

MAE156AB
Fundamental Principles of Mechanical Design I, II

Designation: Required course

Catalog Data:

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

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.

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

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.

Textbook: Course pack from soft reserves

Prerequisites for 156A: grades of C- or better in MAE 130C, 131A, 160, and 170; grades of C- or better or concurrent enrollment in MAE 101C, 150

Prerequisites for 156B: Completion of 156A in the immediately preceding quarter and grades of C- or better in MAE 156A, 101C, and 150.

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

Course Objectives:

(Numbers in parentheses refer to the MAE Program Outcomes)

Objective 1: To teach students how to tackle open-ended design problems (3c).

Objective 2: To train students to effectively work in 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 real world design problems. (1a,5e,9i)).

Objective 5: Engineering ethics relevant to the design projects will be introduced through case studies with an ethical component (6f)

Methods of evaluation:

1. Homework will be collected and graded.
2. Design projects will be done in teams. Intermediate milestones in these projects will be evaluated and graded.
3. Oral and Written reports on projects.
4. Peer evaluation for a component of team project grade.
5. Final product will be evaluated in terms of engineering quality.
6. Exams.
- 7.

Performance Criteria:

(Numbers in parentheses refer to the methods of evaluation used to assess student performance.)

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 (1,2,6).

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, 3,4,5).

2.2 Peer review will be used for providing feedback regarding the contribution of individual team members (4).

Objective 3 (Communication)

3.1 Oral presentations will be made of the team progress, and of the final design. Video tapes of these presentations will be made available for self assessment (2,3)

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 (3).

Objective 4 (Application of Engineering Science)

4.1 Analysis will be used in the preliminary design stage to evaluate feasibility of various design concepts (2,3,5).

4.2 Analysis will be used in the detail design stage to select and design components (2,3,5).

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 (2,3,5).

Objective 5 (Engineering Ethics)

5.1 Team reports will include documentation of safety concerns, performance limitations, and provide credit to external resources, utilizing reference materials from case studies with ethical components.(3).

Contribution of Course to Professional Component:

Engineering Science

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