

**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  
ME315 Stress Analysis.

**Textbook(s) Materials Required:**

Spotts and Shoup, Design of machine Elements, 8<sup>th</sup> Edition, Person Prentice Hall 2004  
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 Objectives<sup>1</sup>:**

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.

**Topics<sup>2</sup>:**

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| 1. Fundamental Principles                            | Chapter 1 |
| 2. Working Stresses and Failure Theories,<br>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 |

11. Spur Gears	Chapter 10
12. Helical, Bevel and Worm Gears	Chapter 11
13. Miscellaneous Machine Elements	Chapter 12

**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.

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<sup>1</sup> 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.

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

<sup>3</sup> 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.