ME 447 INTRODUCTION TO COMPUTER AIDED DESIGN

TYPE OF COURSE: requirement for the following programs: ME MAJOR


PREREQUISITE(S): MATH 220 Introduction to Differential Equations and ME 250 Engineering Graphics and Design

SAMPLE SOURCES AND RESOURCE MATERIALS: Pro/Engineer Wildfire (Release 4.0), Roger Toogood, 2006.

COURSE OBJECTIVES: Students learn some of the theory behind computer aided design (CAD) and computer aided engineering (CAE). Students apply knowledge of mathematics, particularly linear algebra, and engineering to solve problems analytically. These problems include geometric transformations, finite element analysis and curve generation. Simultaneously, in the laboratory portion of the class, they learn to formulate and solve design problems using state of the art commercial CAD/CAE packages. Graphical communication is taught through the laboratory assignments. The laboratory portion culminates in an open ended project.

MAJOR TOPICS:

1. INTRODUCTION TO CAD/CAE 1
2. METHODOLOGY IN DESIGN 2
3. TWO DIMENSIONAL GEOMETRIC TRANSFORMATIONS 5
4. THREE DIMENSIONAL GEOMETRIC TRANSFORMATIONS 5
5. SPLINES AND BEZIER CURVES 6
6. FINITE ELEMENT ANALYSIS IN ONE DIMENSION, TRUSSES 9
7. EXAMINATIONS 2

TOTAL: 30 + 30 hours of lab sessions where commercial CAD and CAE packages are used.

During the lab sessions, students learn to use commercial CAD/CAE packages to apply the concepts covered in lecture. Packages include Pro/Engineer (parametric solid modeling), Pro/Mechanica Structure (structural finite element analysis) and Pro/Mechanica Motion (3D dynamics simulation).

CREDIT HOURS: 3 hours

<table>
<thead>
<tr>
<th>Type of Instruction</th>
<th>Contact Hours/Week</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>2</td>
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<tr>
<td>Instructor Led Laboratory</td>
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**Contribution of course to meeting the professional component**

This course presents a mathematical treatment of computer aided design and computer aided engineering concepts. Real engineering situations are used as examples in both the lecture and laboratory portions of the class. The laboratory portion also includes an open ended project using commercially CAD/CAE software.

As shown in Outcomes Matrix:
- a. Ability to apply mathematics, science and engineering
- c. Ability to design a system, component or process to meet desired needs
- e. Ability to identify, formulate, and solve engineering problems
- g. Ability to communicate effectively
- i. Recognition of the need for, and an ability to engage in life-long learning
- k. Ability to use techniques, skills, and modern engineering tools necessary for engineering

**Person(s) who prepared this description and date of preparation**

Elisa Budyn, January 16, 2008

Comments on outcomes
- a. Ability to apply mathematics, science and engineering. In the lecture portion of this class, students learn some of the theory behind the CAD software they use in the laboratory. Included in this theory is geometry manipulation, curve and surface representations and finite element analysis. Students solve engineering problems on all these topics.
- c. Ability to design a system, component or process to meet desired needs. Course includes a design project and extended design homework problems.
- e. Ability to identify, formulate, and solve engineering problems. Many of the laboratory projects and the design project require the student to use the CAD principles they have learned to design or refine parts and assemblies. In some instances the problem statement is general enough to require the student to formalize the question and solve the problem themselves.
- g. Ability to communicate effectively. The work in the laboratory portion of the class helps students learn to communicate through engineering drawings.
- i. Recognition of the need for, and an ability to engage in life-long learning. In that CAD technology has been advancing so rapidly, students are impressed with the need to constantly keep on top of the field. Also, in performing their laboratories and design projects, students are encouraged to seek information beyond that included in their class materials. One of the outside sources encouraged is the Pro/Engineer newsgroup – an expansive forum of professional Pro/E users worldwide.
- k. Ability to use techniques, skills, and modern engineering tools necessary for engineering. Students use state-of-the-art software packages in order to perform engineering analysis. The software in the CAD lab is updated at least once a year, ensuring that students are always using the most modern CAD analysis tools available.

These outcomes are what students are expected to gain from this course.