



Course Outline

Title: Machine Design I

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Department: Mechanical Engineering Dep.

Prerequisite: Strength of materials I, Material Science

Overview

Machine Design I, is a three-credit course, which emphasizes on designing machine elements based on the fundamental relations learned through courses as static, machine dynamics, strength of material and material science. The course is designed to be taken in fifth semester by undergraduate students of the mechanical engineering department at Iran University of Science and Technology (IUST).

Goal (introduction)

The main goal of this course is to provide students a systematic approach for design and analysis of machine components within the framework of realistic constraints such as cost, size, weight, materials and safety.

Objectives

The emphasis is on the design of machine components for strength. To convey to the students and understanding of: stress, strain and stress strain relationships, failure theories under static loading, failure of machine members under fatigue loading, design of shafts, design of threaded fasteners, design of welded joints and design of mechanical springs, and other topics as time allows.

Skills Objectives

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.

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

- Apply knowledge of solid mechanics to the design of real mechanical devices.
- Recognize failure and fatigue as constraints on component design.
- Understand the details of shafts, bolts, welds and springs and distinguish their use in various applications.
- Unravel the mysteries behind how linkages can be designed to produce complex motions.
- Bridge the gap between ME analysis and ME design by investigating and tinkering with real mechanical devices.

Materials

Week	Subject	Table of Contents
1	Introduction, design concept	Chapter 1
2	Balance and loading analysis, shear and moment diagrams	Chapter 3
3	Stress analysis, stress concentration	Chapter 3
4	Deflection in beams	Chapter 4
5	Strain energy (Castigliano's theorem)	Chapter 4
6	Buckling	Chapter 4
7	Engineering material selection	Chapter 2
8	Failure theories in ductile materials	Chapter 5
9	Failure theories in brittle materials	Chapter 5
10	Fatigue design 1	Chapter 6
11	Fatigue design 2	Chapter 6
12	Fatigue design 3	Chapter 6
13	Shaft design	Chapter 7
14	Bolted joints design	Chapter 8
15	Welded joints design	Chapter 9
16	Spring design	Chapter 10

References

1. Richard Budynas , Keith Nisbett, 2006 "Shigley's Mechanical Engineering Design" , McGraw-Hill, 9th Ed, ISBN: 0-390-76487-6.
2. Karl-Heinz Decker, Karlheinz Kabus, 2009 "Maschinenelemente" Volume 1, 2 and 3, Hanser, 17th Ed, ISBN: 3446417591.

Classroom Methods(policies)

- Attendance is required for all lecture sessions.
- 4-5 sets of homework problems will be assigned during the course. No late homework will be accepted.
- Homework must be written and organized in a professional manner or points will be deducted.
- Students are required to complete a course project and present in the class.

Evaluation

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| • Homework | 10% |
| • Mid exam | 20% |
| • Project | 15% |
| • Final exam | 55% |

Project

Students will be required to complete a group course project as well as some small projects during this course.

Details of the project will be given during the course.