

MAE 156A
Fundamental Principles of Mechanical Design I (4 units)

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

Course Coordinator(s): Nathan Delson

Textbooks/Materials:

Lectures which reference company design guides and design textbooks.

Catalog Description: Fundamental principles of mechanical design and the design process. Application of engineering science to the design and analysis of mechanical components. Initiation of team design projects that culminate in MAE 156B with a working prototype designed for a real engineering application. Professional ethics discussed. Program or material fees may apply.

Prerequisites: Grades of C- or better in MAE 3, 30B, 131A, 150, and 170. Open to Mechanical Engineering majors only.

Course Objective:

Objective 1 (Open-Ended Design Problems)

1.1 Students will be given open-ended design problems which they will tackle in teams. Also, students will answer exam questions and perform homework assignments that apply design methods to specific design problems.

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.
- 3.2 Each student will write an Individual Component Analysis, which describes research that they do on one topic for their capstone design project.

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 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 (Engineering Ethics)

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

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. Analysis of Mechanical Components and System Level Performance
9. Component Selection and Procurement
10. Machine Shop Fabrication Techniques
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: March 2025