ME3300, Computer-Aided Design

Winter 2018, EC 466

CRN 12783, MWF 10:40am ~ 11:47am, Jan. 03, 2018 ~ Apr. 25, 2018

Course Description

Use of engineering software in design and analysis such as: solid modeling of machine parts, projection views layout, parametric and knowledge-based design, assembly design, sheet and metal design, bill of materials, structure design, introduction of finite element method, engineering optimization, space analysis and clash detection, mechanism and kinematics of assemblies. Offered Fall and Winter. Prerequisites or corequisites: ME 361 (ME3250) and major standing.

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Office hours: Mondays and Wednesdays 9:40 ~ 10:40am; or by appointment

Software, Text & Course Materials

- CATIA (Dassault Systems) **V5-6R2016** will be used in this course. Students who use the software rather than the lab computers, please make sure you have a compatible version, and all the submissions are able to be opened by CATIA V5-6R2016 in 466 EC. If your submissions cannot be opened, you will receive 0.0 grade.
- All the course materials including syllabus, announcements, lecture notes, homework assignments, and design project will be posted on Moodle. All the submissions are required to be submitted through Moodle as well. **PLEASE CHECK THE SYSTEM FREQUENTLY**.
- No textbook is adopted for this course. The following books are valuable sources of reference:
  - *CATIA V5 Workbook Release V5-6R2013*, Richard Cozzens, ISBN: 978-1-58503-836-7, Schroff Development Corporation (https://www.sdcpublications.com/Textbooks/CATIA-V5-Workbook-Release-V5/ISBN/978-1-58503-836-7/)
  - *CATIA V5 FEA Tutorials, Release 21,* Nader Zamani, ISBN: 978-1-58503-764-3, Schroff Development (*https://www.sdcpublications.com/Textbooks/CATIA-V5-FEA-Tutorials-Release/ISBN/978-1-58503-764-3/*)
  - *CATIA V5 Tutorials Mechanism Design & Animation Release 21*, Jonathan M. Weaver and Nader G. Zamani, Schroff Development Corporation, (https://www.sdcpublications.com/Textbooks/CATIA-V5-Tutorials-Mechanism-Design/ISBN/978-1-58503-762-9/)

Storage Media

- To save your work, you are highly recommended to save your work in your flash drives/memory sticks. (Additionally, you can also save your work on the mapped network drive (H: Drive), but this is a backup ONLY, not your primary save location, you might lose it without any notice.) Note that there are only a limited number of workstations available, and the lab is also shared with other students from other classes (especially in fall and winter

semesters). Be extremely careful about the files you save in the computers and to start the assignment as soon as possible.

Grading

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

Component	Weight
Homework	30%
Project	15%
Exams	50%
Class Attendance	5%
>95--4, >80--3, >65--2, >55--1, =<50--0	

Homework

There will be **about Ten** individual homework assignments to be given in this semester. The assignments need to be completed using the CATIA software installed on the PC's in 466 EC. Excel and Word may also be used. A completed assignment may include the CATIA files and the corresponding report (specific requirement will be provided in each assignment). All the homework need to be submitted through Moodle **on time**. **Homework will be due in one week.** 10% per day penalty will be applied on the late submission. No acceptance after **Five days** past due.

Exams

There will be total of four examinations (three exams during the semester and one Final exam):

	Date	Weight
Exam #1	Jan. 26th, 10:40 ~ 11:47am	10%
Exam #2	Feb. 28th, 10:40 ~ 11:47am	10%
Exam #3	March 28th, 10:40 ~ 11:47am	10%
Final Exam	April 23rd, 12:00 ~ 3:00pm	20%

The exams are hands-on computer operations during the class (for exams #1, #2 and #3) or the scheduled time for the Final. In the exams, you will be asked to create and/or use given models to analyze the mechanical systems by using CATIA software (may Excel as well). All exams are open-book and open-notes. But personal laptop, smart devices and web access are not allowed. All exams are cumulative in which taking an exam requires knowledge from the previous exams. **No make-up examination will be provided.**

Design Project & Presentation

The design project will be assigned in the 4th week (Jan. 24th). Each team which should consist **2~3** persons (3 is preferred), will be asked to use CATIA to design and analyze a product that satisfies a set of specifications. You are responsible for forming a team yourselves. The due date of the project is April 8th (Sunday). No late project will be accepted. The final project presentation is scheduled on April 9th and 11th (in Class), and all groups are required to do the presentation. Further details about the project will be provided in the 4th week.

