and mechanical(M4b) systems areas including the design and realization of such systems; | M4b. Design Methodology | | | | | |

Guidelines: Learning is not a binary operation ("no, I don't know it" or "yes, I know it"), but rather progressive and dynamic. Therefore, the outcomes matrix is divided into five different levels of learning defined as follows:

Knowledge (can recall, repeat)
Comprehension (can describe, explain)
Application (can recognize, apply)
Analysis (can analyze, explain why)
Synthesis (can design, formulate)