



California State University, Chico
Mechanical and Mechatronic Engineering and Sustainable Manufacturing
MECH 340: Mechanical Engineering Design
Fall Semester 2019

Instructor: Dr. Dennis O'Connor

Office Hours: O'Connell 417, Tuesday and Friday 2 - 3PM, Thursday 1-3PM

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Prerequisites: MECH 100, 100L; MECH 210 and CIVL 311 with C- or higher. Students who have not met the prerequisites will be dis-enrolled from the course unless given permission through the department.

Textbooks: *Shigley's Mechanical Engineering Design* (10th Edition) by Budynas and Nisbett, McGraw-Hill 2015.

Class: Lectures MWF in Holt 268, 11:00 - 11:50AM | Activities MW 2:00-3:50PM in O'Connell 431

Course Grade: Minimum passing grade is C-, letter grades will be assigned as follows.

- ❖ Homework 10%
- ❖ Design Activities 20%
- ❖ Design Project 20%
- ❖ Exams 50%

[90,100]	A
[80,90)	B
[70,80)	C
[60,70)	D

Homework: Problem sets will be posted on the Blackboard class site and will be collected at the START of the class period on the due date specified. Late homework, including after the start of class, will not be graded. Work must be legible for full credit and the final answer of each problem enclosed in a box.

Design Activities: A combination of short paper design assignments and hands-on experiments will be facilitated through the two hour activity time. Experiments will focus on utilizing professional strain gauge measurements to demonstrate key stress-strain relationships for machine design. The paper design activities will give you an opportunity to practice the course material in a manner which requires technical communication, both written and graphical.

Design Project: The design project in MECH 340 will be a group assignment requiring the practice of design, fabrication and presentation. This semester's project will be on making an electrical hoist device capable of lifting a minimum weight to a predetermined height. Emphasis will be given to the application of technical design and implementation of course-related material. Each group will be provided a budget with which to purchase necessary parts and have access to electrical motors through the Mechatronics Center. The following list describes the project grade makeup.

- ❖ Design Report 10%
- ❖ Prototype 10%

Exams: There will be three one-hour exams throughout the semester plus a two-hour final exam. The one-hour exams each be worth 10% of your grade and the final 20%. Exams will be open-book and open-note, paper only. For full credit, each answered question must demonstrate sufficient work and maintain correct units.

Design Drawings: Design drawings are expected to conform to the MEM Department drawing standards. Further information can be found on at: http://www.csuchico.edu/mem/drawing_standards.shtml and the specific standards at: http://www.csuchico.edu/mem/documents/Department_Drawing_Standard.pdf.

Course Schedule: The following table is a tentative course schedule outlining the chapters covered and approximate time for the Tests.

Week	Dates	Topics	Readings
1	Aug 26 - Aug 30	Load and Stress Analysis, Ch.3	3.1 – 3.6
2	Sept 2 - Sept 6	Load and Stress Analysis, Ch.3	3.7 – 3.19
3	Sept 9 - Sept 13	Deflection and Stiffness, Ch.4	4.1 – 4.17
4	Sept 16 - Sept 20	Review (Exam I: 3,4)	
5	Sept 23 - Sept 27	Static Load Failure Theories, Ch.5	5.1 – 5.13
6	Sept 30 - Oct 4	Dynamic Load Fatigue Failure, Ch.6	6.1 – 6.17
7	Oct 7 - Oct 11	Shaft Components, Ch.7	7.1 – 7.8
8	Oct 14 - Oct 18	Review (Exam II: 5,6,7)	
9	Oct 21 - Oct 25	Nonpermanent Joints, Ch.8	8.1 – 8.12
10	Oct 28 - Nov 1	Rolling-Contact Bearings, Ch.11	11.1 – 11.12
11	Nov 4 - Nov 8	Gears-General, Ch.13	13.1 – 13.9
12	Nov 11 - Nov 15	Gears-General, Ch.13	13.10 – 13.17
13	Nov 18 - Nov 22	Review (Exam III: 8,11,13)	16.1 – 16.12
14	Nov 25 - Nov 29	Thanksgiving	Break
15	Dec 2 - Dec 6	Flexible Mechanical Elements, Ch. 17	17.1 – 17.7
16	Dec 9 - Dec 13	Power Transmission, Ch. 18	18.1 – 18.11
17	Dec 16 - Dec 20	Final Exam (Comprehensive)	

Academic Integrity: Incidences of plagiarism will be referred to student judicial affairs and may result in failure in the course. Students are expected to be familiar with the University's Academic Integrity Policy. The policy on academic integrity and other resources related to student conduct can be found at: <http://www.csuchico.edu/sjd/integrity.shtml>.

Student Learning Center: The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The SLC is online at <http://www.csuchico.edu/slc>.

Americans with Disabilities Act: If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations. Accessibility Resource Center (530-898-5959) and Student Services Center (arcdept@csuchico.edu).

MECH 340 Course Objectives: For students to:

- 1) Learn a process for designing mechanical systems with a balance of the conceptualization and detail design phases of the process.
- 2) Synthesize and apply concepts from the engineering sciences including statics, dynamics, strength of materials, and materials science.
- 3) Practice choosing parameters for a mechanical system (e.g., dimensions and material properties) based upon a set of performance specifications.
- 4) Learn how to determine allowable stresses in a component based upon an appropriate theory of failure and a reasonable set of assumptions including factors of safety where appropriate.
- 5) Learn how to mathematically model a selection of common mechanical components in order to predict particular performance measures and to utilize equation solving software to streamline the analytical solution process.
- 6) Have opportunities to be creative, and at the same time, mindful of the constraints imposed by material limitations, manufacturing, standard practices, codes and standards.
- 7) Be introduced to the concepts of uncertainty and reliability in design, as they pertain to material properties, manufacturing processes, and applied loads.

MECH 340 Course Outcomes: Students shall be able to:

- 1) Apply energy methods to relate the steady-state input/output characteristics of machines to relate quantities such as torque, force, velocity, and angular velocity.
- 2) Determine stresses in straight, slender bodies caused by combinations of axial, shear, bending, and torsional loads.
- 3) Determine stresses in curved beams.
- 4) Determine miscellaneous stresses in machine components such as direct shear, tearout, and bearing stresses that occur commonly with interconnected machine parts.
- 5) Apply stress concentration factors where appropriate.
- 6) Determine principal stresses due to combinations of simple stress states.
- 7) Size components using static failure theory.
- 8) Size components using fatigue failure theory.
- 9) Estimate and apply appropriate factors of safety for a given machine environment and loading, and apply them in selecting materials and sizing selected machine components.
- 10) Determine the appropriate size of a rotating shaft for infinite-life strength.
- 11) Select components such as bearings, gears, springs, threaded fasteners, clutches and brakes based on accepted practice and theory for particular machine elements.