

**MEEG 304 Machine Design - Elements  
Spring Semester 2004  
Required Course**

**2003-2004 Catalog Data:**

**Credit:** 3

Aspects of machine design: statistical nature, theories of failure and design for strength and design of machine elements. PREREQ: MEEG215.

**Textbook:** Required: R.L. Norton, *Machine Design: An Integrated Approach*, 2nd edition, Prentice-Hall, 2000.

**Goals:**

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 only one part of the entire design process. In detailed design, the general concept, application and basic outline of the required device have already been designed. In this course, one is not trying to invent a new device but rather 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 focus in this course is primarily on the stress-life approach.

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, and
    - Manufacturing considerations;

**Topics:**

1. Review of design process
2. Introduction to engineering economics
3. Static failure review
4. Fatigue failure review
5. Shafts
6. Bearings (rolling element)
7. Spur gears
8. Springs
9. Fastening
10. Design process (project)

**Class meeting Schedule:**

Three 50-minute periods per week.

**Contributions to Professional Component of the Curriculum:**

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: See Page 2.**

Prepared by: Dick Wilkins Date: 5 February 2004

The ABET Program Outcomes expected of all graduates are:	Course: MEEG 304, Machine Design – Elements (Wilkins)	Levels of Learning				
	Course Elements Satisfying Indicated Program Outcome	K	C	A p	A n	S
a. an ability to apply knowledge of mathematics, science and engineering;	Static & fatigue failure applied to machine elements					
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;	Open-ended projects with customers, where will it fail & why					
f. an understanding of professional and ethical responsibility;	Working with real customer on projects					
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;	Real customers					
i. a recognition of the need for and an ability to engage in life-long learning;	Real customers, projects require specialized knowledge					
j. a knowledge of contemporary issues;	Projects					
k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;	CAD, analysis methods, etc.					
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. Structural Analysis 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)