ME 225 – Computer-Aided Design, Modeling & Graphics

Catalog Description:
Introduction to geometric modeling and Computer-Aided Design for engineering applications. Practical aspects of computer aided design in Unigraphics.

Prerequisites:
- Linear Algebra or consent of instructor

Texts:
- No formal text required. Class notes and reading material are available on-line during the semester.

Course Objectives:
The objective of this course is to introduce students to the fundamental issues in geometric modeling and their applications to modern computer aided product design. In addition, the course provides significant hands-on experience with a high-end CAD/CAM package—Unigraphics—through laboratory work and a number of project assignments.

Topics:
- Geometric modeling concepts and systems
- Construction, analysis, and interrogation of models
- Points, vectors, coordinate systems, views, and transformations
- Curves: models, representations, and applications
- Surfaces: models, representations, and applications
- Sketches, dimensions, and constraints
- Solids, features, and parametric design
- Assemblies and fits
- Drawings and annotations
- Geometric dimensioning and tolerancing (GD&T)
- Basic design analysis with Unigraphics

Design Projects: not applicable.

Computer Use:
The students use Unigraphics to complete 6 to 7 assignments and apply the concepts discussed in the lectures. The deliverables for each assignment include a CAD file and a written report.

Evaluation Methods:
Class Participation, Lab Reports and Homework, Midterm Exam, Final Exam

Contribution to Professional Component:
The course builds upon mathematics, physics and other science foundations. It provides education in Computer Aided Design and enhances the design experience of students to better prepare them to become practicing engineers.
Relationship of Course Objectives to Program Educational Objectives:
The course objectives directly tie to the fulfillment of Program Educational Objective #1: “our alumni practice mechanical engineering by designing systems and solving problems using mathematical, scientific and engineering principles and tools,” Program Educational Objective #2: “our alumni approach engineering decisions with an informed consideration of global and societal contexts and consequences,” and Program Educational Objective #3: “our alumni continue to expand their professional and personal skills and engage in life-long learning.”

Relationship of Course Objectives to ABET 3a-k:

a) an ability to apply knowledge of mathematics, science, and engineering:
   *This course builds upon the foundations of Mathematics (Linear Algebra and Euclidean Geometry), and engineering mechanics applied to modern engineering design.*

b) an ability to design and conduct experiments, as well as analyze and interpret data:
   *not applicable*

c) an ability to design a system, component, or process to meet desired needs:
   *Students will be able to design a component or system using modern Computer Aided Design techniques, evaluate model validity and take advantage of the significant computational support offered by modern CAD/CAM/CAE systems to refine and optimize their designs.*

d) an ability to function on multi-disciplinary teams: *not applicable*

e) an ability to identify, formulate, and solve engineering problems:
   *Students will be able to formulate and solve engineering problems using modern Computer Aided Design techniques.*

f) an understanding of professional and ethical responsibility: *not applicable*

g) an ability to communicate effectively:
   *This course requires students to prepare written reports detailing their approach for solving the analytical and practical assignments.*

h) the broad education necessary to understand the impact of engineering solutions in a global and societal context:
   *Students are exposed to the state-of-the-art product design cycle and tools, from conception and analysis to validation and simulation.*

i) a recognition of the need for, and an ability to engage in life-long learning:
   *Students recognize the rapid changes in product design, driven by continuously evolving computational infrastructure, which emphasizes the need for continuous learning.*

j) a knowledge of contemporary issues:
   *During this course the students use state-of-the-art CAD/CAM/CAE software and apply modern computational techniques to the solution of practical problems.*

k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:
   *Students are introduced to the latest high-end CAD system and understand how the available tools assist in creating designs in engineering practice.*

Relationship of Course Objectives to Course Outcomes:

1) Students will be able to understand the fundamental concepts that drive the CAD systems. This trains them to be knowledgeable CAD users, and in turn, better future design engineers.

2) Students will be able to understand the capabilities and limitations of modern CAD/CAM/CAE systems.

3) Students will be able to understand the application of mathematics, physics and engineering sciences in engineering design.

4) Students will be able to construct virtual 3D models for design analysis and simulation.

5) Students will be able to obtain designs that are functionally superior and more robust by using the concepts learned in this course.
6) Students will be able to proficiently use high-end CAD packages.
7) Students will be able to adapt to another CAD system with relative ease because they have an understanding of the fundamentals of a modern CAD system.

Approval Block:
Prepared by: H. Ilies, March 2007
Revised by: H. Ilies, May 2007
C&C Approval: N. Olgac, June 2007
Dept. Head Approval: B. Cetegen, June 2007