

California State University, Chico
 Department of Mechanical and Mechatronic Engineering and Sustainable Manufacturing

MECH/MECA 140: Introduction to Engineering Design

Section 01-02 M/W 9:00-10:50am

Instructor: Scott Vanni

Office Location: LANG 114

Office Hour: Monday 11-12

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Textbook and other supplies:

Required: Moaveni, Engineering Fundamentals, Thomson, 5th Ed

Your Physics book will also be a useful reference.

You will need a USB memory drive or cloud storage to store many of the assignments and exercises

Course Description:

Through the process of designing and building a machine, you will learn a process for designing and essential project management skills. You will learn the basic systems used in most every machine such as sensors, pneumatics, hydraulics, bearings, bushings, gears, belts and pulleys, clutches and brakes, and framing materials. You will also get introduced to ac and dc motor control, simple electrical circuits, machine controllers, programming, testing and analysis of results. The class has an economic overlay in that the project(s) will include budgeting and feature justification. Labs are not recipe-type activities. They demand the student simulate the actions an engineer might take in considering automation of a machine or process, and then complete a proof-of-concept system to verify those decisions. Many of the project skills introduced here will be used in other projects in and out of classes, and especially in your capstone senior design project.

Prerequisites:

Corequisite: PHYS 204A.

Grading:

Homework	20%
Project Scale Model & Presentation	15%
Final Project - Amount Completed	35%
Project Knowledge	10%
Individual Contribution & Teamwork	15%
Design Notebook	5%

Academic Integrity:

The students, faculty, administrators, and staff of CSU, Chico are committed to a culture of honesty in which members of the community accept responsibility to uphold academic integrity in all they say, write, and create. The complete CSU, Chico policy is available at: www.csuchico.edu/prs/EMs/2004/04-036.shtml. Review this policy and especially review the examples provided by the Office of Judicial Affairs of using previous work (plagiarism) and unauthorized collaboration, www.csuchico.edu/sjd/integrity.shtml. You can feel confident your instructor will protect the integrity of the class by taking appropriate action for any deviations from this policy of academic integrity.

Attendance:

You are allowed one class period of excused "sick leave" and one "wander in late". Otherwise attendance is required at all class meetings including during the scheduled final exam period. Your course grade will be lowered 1/3 grade point for each additional unexcused absence from class. Also, please get to class on time. Each additional "wander in late" = 1/2 of an absence.

Exams:

None planned.

Homework:

Homework should be typed (except sketches, calculations, and diagrams which are to be done on engineering paper) and proofread. It will be graded on effort, content, spelling and grammar. Since this is a more project/lab-oriented course there will be plenty of out-of-class work you will need to do with your project team to accomplish each project. Generally, an average student during an average week should spend four hours per unit on a class. This includes time in class and time spent out of class doing homework and studying. Since this is a 2-unit class which meets four hours per week, on average you should devote at least 4 hours outside of class each week to this course.

Design Notebooks:

Each student needs to keep a design notebook. It is a collection of your work for the semester. It should be 1" (or less) thick 3-ring binder. It may be collected for review after each major section. It should be organized and include a Table of Contents. Date the start of each session's entry. Use only the right hand pages for project notes (only those pages will be read). You may use the left hand pages for lecture notes. The notebook should include items such as sketches, wiring diagrams, pictures of your setup, printed programs, Excel files etc.

Submitted Work:

Assignments are due at the beginning of a class and need to be ready to submit when the class starts. All pages must be stapled together. Only the first page and any additional pages which are stapled to the first page will be graded. The availability of a functional stapler or printer or time before class is not guaranteed. For hand written work, engineering paper is required, and only the front of the page. For computer work, please print out your work prior to class starting. Late or inappropriately submitted work is subject to grade reduction or not accepted at all.

All work must have an appropriate heading including:

1. Assignment title
2. Your name
3. Date submitted

All typed work (except the lab notebook) will be graded for spelling. Each spelling error will deduct one letter grade from that assignment.

Safety:

You will be working with tools which have the potential of causing injury. The Department's General Lab Safety Policies are available to read on the department web site. The policies are required to be read and signed before using the lab. Safety glasses are available outside of the lab door.

Everyone in OCNL 432 (Lab) must wear eye protection at all times. Anyone failing to comply with all lab safety rules will be told to leave the lab immediately and not be allowed to return to the lab that day. Repeated offenses will result in failing the course.

(Note that when OCNL432 and 436 are not being used for another scheduled class you may use them, but you may NEVER work alone.)

Project Expenses:

During the project if you have minor expenses (<\$15) for parts necessary to your design, the instructor will need to pre-approve the expense based on seeing your design need. In general, reimbursements are not available. There is a purchasing option for specific items.

Courtesy:

To keep the facilities a pleasant place for you and students who follow you to work, please:

1. Always cover your table in OCNL 436 or 431 with a sheet of Masonite when working with any tools.
2. When finished working, clean up your table, any power tool you used and any other area in which you worked. Return tools to the tool cabinet and sweep up if necessary.

Course Outline:

Week # (approximate)

1-2 Introduction to the design process

1. Project Justification (Why spend time or money on this project?)
2. Problem Definition - (What it must accomplish - define the specs)
3. Project Planning
4. Conceptualization
5. Evaluation of Alternatives
6. Detail Design and Analysis
7. Construction and Programming
8. Testing and Analysis of results
9. Communication of solution and give a "proof-of-concept" presentation iterative!

The groups will meet with a 'customer' to gather the technical details of a simple project. As you ask questions, constraints arise that lead to a simple system. Upon acceptance of your design, you receive the materials needed to build a proof-of-concept. You and your partner(s) must build it and demonstrate the project.

3-5 Design Project Mockup

6-7 Computer Control of Machines

8-15 Final Design Project

Lectures:

Lectures have been developed to address specific technical and economic issues. Interaction between the instructor and students is encouraged and expected. Lectures are scattered throughout the semester, as they become needed. The lectures are, in no particular order:

- Framing Material Choices
- Electrical Safety
- Machine Control Topologies
- Power Supplies

- I/O Circuits and Devices (Sensors)
- AC and DC Motors
- Gearing
- Belts and Pulleys
- Solenoids
- Bearings and Bushings
- Energy Sources
- Clutches and Brakes
- Couplers
- Motor Control (VFD's, Vector Drives)
- Asking Project Questions
- Pneumatics and Hydraulics in Machines
- Machine Controllers
- plus more...

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, Student Services Center 170, arcdept@csuchico.edu