
SYLLABUS

Date/ Revision	7 August 2016
Faculty	Engineering
Approval	Dean Faculty of Engineering

SUBJECT : THERMO FLUID SCIENCE 1

1. Identification of Subject:

Name of Subject	: Machine Elements
Code of Subject	: MELM-2100
SKS	:3
Semester	:3
Study Program	:B-AVE, B-INE, B-MEE, B-MTE
Lecturer	:Dr. Ir. Prianggada I. Tanaya, MME, Ananta Widjaja, ST, Ms.Avi.Mgmt

2. Competency

After having the course, students are expected to:

- Understand concepts and definitions of mechanical design, machine design.
- Using the theory of statics and mechanics of materials for designing mechanical components
- Knowing the stresses, strain, load, power, geometric dimension, and shape
- Describe the system specification
- Implementing technical drawing
- Understanding mechanical system structure
- working with table in designing mechanical components

3. 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.

4. Learning Approach

Approach	: Combination of Expository - inquiry and collaborative
Method	: Discussion, question answer, sample problem, group work
Student Task	: Home work, group report, group presentation
Media	: LCD projector, slide.

5. Evaluation

a) Absence maximum	: 25%
b) Participation in discussion	: 5 points
c) Homework, Classwork	: 5 points
d) Presentation, Simulation	: 10 points
e) Daily Quiz	: 20 points
f) Final Examination	: 60 points

Total : 100 points

6. Contents/ Topics of Lecturing:

Week	Content/ Topics of Lecturing	Text Book Chapter	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	Ch4[1]	
	Geometry Determination The contrast in objectives between analysis and design; basic principles and guidelines for creating shape and size	Ch 6[1]	
5	Power Transmission Shafting; Couplings, Keys, and Splines: Uses and Characteristics of Shafting; Potential Failure Modes;	Ch8[1]	

	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.		
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]	
7,8	Plain Bearings and Lubrication: Types of Bearings; Uses and Characteristics of Plain Bearings; Potential Failure Modes; Plain Bearing Materials; Lubrication Concepts; Boundary-Lubricated Bearing Design; Hydrodynamic Bearing Design; Hydrostatic Bearing Design.	Ch10[1]	
9,10	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]	
11-13	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]	
14	Rehearsal and Tutorial: Rehearsal of all subject and students can ask for more detail.		
15	Final Examination		

7. Book Reference:

- a) **Main Text Book:** [1] **Mechanical Design of Machine Elements and Machines**, Jack A. Collins, Henry Busby, George Staab, 2nd edition, Wiley, 2010
- b) **Supplement Textbooks:**
 - a. **Engineering and Scientific Computing with Scilab**, Claude Gomez, Carey Bunks, Jean-Philippe Chancelier, François Delebecque, Birkhäuser Basel, 1999