Department of Mechanical Engineering
ME 316 - Machine Design
(Required)

Catalog Data: ME 316 (3-0-3)
Aspects of the design process and design of machine elements. Mini-projects are used to introduce engineering design procedures

Prerequisites: ME 231 Kinematics of Machinery
ME 315 Stress Analysis.

Textbook(s) Materials Required:
Handouts prepared by instructor

Coordinator: Raj Sodhi, Ph.D., P.E., Professor ME

Prerequisites by Topic:
1. Understanding of design, selection and evaluation of mechanisms (from ME 231 – Kinematics of Machinery)
2. Understanding of stress analysis related to mechanical design (from ME 315- Stress Analysis)

Course Objectives Objectives¹:
Objective 1: To teach students how to apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
Objective 2: To illustrate to students the variety of mechanical components available and emphasize the need to continue learning.
Objective 3: To teach students how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.
Objective 4: To teach students how to apply computer based techniques in the analysis, design and/or selection of machine components.

Topics²:
1. Fundamental Principles Chapter 1
2. Working Stresses and Failure Theories, Fatigue Chapter 2
3. Shafts, keys and couplings Chapter 3
4. Springs Chapter 4
5. Power screws and bolted connections Chapter 5
6. Belt and chain drives Chapter 6
7. Brakes and clutches Chapter 6
8. Welded and Riveted Connections Chapter 7
9. Journal bearings and lubrication Chapter 8
10. Ball and Roller bearings Chapter 9
Evaluation:
1. Quizzes
2. Homework
3. Exams
4. Reports
5. Terms Papers
6. Computer Assignments
7. Mini projects

Schedule: Lecture Recitation: 3 hours, per week
Professional Component: Engineering Science
Program Objectives Addressed: A, B, C, D, E

Course Outcomes:

Objective 1
1.1 The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of machine components. The students will demonstrate the ability to make proper assumptions, perform correct analysis while drawing upon various mechanical engineering subject areas.
1.2 Specifically, the students will demonstrate the preceding abilities by performing correctly:
   • the design, analysis and sizing of shafts
   • the selection, sizing and analysis of springs
   • the selection of bearing types, and sizing and analysis of rolling element bearings
   • the selection of gear types, sizing, analysis and material selection of gear systems
   • the selection, sizing, design, and analysis of other mechanical components/systems

Objective 2:
a. Students will demonstrate the ability to seek and learn new material in addition to the class topics through the completion of an open-ended project. The amount as well as the depth of new material identified and used by the students are measurable indicators of the students’ performance.

Objective 3
3.1 Students will demonstrate the ability to take technical, safety, legislative and other issues such as environmental into account when selecting and/or designing mechanical systems, in particular with respect to those components and systems defined in the topical areas and performance criteria 1.3. The breadth and depth of the issues taken into account by students are measurable indicators of their performance.

Objective 4
4.1 Students will demonstrate their ability to use existing as well as develop new computer-based techniques and algorithms for the analysis, selection, and synthesis of mechanical components, in particular with respect to those components and systems defined in the topical areas and performance criteria 1.3. The breadth and depth of the issues taken into account by students are measurable indicators of their performance.

Prepared by: Raj Sodhi               Date: September 2006.
1 Capital Letters in parenthesis refer to the Program Objectives of the Mechanical Engineering Department. Listed in Sec 2 d Tables B-2-9, B-2-12. Table B-2-8 links Program Objectives with the ABET a-k Criterion.

2 Topic numbers in parenthesis refer to lecture hours. (three hours is equivalent to 1 week)

3 Outcome numbers in parenthesis refer to evaluation methods used to assess the student performance. Lower case letters in parenthesis refer to ABET a-k outcomes.