ME 4360 - MECHANICAL COMPUTER-AIDED MANUFACTURING

INSTRUCTOR

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OFFICE HOURS

3:00 PM ~ 5:30 PM, Tue. & Thurs.; or by appointment.

PROGRAM OUTCOMES

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environ., social, political, ethical, health, safety, manufactured ability, sustainability
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global economical, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

COURSE OBJECTIVES

To acquaint students with the state-of-the-art computer technology in solving mechanical manufacturing problems such as surface design, NC machining, mold core and cavity design, weld design, structure build evaluation, etc. By the end of the course, the successful student will be able to:

- Create parts with sculpted surface (a, b, c, e, g);
- Determine dimensional quality of structure builds (a, b, c, e, g, j, k);
- Analyze postures under manufacturing environment using digital human (c, f, h, j, k);
- Simulate 3D NC machining (a, b, e, g, k);
- Manage point cloud and reconstruct digitized 3D surfaces (a, b, e, k);
- Design core and cavity for molded parts and tooling (a, b, c, e, g, k);
- Model welds in assemblies (a, b, e, g, k).

TEXT & REFERENCES

There is no text adopted for this course. Class notes will be posted online from time to time. The following books are representative references containing some materials covered in the course:

1. *Computer-Aided Manufacturing*, 3rd edn., TC Chang, RA Wysk, HP Wang, Prentice Hall, 2005, ISBN-13: 9780131429192.
2. *CAD/CAM Principles, Practices and Manufacturing Management*, C. McMahon and J. Browne, 2nd Edn., Addison-Wesley; 1998.
3. *Computer-Integrated Design and Manufacturing*, D. Redworth, M. Henderson, and P. Wolfe, McGraw-Hill, 1991.
4. Various CATIA-related web documents.

SOFTWARE

1. The main computer program used in the course is CATIA V5-6R2016 which is installed on PCs in 466 EC and 550 EC. It is to be used in topics listed in COURSE CONTENT below.
2. Student version of CATIA is also available at the following site for an annual lease fee $99 (as of 01/02/2018).

Make sure you get a compatible version (V5-6R2016).
https://academy.3ds.com/en/software/catia-v5-student-edition

3. Other computer programs such as MS Excel, BEv (for Build Evaluation), FLB (Line Balancing), and MATLAB will also be used in doing homework, and exams.

HOMEWORK

1. There will be about seven homework assignments to be given throughout the semester. All homework assignments must be performed individually. No collaboration or files sharing is permitted.
2. You will use the computer programs indicated above to do the homework. You need to prepare USB drives for these assignments. A 16-GB USB flash drive supplied by a sponsor will be made available for loan.
3. It is suggested that in the USB drives you create a folder named ME4360ABmn, where ABmn is your IID. Namely, AB is your first and last initials, and mn is the last two digits of your GID. The name of the folder may be used to identify the owner of the device.
4. Ensure that you make backup copies for the files you turn in for grading. Proper formats for the HW will be given in the assignments as they are assigned. Late homework may be accepted, but a 10% per day penalty will be placed. Homework assignments and related materials will be posted on-line. The web site address is: www.secs.oakland.edu/~gu.
5. You must use Chrome or Edge or Safari to view and download course materials from the website.
6. You will be using your own UserID for accessing the computers in the lab. Follow the instruction in the website below to request an SECS computer account.
https://elara.secs.oakland.edu/SECSNetworkLogins/request.aspx

   The account would enable you to access most of SECS computers, and save your work files in the network drive.

PROJECT

1. There will be a term project to be given in the first week of February.
2. The project is to be performed by a team of two persons. You are responsible to form a team yourselves. The due date for the project is April 17, 2018. No late project will be accepted.
3. Project Presentation – Each team will be given 10~15 minutes to present their design and analysis in the class on Tue., April 17, 2018.

EXAMINATIONS

There will be two exams scheduled below. They will be open-book/notes tests consisting of a written part and a CATIA session. NO make-up examinations will be provided. If you have any conflict or urgent matters, please contact the instructor as soon as possible so that the exams can be re-scheduled.

The exams consist of principles, examples shown in the class and homework problems. They will include computer operations in the lab. It is important that you understand the material thoroughly.

Exam	Date
Exam 1	February 15, 2018 (Thur.) (7:30P ~ 9:17P)
Exam 2	April 5, 2018 (Thur.) (7:30P ~ 9:17P)

GRADING

Your final course grade will be a weighted average of the following components.

Component	Percentage
Exams	60 %
Homework	20 %
Project	20 %

Each homework or test may weigh differently. The grades will be calculated using "curve" method. If you wish, your course grades may be posted by the last four digits of your GID online (can be viewed using the click sequence COURSES : ME4360 : LOG : 1). If so desired, you need to email Dr. R. Gu (gu@oakland.edu) with the subject that reads as: “ME4360 - I Wish to Have My Course Grades Posted Online”.

COURSE CONTENT

1. CATIA Fundamentals - Review

Sketch-based features; dimensional and geometric constraints; pad and pocket; holes; shaft; sheet metal design; and assembly design

2. Weld Design

Creating various welds; physical properties of welds; editing and extending welds; creating joints and joint bodies; annotating welds

3. Stress and Modal Analysis

Finite element theory; failure theories; apply material properties; mesh control; specify boundary constraints; create applied loads; post-processing; stress analysis of assemblies; free vibration of assemblies; modal analysis examples

4. Curves and Surface Design

Parametric representation of curves; Bezier curves; 2D and 3D splines; surface modeling; surfaces by revolving, extruding, loft, and sweeping; curves by intersection and projection; creating free style surfaces and styling fillets; deforming surfaces; analyzing curves and surfaces

5. BEv - Dimensional Quality Evaluation of Assemblies

Coordinate measuring machines; best-fit algorithms, CMM data processing; BEv; determination of dimensional quality of structure builds

6. Mold Tooling and Core-Cavity Design

Terminology, creating mold base, gates, runners, and coolant channels; inserting leader pins; positioning ejector pins; defining main pulling and slider directions; creating parting surfaces; aggregating surfaces; blow molding analysis;

7. Generative Machining

Theory of NC; prismatic machining, 3D surface machining, multi-axis milling; lathe machining

8. Ergonomic Design and Analysis

Kinematic chain, forward and inverse kinematics, human builder; human activity analysis; human measurement editor; human posture analysis

9. Digitized Surfaces (time permitting)

Point cloud management; tessellating cloud points; creating sections from cloud points; reverse engineering

10. Line Balancing

Precedence, constraint, use of Flexible Line Balancing

11. Mechanism Design and Simulation (time permitting)

Creating various types of joints and constraints; creating loads and commands; simulating and analyzing mechanisms

CONDUCT CODE

Discussions between fellow students are encouraged, there should not be, however, collaboration of any form. Persons suspicious of cheating or plagiarism will be brought to the attention of the Academic Conduct Committee (ACC) for investigation. If found guilty, they will be given a 0.0 final course grade in addition to the possible sanction imposed by ACC. You are urged to review the Academic Conduct Policy contained in your University Catalogs.