

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

**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:**

1. Course pack from soft reserves

**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.

**Prerequisites:** Grades of C- or better in MAE 3, 130B, 131A, 143B, 150, and 170. Open to MC 27 majors only.

Technical Elective Course

Other: \_\_\_\_\_

**Performance Criteria:**

Objective 1 (Machine and Mechatronics Design)

- 1.1 Students will be given a machine design task, which they will have to optimize using engineering theory. The task will involve use of a microprocessor, and thus optimization will require integration of mechanical, electrical, and control components.
- 1.2 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 Student design decisions and analysis will be communicated in written reports.

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 (Fabrication Process)**

5.1 Students will be responsible to use a mill and lathe in the machine shop to fabricate a simple device and gain expertise in fabrication processes and Design For Manufacturability (DFM).

**Objective 6 (Problem Identification of Open-Ended Design Challenge)**

6.1 Students will begin their capstone design project, which will be completed in MAE156B. In MAE156A, the Problem Identification component of the project will be implemented, where students identify customer needs and project constraints.

**Course Objectives:**

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

Objective 1: To teach students how to tackle design problems (3c, 11k).

Objective 2: To train students to effectively work in multidisciplinary teams, manage project priorities, and meet project deadlines (3c, 4d).

Objective 3: To train students in graphical, written, and oral communication (7g).

Objective 4: To provide students with the experience of applying engineering science theory to Machine Design problems (1a, 5e, 9i, ME14).

Objective 5: to gain knowledge in manufacturing process and Design For Manufacturability (DFM) (ME14).

**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. Detailed Design Techniques
13. Application of Computer-Aided-Design and Computer-Aided-Analysis
14. Oral, Written, and Graphical Communication

**Prepared by:** Nathan Delson, April 2000

**Revised:** June 2006

**Reviewed TWG:** June 2010; July 2010

**Reviewed:** TWG, August 2012

**Updated by:** Nathan Delson, June 2013