

MAE 156B
Fundamental Principles of Mechanical Design II (4 units)

Class/Laboratory Schedule: four hours of lecture, three hours of lab, five hours of outside preparation. 12 hours/week total

Course Coordinator(s): Jerry Tustaniwskyj

Textbooks/Materials:

Catalog Description: Fundamental principles of mechanical design and the design process. Culmination of a team design project initiated in MAE 156A which results in a working prototype designed for a real engineering application.

Prerequisites: Completion of 156A in the immediately preceding quarter, MAE 101C, MAE 143B, and MAE 150

Course Type: Required

Performance Criteria:

Objective 1 (Open-Ended Design Problems)

1.1 Students will be given open-ended design problems, which they will tackle in teams. Projects assigned are real world problems having defined requirements and are sponsored by industry, UCSD research faculty, or UCSD Medical research faculty.

Objective 2 (Design Project Management and Teamwork)

2.1 Students will be responsible for setting team deadlines, schedule, and budget allocation. Student teams will collectively make design decisions.

2.2 Peer review will be used for providing feedback regarding the contribution of individual team members.

Objective 3 (Communication)

3.1 Oral presentations will be made of the team progress, and of the final design. Instructor comments and peer review will be used for providing feedback.

3.2 Students will write a final report of their design project, and post components of the report on a web page, which can be used by the students as part of their portfolio. Instructor comments and peer review will be used for providing feedback.

Objective 4 (Application of Engineering Science)

4.1 Analysis will be used in the preliminary design stage to evaluate feasibility of various

design concepts.

4.2 Analysis will be used in the detail design stage to select and design components.

4.3 Engineering Standards will be incorporated into the design

4.4 The performance of the device will be evaluated, and engineering analysis will be used for redesign, optimization, and correlation of theory with practice.

Objective 5 Professional Responsibility (Engineering Ethics and Impact on Society)

5.1 Team reports will include documentation of safety concerns, performance limitations, and provide credit to external resources.

5.2 Team reports will describe how the results of their project will impact society.

Objective 6: Lifelong Learning

6.1 Students will be required to investigate previous designs, study existing designs have similar constraints, and research topics not covered in previous courses but needed for optimizing their design.

Course Objectives:

(Numbers in parentheses refer to the specific MAE Program Outcomes)

1. To teach students how to tackle open-ended design problems with multiple constraints. (1, 2, 6)
2. To train students to effectively work in teams, manage project priorities, and meet project deadlines. (2, 5)
3. To train students in graphical, written, and oral communication. (3)
4. To provide students with the experience of applying engineering science theory to real world design problems. (1, 7)
5. Engineering ethics and impact on society relevant to the design projects addressed in the project report. (4)

Course Topics:

1. Engineering Design Process
2. Design Problem Identification
3. Concept Generation and Creativity
4. Concept Selection
5. Project Management: Scheduling, Risk Reduction Strategies, and Budgeting
6. Teamwork

7. Information Gathering (Lit. Searching and Vendor Contact)
8. Application of Standards to proposed design
9. Analysis of Mechanical Components and System Level Performance
10. Component Selection and Procurement
11. Application of Engineering Science in areas relevant to design topic (e.g. material strength, dynamics, fluid mechanics, heat transfer, control, and thermodynamics)
12. Detail Design Techniques
13. Application of Computer-Aided-Design and Computer-Aided-Analysis
14. Oral, Written, and Graphical Communication

Last Updated: 15th June 2025