MECH/MECA 140: Introduction to Engineering Design and Automation

Instructor: Scott Vanni
Section 01-02 M/W 9-11am
Office Location: LANG 114
Office Hour: 
Phone: (530) 898-5129
Email: svanni@csuchico.edu

Instructor: Daisuke Aoyagi
Section 03-04 T/Th 9-11am
Section 05-06 T/Th 11-1pm
Section 11-12 M/W 11-1pm
Office Location: OCNL 428
Office Hour: M-Th 3-4pm
Phone: (530) 898-4619
Email: daoyagi@csuchico.edu

Instructor: Grant Keeny
Section 07-08 T/Th 5-7pm
Office Location: OCNL 228/431
Office Hour: 
Email: gdkeeny@gmail.com

Instructor: Josh Miranda
Section 09-10 M/W 7-9pm
Office Location: OCNL 228/431
Office Hour: M-Th 3-4pm
Email: mmiranda@csuchico.edu

Instructor: Nick Repanich
Section 07-08 T/Th 5-7pm
Office Location: OCNL 228/431
Office Hour: 
Email: nrepanich@csuchico.edu

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:
None, though working knowledge of concepts taught in High School Physics will be helpful.

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.

Textbook and other supplies:
Required textbook: Moaveni, Engineering Fundamentals, Thomson/Cengage, 5th Ed.
Your high school Physics book will also be a useful reference.
You will also need a USB flash drive to store many of the assignments and exercises.
**Grading:**

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

**Exams:**
None planned.

**Homework:**
Homework should be typed (except sketches) and proofread. It will be graded on effort, content, spelling and grammar. Each spelling error will deduct one letter grade from that assignment.

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, including items such as sketches, wiring diagrams, pictures of your setup, programs, spreadsheets, etc.

The instructor will specify format, requirements, and recommendation for the Notebook.

**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.

**Safety:**
You will be working with tools which have the potential of causing injury. The Department's Lab Safety Policies and Procedures are available to read on the department web site. There is also a form to sign before you can enter and use OCNL 432 for the semester. When you submit this form, you will receive a special sticker to put on your student ID card. Be prepared to show your ID card with the sticker whenever you are in OCNL 432.

You may NEVER work alone in OCNL 432. Everyone in OCNL 432 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.

You are to bring your own eye protection (safety glasses). The instructors will try to maintain several pairs of safety glasses at the door to OCNL 432 as backup. However, the numbers are limited and the quality/condition
may not be ideal. You are strongly urged to bring your own, and should not depend on the provided backup safety glasses.

Note that OCNL 436 will be available as additional workspace. However, you must first obtain permission from the instructor, and may NEVER work alone in there.

**Project Expenses:**
During the project if you have minor expenses for parts necessary to your design, you may buy them yourself and then get reimbursed, depending on the availability of MMEM department funding. Instructor will need to pre-approve the expense based on seeing your design need, and you must pay cash (or debit card, not credit card) to get reimbursed.

**Courteous:**
To keep the facilities a pleasant place for you and other students to work in, 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 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
- Project Justification (Why spend time or money on this project?)
- Problem Definition - (What it must accomplish - define the specs)
- Project Planning
- Conceptualization
- Evaluation of Alternatives
- Detail Design and Analysis
- Construction and Programming
- Testing and Analysis of results
- 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. Your 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