Conduct Code

Students are encouraged to discuss assignments in a study group, BUT everyone NEEDS to turn in individual work; and are also expected to read, understand, and comply with the "Academic Conduct Policy" as explained in Oakland University Undergraduate and Graduate catalogs. Suspicions of cheating or plagiarism will be brought to the attention of the Academic Conduct Committee (ACC) for investigation. Students found guilty of academic misconduct in this course will receive a grade of 0.0 in addition to the sanction imposed by ACC.

Tentative Course Contents:

1. Assembly Design, Kinematics and Mechanism Design
   - Constraints, manipulating components, joints, simulation, laws
2. Part Design & Knowledge Advisor
3. Part Design, Generative Shape Design
4. Drafting
   - Principles of engineering graphics, scales, engineering lines, sectional views and conventions, auxiliary views
5. Sheet Metal Design
6. Finite Element Analysis
   - Theory of finite element method
   - Stress analysis of individual machine elements subject to various loading conditions
   - Mesh quality
   - Symmetric models
   - Post-processing
   - Finite element modeling of mechanical systems, virtual parts and connections
7. Frequency Response Analysis
   - Introduction to vibration theory, determination of natural frequencies, mode shapes

Tentative Course Important Dates

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Dec 2017	31 WK1	1	2	3	4	5	6
Jan 2018	7 WK2	8	9	10 HW 1	11	12 HW 2	13
	14 WK3	15 Martin Luther King, Jr. Day - No class	16	17	18	19 HW 3	20
	21 WK4	22	23	24 Assign Project	25	26 Exam #1	27
	28 WK5	29	30	31	1	2 HW 4	3
Feb 2018	4 WK6	5	6	7 HW 5	8	9	10
	11 WK7	12	13	14 HW 6	15	16	17
	18 WK8	19 - Winter Recess, No Class	20	21 - Winter Recess, No Class	22	23 - Winter Recess, No Class	24
	25 WK9	26	27	28 Exam #2	1	2	3
Mar 2018	4 WK10	5 HW 7	6	7	8	9 HW 8	10
	11 WK11	12	13	14	15	16 HW 9	17
	18 WK12	19	20	21 HW 10	22	23	24
	25 WK13	26	27	28 Exam #3	29	30 Project Q&A	31
Apr 2018	1 WK14	2	3	4	5	6 No Class	7
	8 WK15	9 Project Presentation	10	11 Project Presentation	12	13 Class Review	14
	15 WK16	16 Q&A	17	18 Exam Week	19	20	21
	22	23 Final 12-3pm	24	25	26	27	28

Program Outcomes (ABET)

(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-aided design (CAD) technology in mechanical engineering design problems such as stress analysis, dynamic structural response, heat conduction, etc. By the end of the course, the successful students will be able to:

1. Demonstrate proficiency in the principles of engineering graphics (b, g)
2. Demonstrate proficiency in creating planar sketches using a commercial CAD package (a, b, e, g, k)
3. Design 3D parametric solid models using a commercial CAE package (a, b, c, e, g, k)
4. Design and animate mechanical systems consisting of a number of components using a commercial CAE package (a, b, c, e, g, k)
5. Formulate and solve finite element equations for 2D frames consisting of two-node bar and beam elements (a, b, e, k)
6. Analyze machine components and mechanical systems subject to certain boundary and loading conditions using a commercial CAE package (a, b, c, e, g, k)