ME 447 INTRODUCTION TO COMPUTER AIDED DESIGN

INSTRUCTURE: Farid. Amirouche, PhD.
Professor of Mechanical Engineering and Bioengineering.
Professor of Orthopedics.
Director of Orthopedic Research.

OFFICE: 2027 ERF

CAD LAB: 1083 ERF

OFFICE HOURS: By Appointment Only.

TA’s: Harish R. Palnitkar, hpalnitkar@gmail.com  OFFICE HOURS IN: ERF1072
M 11:30-1:00
W 11:30-1:00
F 11:30-12:30

Michael Gray, mgray9@uic.edu  OFFICE HOURS IN: ERF1032
M 2:00-3:00

TYPE OF COURSE: Required for ME Major


COURSE OBJECTIVE: 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.


CREDIT HOURS: 3hr Undergraduate, 4hr Graduate

THPE OF INSTRUCTION: Lecture-Discussion Undergraduate 2 hrs, Graduate 3 hrs.
Lab 1hr

BOOK:
2. Textbook materials will be available on course website.

COURSE WEBSITE: http://www.uic.edu/classes/me/me447/


TOPICS: The following are the topics which will be covered during this semester.

1. Computer Aided Design
   a. Characteristics of CAD
   b. Parametric design
   c. Variational design
   d. Examples

2. Transformation and Manipulation of Objectives
   a. 2D and 3D transformation
   b. Reflection, projection, zoom
   c. Rotation about arbitrary axis. Successive transformation
   d. Initial and Final positions of objects
   e. Isometric views

3. Description of Curves and Surfaces
   a. Regression line, curve fitting polynomials
   b. Parametric versus Nonparametric cubic splines
   c. Bezier curve

4. Int. to FEM and CAD
   a. Basic concepts in FEM and its use in Design
   b. Potential Energy Functions
   c. Closed form Solutions
   d. WRM
   e. Galerkin Method

5. Application of FEA to Stress and Strains, Structures and Trusses
   a. Properties of Local Stiffness
   b. Global stiffness
   c. Solution of Trusses
   d. Stress Analysis and Design

GRADES:

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<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>HW’s</td>
<td>10%</td>
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<tr>
<td>Lab</td>
<td>60%(Hw 50% and Final Project 50%)</td>
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<tr>
<td>Midterm</td>
<td>10%</td>
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<tr>
<td>Final</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.

Relationship of course to program outcomes

As shown in Outcomes Matrix:

a. Ability to apply mathematics, science and engineering
e. Ability to identify, formulate, and solve engineering problems
g. Ability to communicate effectively
k. Ability to use techniques, skills, and modern engineering tools necessary for engineering

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.
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.
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.