ME 44400
COMPUTER-AIDED DESIGN AND PROTOTYPING

Course Outcomes  [Related ME Program Outcomes in Brackets]

1. Provide hands-on experiences with state-of-the-art computer-aided design (CAD) software.  [A3]
2. Learn to use CAD programs for productive mechanical engineering design.  [A3, A5, A7]
4. Reinforce the ability to work in a product design team, sharing ideas and models.  [B2, B3]
5. Learn to use computer-aided engineering programs for advanced stress analysis.  [A3, A7]
6. Provide practical experiences to meet expectations of industry in design and manufacturing.  [A5, A7]
7. Integrate computer-based product design with earlier experiences in design and manufacturing.  [A3, A7]

Advanced CAD Modeling (6 wks)
1. Learn advanced CAD concepts
2. Parametric design
3. Feature based design
4. Part design
5. Assembly design
6. Mechanism simulation

Team-Based CAD Design Project
1. Design, simulate, manufacture and purchase, and build mechanical “action toy” product
2. Teams formulate their own design
3. CAD used to create full CAD model including purchased and new parts.
4. Selected parts built using rapid-prototyping.
5. Prototype built and demonstrated.

Design & Manufacturing Project  (4 wks)
1. Action toy project for practical experience using CAD to design, simulate, manufacture and build a working prototype.
2. Simulate motion using CAD.
3. Evaluate manufacturability using CAD and rapid-prototyping planning software.

Example Projects
1. Airplanes with moving wings, landing gear.
2. Cars, trucks, etc. with remote controls.
3. Ancient clocks, military gadgets.
4. Merry-go-rounds, puzzles, games.

Introduction to Finite-Element Analysis (FEA) (5 wks)
1. Learn FEA theory – nodes, elements, boundary conditions, reaction forces.
2. Study 1-D element and 2-D solid element theory.
3. Hands-on learning using a commercial FEA program to solve truss and plane stress problems.
4. Learn how to develop appropriate FEA models with various types of boundary conditions, loading cases.
5. Use results data (displacements, stresses, and reaction forces) to solve various kinds of engineering problems.
6. 3-D modeling using both a CAD and a CAE program together.
1. COURSE NUMBER AND NAME: ME 44400 Computer-Aided Design and Prototyping

2. CREDITS AND CONTACT HOURS:  3 credits
   a. Lecture - 1 day per week at 50 minutes for 15 weeks
   b. Lab – 2 days per week at 110 minutes each for 15 weeks

3. COURSE COORDINATOR OR INSTRUCTOR: D. C. Anderson and K. Ramani

4. TEXTBOOK: None
   Other Supplemental Material: None

5. SPECIFIC COURSE INFORMATION:
   a. Catalog Description: Introduction to advanced computer-aided design (CAD) and computer-aided engineering (CAE) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional toy product. Project includes use of the advanced design tools to produce a working prototype that is manufacturable. Application to manufacturing and analysis. Typically offered Fall Spring.
   b. Prerequisites
      Senior standing or consent of instructor
   c. Status: Elective

6. SPECIFIC GOALS FOR THE COURSE
   a. Course Outcomes:
      [Related ME Program Outcomes in Brackets]
      1. Provide hands-on experiences with state-of-the-art computer-aided design (CAD) software. [A3]
      2. Learn to use CAD programs effectively for productive design. [A3, A5, A7]
      4. Reinforce the ability to work in a product design team, sharing ideas and models. [B2, B3]
      5. Learn to use computer-aided engineering programs for advanced stress analysis. [A3, A7]
      6. Provide practical experiences to meet expectations of industry in design and manufacturing. [A5, A7]
      7. Integrate computer-based product design with earlier experiences in design and manufacturing. [A3, A7]

   b. Related ME Program Outcomes
      [Related ABET Outcomes listed in Brackets]
      A1. Engineering Fundamentals; B3. Prof/Ethical Responsibility;
      A3. Experimental Skills; B5. Life-Long Learning;
      A4. Modern Engr Tools; C1. Leadership,
      A5. Design Skills; C2. Global Engineering Skills;
      A6. Impact of Engr Solns; C3. Innovation;
      B1. Communication Skills; C4. Entrepreneurship
      B2. Teamwork Skills

7. LIST OF TOPICS: See following page.

PREPARED BY: D. C. Anderson
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