

SYLLABUS: MACHINE ELEMENTS

Date / Revision August 22, 2017 / 22.08.17 /MaS
Faculty Engineering
Study Programm Mechatronik

SUBJECT: Machine Elements

1 Basic Information

1.01	Subject Name	Machine Elements
1.02	Semester	3
1.03	Level	1
1.04	SKS	3
1.05	Mandatory / Curriculum	Mandatory / D-01
1.06	Subject Code	MELM
1.07	Subject Code	MTE-D-MELM-3101
1.08	Year	2017 (7)
1.09	Quality Control	Final Test, see evaluation
1.10	Limitations	Min 12 and Max 32 students in one class
1.11	Combined with	AVE, MEE, INE
1.12	Perquisite	Statics and Mechanics of Materials
1.13	Responsible	Dean of Engineering Faculty
1.14	Revision	22-08-2017/MaS

2 Description of Subject

Introduces the design viewpoint and provides analytical support for the mechanical engineering design task. Knowing the material, shape, dimensions and loading, characterized as the analysis viewpoint. The result of the analysis include the calculation of stresses, strain, safety factors. Geometry determination is include to provide basic principle and guidelines for creating efficient shape and sizes. A case is made from analysis of mechanical parts, and its synthesis.

A case is selected from any mechanical components, such as rear-axle gear transmission of vehicle, bicycle, robot manipulator, where many mechanical can be integrated. Dismantling this components from its system, produce the technical drawing, measuring. Re-designing is explored by selecting different material, re-calculation of stresses, strain, safety factor, and shape – size. The result is compared with the original mechanical components.

3 Objectives

- Introduces the design viewpoint and provides analytical support for the mechanical engineering design task

4 Competency

After having the course, students are expected have to:

- understand concepts and definitions of mechanical design, machine design.
- use the theory of statics and mechanics of materials for designing mechanical components
- know the stresses, strain, load, power, geometric dimension, and shape
- describe the system specification
- Implement technical drawing
- understand mechanical system structure
- work with table in designing mechanical components

5 Learning Approach / Methodology

- Lectures/ Class contact (time-tabled) supplemented with interactive questions and answers;
- Tutorial/ Practice Classes: preview of materials, revision;
- Student Study Effort: homework/assignment; preparation for test/quizzes/ examination.

6 Evaluation

5.1	Absence maximum	25%
5.2	Participation in Discussion	05 Points
5.3	Homework / Classwork	05 Points
5.4	Presentation /Simulation	10 Poin
5.5	Daily Quiz	20 Points
5.6	Final Examination	60 Points
	Total	100 Points

7 Text Book and Reference

- 1 Main Text Book:**
Mechanical Design of Machine Elements and Machines, Jack A. Collins, Henry Busby, George Staab, 2nd edition, Wiley, 2010
- 2 Supplementary Text books:**
 - **Engineering and Scientific Computing with Scilab**, Claude Gomez, Carey Bunks, Jean- Philippe

Chancelier, François Delebecque, Birkhäuser Basel, 1999

8 Content / Topics of Lecture

Week	Content/ Topics of Lecturing	Text Book	Remark
1	Introduction and Overview: Introduction to mechanical design, mechanical design project, machine elements: power transmission chain, joining, material selection, loading. Overview of theory from statics and mechanics of materials. Introduction to Scilab, application for design calculation	Ch1 [1]	Download scilab from www.scilab.org
2	Basic Concepts of Mechanical Design: Keystone of design: materials selection and geometry determination; Failure prevention perspective; Overview of theory from statics and mechanics of materials (continuation)	Ch2[1]	
3	Materials Selection: Steps of material selection; analyzing the requirement of application; assembling list of responsive materials; machine of responsive materials to application requirement (rank-ordered and Ashby Chart)	Ch3[1]	
4	Reponse of Machine Elements to Loads and Environments; stress, strain, and energy parameters Load & geometry; equilibrium concept and free body diagram; force analysis; stress analysis; deflection analysis; stresses caused by curved surfaces in contact; load sharing in redundant assemblies and structures; preloading concept; residual stresses, environmental effects Geometry Determination The contrast in objectives between analysis and design; basic principles and guidelines for creating shape and size	Ch4[1] Ch 6[1]	
5	Power Transmission Shafting; Couplings, Keys, and Splines: Uses and Characteristics of Shafting; Potential Failure Modes; Shaft Materials; Design Equations-Strength Based; Design Equations-Deflection Based; Shaft Vibration and Critical Speed; Summary of Suggested Shaft Design Procedure; General Guidelines for Shaft Design; Couplings, Keys, and Splines	Ch8[1]	Q2(Laplace)
6	Pressurized Cylinders; Interference Fits: Uses and Characteristics of Pressurized Cylinders; Interference Fit Applications; Potential Failure Modes; Materials for Pressure Vessels; Principles from Elasticity Theory; Thin-Walled Cylinders; Thick-Walled Cylinders; Interference Fits: Pressure and Stress; Design for Proper Interference.	Ch9[1]	
7	Plain Bearings and Lubrication: Types of Bearings; Uses and Characteristics of Plain Bearings; Potential Failure Modes; Plain Bearing Materials;	Ch10[1]	
8	MIDTERM SEMESTER BREAK		

9	Plain Bearings and Lubrication: Lubrication Concepts; Boundary-Lubricated Bearing Design; Hydrodynamic Bearing Design; Hydrostatic Bearing Design.	Ch10[1]	
10-11	Rolling Element Bearings: Uses and Characteristics of Rolling Element Bearings; Types of Rolling Element Bearings; Potential Failure Modes; Bearing Materials; Bearing Selection; Preloading and Bearing Stiffness; Bearing Mounting and Enclosure.	Ch11[1]	
12-14	Power Transmission Shafting; Couplings, Keys, and Splines: Uses and Characteristics of Shafting; Potential Failure Modes; Shaft Materials; Design Equations-Strength Based; Design Equations- Deflection Based; Shaft Vibration and Critical Speed; Summary of Suggested Shaft Design Procedure; General Guidelines for Shaft Design; Couplings, Keys, and Splines.	Ch8[1]	
15	Rehearsal and Tutorial: Rehearsal of all subject and students can ask for more detail.		
16	Final Examination		