Mechanical Engineering Design
MAE 162 D/E
MAE 162 D Mechanical Engineering Design
Course Description

• **Units:** 4
• **Lecture:** two hours;
• **Laboratory:** four hours;
• **Outside study:** six hours.
• **Enforced requisites:** courses 94, 156A (or 183A or M183B), 162A (or 171A). Limited to seniors.
• **Description:** First of two mechanical engineering capstone design courses. Lectures on engineering project management, design of thermal systems, mechatronics, mechanical systems, and mechanical components. Students work in teams to begin their two-term design project. Laboratory modules include CAD design, CAD analysis, mechatronics, and conceptual design for team project.
• **Letter grading.**
MAE 162 E Mechanical Engineering Design
Course Description

• Units: 4
• Lecture: two hours;
• Laboratory: four hours;
• Outside study: six hours.
• Enforced requisite: course 162D. Limited to seniors.
• Description: Second of two mechanical engineering capstone design courses. Student groups continue design projects started in course 162D, making use of CAD design laboratory, CAD analysis laboratory, and mechatronics laboratory. Design theory, design tools, economics, marketing, manufacturability, quality, intellectual property, design for manufacture and assembly, design for safety and reliability, and engineering ethics. Students conduct hands-on design, fabrication, and testing. Culminating project demonstrations or competition. Preparation of design project presentations in both oral and written formats.
• Letter grading.
Instructors

Jacob Rosen (MAE)
Email: jacobrosen@ucla.edu
Zoom: https://ucla.zoom.us/j/8044567769

Ankur Mehta (ECE)
Email: mehtank@ucla.edu
Zoom: https://ucla.zoom.us/j/6818072756
Expect the Unexpected

Tune Our Expectations
Course Expectations

• Ultimate Goal - Develop an innovative fully functional engineering system (group project)
  • Me:
    • Teach (Class, Sections, Office Hours)
    • Mentor Design Projects of Groups / Customer – User Advocate
    • Provide constructive feedback and pointers for additional resources
  • You:
    • Learn Design
    • Perform R&D
    • Proactive team member
    • Expect to apply the information gained from engineering, English writing, economics, statistics, accounting, management, marketing, law, ethics, and computer engineering to the task-at-hand.

• Modes of Interactions (You & Me)
  • Mode 1 - Classroom (You & Me – TA Guest Lectures)
  • Mode 2 - Lab Sections (You & TA ? Me )
  • Mode 3 - Office Hours (You & Me, You & TA)
  • Mode 4 - Group Meeting – You & Your Group Members (Peers)
  • Mode 5 - Lab / Home – You –individual work
Course Expectations

• Mode 1 - Classes (Led by Me, TA, Guest Lectures)
  • Me:
    • Present high level and low level topics related to design
    • Teach complimentary engineering skills (applied knowledge)
    • Initiate verbal interaction dialogue/discussion
  • You
    • Learn high level and low level topics related to design
    • Learn complimentary engineering skills (applied knowledge)
    • Participate in the verbal interaction dialogue/discussion

• Mode 2 - Sections (Led by the TA / Me)
  • TA
    • Mentor home assignments
    • Mentor Project
    • Facilitates dialogue and discussion
  • You
    • Discuss challenges and Problems
Course Expectations

• **Mode 3 – Office Hours** (Led by you)
  • ME
    • Location – my office Eng. 4 Room 37-146
    • Time – Wed 2:00-4:00
    • Email – jacobrosen@ucla.edu
  • You
    • Email me the day before indicating that you are planning to come/zoom for an office hours
    • Subject Line – MAE 162

• **Mode 4 - Lab / Group Meeting – You & Your Group Members**
  • You (Group Assignments)
    • Work with your group remembers on
      • Home Assignments
      • Project
Course Expectations

• Mode 5 - Lab / Home – You –individual work
  • You – Work on individual assignments
    • Homework
    • Project subtasks

• Homework
  • Me/TA
    • Provide Feedback
    • Grade
  • You
    • Complete & Submit (Upload) HW on time
    • Upload Homework to CCLE and Google share directory of the class

• Attendance
  • Me – Mandatory
  • You – Mandatory
Class Schedule & Topics

High and Low Levels Topics Covered in the Classroom
# Class Structure (Winter & Spring)

<table>
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<th>Activities</th>
<th>Load</th>
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<th>Spring</th>
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<td>Weeks</td>
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<td>1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>Class</td>
<td>H</td>
<td>CA1 CA2 CA3 CA4</td>
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<tr>
<td>Labs (Minor Project)</td>
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<td>SW SIM1 SIM2 Servo SIM3 CIRC ARD TOL</td>
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<td>Major Project</td>
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<td>Reports Milestones</td>
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<td>IDEA IDEA RR SDR PDR PDR PDR</td>
<td>CDR FDR</td>
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### Leganes (Class / Lab)
- CA# - Class Assignment
- SW – Solidworks
- SIM – Simulation
- Servo – Servo Feedback Control
- Circ – Circuits
- ARD – Arduino
- TOL – Tolerance

### Leganes (Reports / Milestones)
- IDEA (IND) – Project Idea by Individual Students Class Assignment
- IDEA (TM) – Project Idea by group.
- SDR – System Design Review
- PDR – Preliminary Design Review
- CDR – Critical Design Review
- FDR – Final Design Review
Topics

• High Levels
  • Introduction – Design Process
  • Explicit Problem Definition
  • Requirements Definition
  • Design & Development
  • Systematic Innovation
  • Demonstration
  • Evaluation
  • Reporting & Communication
  • Ethics & Design Sciences (PF)
  • Business Plan (Guest Lecture)
  • Intellectual Properties (Guest Lecture)
  • Errors in Engineering
  • Biologically inspired Design
  • User Centered Design
  • Optimization
  • Cost
  • Inclusive Design
  • Design By Evolution
  • Safety
  • Design of Experiments

• Low / Technical Levels
  • Solidworks (PF)
  • Solid Mechanics – Design (JR)
  • Finite Elements (PF)
  • Data Acquisition and Signal Processing (PF)
  • Adriano / LabVIEW / Matlab Real-time workshop (PF)
  • Sensors / Actuators (JR)
  • Servo Motor Selection (JR)
  • Practical Servo Control Design (JR)
  • Circuits I - H Bridge (PF)
  • Circuits II - Analog Filters (PF)
  • Circuits III - Op-Amp) (PF)
  • Eagle (PF)
  • Soldering & Bread boarding (PF)
  • Computer Vision (Sahba Changyeob)
Project & Team
Definition / Operation
Project Definition

- **Nature of the Project:** Social Impact

- **Type of the Project**
  - System
  - Technology

- **Elements of the Project**
  - Mechanism / Structure
  - Sensing
  - Actuation
  - Control
  - Algorithm / Computation
  - User Interface
Groups & Teamwork – Mechanisms

- Collaboration

- Instructors
  - MAE 162D/E – Jacob Rosen (MAE)
  - ECE183DB – Ankur Mehta (EE)

- Format - Multidisciplinary (ME / EE) collaborative project

- Team - Hybrid Team – 3 ME Students & 3 EE Students

- Team Member Roles
  - Team Leader
    - Self Selected / Assigned
    - Scheduling
    - Integrator (Solidworks Assembly Control)
    - Subsystem Member
  - Subsystem Lead
    - Lead the design of a subsystem of a subgroup
  - Subsystem Member
    - Member in a subsystem design subgroup