ME407: Computer-Aided Design and Manufacture

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The classes will be on Tuesday and Thursday from 4-6 pm Tuesday and Thursday. The first hour will usually be spent with lectures, examples, demonstrations, and presentations. Often this will last through the second hour as well. The classroom for the first hour is in Rm. 203 in the Photonics Building. The second hour will either continue in 203, or will move to Rm. 125 in the MFG building at 15 Saint Mary's, namely, the ECL lab. This is the classroom where EK127 used to be taught. Sometimes we will have demonstrations and exercises there.

Please note that just because the formal lecture is typically only from 4=>5 in Rm. 203, it is inappropriate to schedule other activities during the second hour, including meetings in other courses such as for senior projects. If you miss the second class due to such activities, and miss exercises, quizzes, etc., then your course grade will clearly reflect this.

My office hours will be on Wednesdays and Thursdays from 10:30am-noon in room 135, at 15 Saint Mary's. My office is near the ECL lab. Please feel free to contact me by email or phone to arrange to meet with me at other times, or, just stop by and see if I am free.

The GTF for our course is Bob Saphirstein. TAs will be: Warren Huffman, Ravi Heugle, and Josh Prescott. Warren, Ravi, and Josh have taken this course before and will spend extra hours in the lab, outside of class, to help with questions.

Prerequisite: Junior standing in engineering, or higher, or consent of instructor.

Manufacturability of high-tech products has grown and excelled in the present digital era due to enormous advances in computation, communication, control, and software. Computer-integrated design and manufacturing (CIM) concepts are first introduced, followed by a heavy emphasis on computer-aided design (CAD), manufacturing (CAM), and engineering (CAE) tools. Topics include geometrical tolerancing and specification, transformation and manipulation of objects, description of curves and surfaces, solid modeling, tooling and fixturing, computer numerical-control (CNC) of machine tools, rapid prototyping technologies, optimization of designs, introduction of finite element methods (FEM) and application to stress/strain, deformations, and thermal engineering problems, and testing of parts while incorporating CAD/CAE methods. Projects are selected from a variety of engineering areas. The course includes a lab with extensive use SolidWorks, plus COSMOSWorks, and demonstrations on COMSOL and ProEngineer.4 cr. Spring semester.

Assigned textbook: Fundamentals of Geometric Dimensioning and Tolerancing," by Alex Krulikowski, 2nd edition, 1997, ISBN 0827379951.

Possibly helpful textbooks, but not required:

"Computer-Aided Manufacturing" (3rd Edition) (Prentice Hall International Series on Industrial and Systems Engineering) by Tien-Chien Chang, Richard A. Wysk (Author), and Hsu-Pin Wang.

"Principles of Computer-Aided Design and Manufacturing," 2nd edition, by Farid Amirouche, Pearson Prentice Hall (2004).

Other material will be distributed in class. In addition, a large number of videos are being assigned this year for viewing, concerning (1) how to machine parts, make a wide variety of products, how to manufacture them, and (2) how to design various products.

A lab instructional manual on Pro/E will be made available: This lab instructional manual, written by Guy Thompson, will be made available for those wishing to learn more about Pro/E. We will also have a demo on the program.

Other material: Background on CAD, math for FEM, will be supplied in class lectures and course material.

A detailed listing of topics and dates will be posted soon.

Grading: This will be based on four to five homework assignments, a midterm, a final, and a final project. The breakout for this material will be as follows: the homework will constitute 20%, while the midterm and final will be 21% each, and the final project will constitute 30% of your final grade. Two quizzes will be given, each 4% of the final grade. I reserve the right to modify this breakout slightly, but, if so, I will let you know well ahead of time. I do not expect much of a change, if any.

(1) Laboratory assignments. These assignments enable the students to learn and apply SolidWorks, and COSMOSWorks in sufficient detail to tackle a later, more complex project.
(2) Midterm.
(3) Final.
(4) Class project. This project makes use of the skills acquired by students in using SolidWorks, and COSMOSWorks. COMSOL will also be made available and demonstrated.
(5) Two quizzes will be added in, mostly on the videos. Each will be worth 4%. There will be no "surprise quizzes". They will all be announced well in advance.

All information about the course, including slides of lectures, if slides are presented, and emails, will be posted on **blackboard** at the BU web site.

Class: This class involves a number of things, such as CAD usage, design ideas in general, and use of advanced software for analyzing problems such as stress/strain, temperature and heat flow, and fluid flow. Knowledge of math through differential equations is expected. All essential math background material will be reviewed, although engineering math through the junior year is expected.

Goals:

1. Provide in-depth training on CAD methods in general, and two programs, SolidWorks and COSMOSWorks, in particular.
2. Provide CAD training to enable students to design reasonably complex assembly parts, providing all appropriate part specifications.
3. Teach about the relationship of CAD representations of parts to CNC of machining tools for creating parts.
4. To teach in fair detail about tolerancing specifications.
5. To teach in general about FEA approaches for analyzing stress/strain distributions, deformations, and heat flow in 3D structures, and to teach how to use COSMOSWorks, in particular, to solve such problems on various 3D solid structures.