

Sichuan University Pittsburgh Institute

Mechanical Engineering Design II

Syllabus

Instructor: Dr. Ho Chen Chien

Lecture Hours: 1:50 to 3:30 PM on Tuesday and Thursdays

Class Requirements:

- 1) Completion of Mechanics of Material II is a prerequisite for this course.
- 2) Assigned homework will be discussed at the following class session - students will present their solutions at the beginning of the session.
- 3) Oral and written reports will be required for the reverse-engineering and the design projects.

Course Description:

Lectures will include fundamentals of mechanical engineering design that are applied to analyze, design, and/or select components typically used in the designs of complete mechanical systems. Part 1 of the course covers the design process, analysis of stress and deflection, material properties and loadings (steady state and variable) as they relate to failure prevention. Responsible design (safety factors and ethics) will also be addressed. Part 2 covers the design and analysis of common machine elements including power screw, mechanical springs, journal and ball bearings, gears, shafts and springs.

There will be a team “reverse engineering” project and a team design project. Students will apply the course topics to real-life mechanical design. Team work, project execution and presentation skills are emphasized.

Textbook: Shigley’s Mechanical Engineering Design by Richard G. Budynas and J. Keith Nisbett, 10th edition, McGraw-Hill Education, 2015. ISBN 978-0-07-339820-4. Only paper version may be used during exams – no e-books.

Course Learning Goals and Expected Outcomes

Goals	Expected Outcomes
1. Student will learn the fundamentals of key machine components	<ol style="list-style-type: none">1. Ability to identify key machine components and their materials2. Ability to select appropriate components for required functions and life
2. Students will learn to analyze the stress and strain aspects of machine components	<ol style="list-style-type: none">1. Ability to correctly analyze stress and deflection of loaded structures2. Ability to select correct material strength properties
3. Students will learn to determine failure and fatigue in mechanical components and determining safety factors	<ol style="list-style-type: none">1. Ability to understand and apply safety margins2. Demonstrate ability in the reverse engineering project
4. Students will learn to design simple mechanical devices and make prototypes of the design	<ol style="list-style-type: none">1. Ability to apply the analytical skills, to formulate design plans and execute plans.2. Demonstrate ability to make assumptions, analyze problems and provide solutions
5. Students will learn to produce oral and written presentation	<ol style="list-style-type: none">1. Generate professional quality project report and presentation2. Demonstrate ability to work in team environment

Schedule:

Session	Week of	Topics	Reading Assignment (Before Class!) and Notes (*)
1	February 25, 2019	Introduction - Fundamentals of the Design Process, Review of Stress, Units,	Sections 1.1 ~ 1.15
2	March 4, 2019	Materials - Strength & Other Properties, Stresses & Strains, Power Transmission, Mohr's Circle Review of Deflection, Strain Energy Methods	Sections 2.1 ~ 2.7, 2.12 ~ 2.15 Sections 3.1 ~ 3.13, 3.19 Sections 4.1 ~ 4.15
3	March 11, 2019	Stress Concentration, Static Loading Failure Theory First In-Class Mid-Term Exam	Section 5.1 ~ 5.9 *Mid-Term Exam covers Chapters 1 to 4
4	March 18, 2019	Reverse Engineering Project. Variable Loading Fatigue, S-N Curves	Sections 6.1 ~ 6.3, 6.7 ~ 6.9,
5	March 25, 2019	Fluctuating Fatigue theories, Impact	Section 6.11~ 6.13, 6-15. Section 4.17
6	April 1, 2019	Power Screws. Reverse Engineering Project Presentation	Section 8.1 ~ 8.2
7	April 8, 2019	Mechanical Springs. Team Project Discussion	Section 10.1 ~ 10.11
8	April 15, 2019	Journal Bearings. Second In-Class Mid-term Exam	Section 12.1 ~ 12.8 *Mid-Term Exam covers Chapters 5, 6, 8 and 10
9	April 22, 2019	Ball Bearings. Team Project Group Work	Section 11.1 ~ 11.6
10	April 29, 2019	Gears ; Team Project Group Work	Section 13.1 ~ 13.7, 13.13 ~ 13.14
11	May 6, 2019	Shafts. Team Project Group Work	Section 7.1 ~ 7.6
12	May 13, 2019	Team Project Presentation Final Exam	

Grading:

Home work /Participation/ Quizzes	10%	
Midterm Exams (2)	20%	
Rev. Engineering Report	15%	
Team Design Project	30%	
Final Exam	20%	
Engineering Log	5%	

Attendance Policy: All students are expected to attend every scheduled class session and to turn in all homework. Students are responsible to acquire notes and homework assignments from classmates in case of absence, and to notify the professor.

The characteristics of students expected to do well in this class:

1. Complete textbook readings before class.
2. Complete all homework assignments.
3. Ask questions when something isn't clear (for class, homework, & exams).
4. Draw good sketches, show all steps, apply sanity checks to their work, and keep track of units.
5. Be a team player in the Reverse Engineering projects, team project and in-class activities.