UNIVERSITY OF CALIFORNIA
Mechanical Engineering Department

E 26 Three Dimensional Modeling for Design Fall 2018

Faculty: Dr. Ken Youssefi
Office: 5106 Etcheverry Hall, phone: (510)642-4483, email: kyoussefi@aol.com
Office Hours: TuTh. 11:10 – 1:00
Class website: http://bcourse.berkeley.edu (use CalNet ID and password to login)

Course Description:

Three-dimensional modeling for engineering design. This course will emphasize the use of CAD on computer workstations as a major graphical analysis and design tool. Students develop design skills, and practice applying these skills. A group design project is required. Hands-on creativity, teamwork, and effective communication are emphasized. 2 units, no prerequisite

Lecture: Tuesday 8:10 – 9:00, 120 Latimer

Laboratory:	section 101:	Wed.	9:00 – 11:00	10 Jacobs	GSI - Maria
	section 102:	Th.	9:00 – 11:00	10 Jacobs	GSI - Maria
	section 103:	Tu.	3:00 – 5:00	10 Jacobs	GSI - Sarah

Graduate Student Instructors (GSI): Maria Echeverria, miecheverria@berkeley.edu, and Sarah Frank, sarah_frank@berkeley.edu

Textbooks:

Recommended,
Lieu, D.K., and Sorby, S.A., Visualization, Modeling, and Graphics for Engineering Design, Cengage Publishers, 2009.

SolidWorks 2018/19, free download with the SDK ID, will be provided in the class

Course Objective
Introduce computer-based solid, parametric, and assembly modeling as a tool for engineering design; enhance critical thinking and design skills; emphasize communication skills, both written and oral; develop teamwork skills; offer experience in hands-on, creative engineering projects; reinforce the societal context of engineering practice; develop early abilities in identifying, formulating, and solving engineering problems.

Semester Project
Wind turbine project: rotor blade and tower design and fabrication (3D print). See project description.

Grading: The final course grade will be based on a normal distribution curve.
- 30% Laboratory work
- 10% Class participation
- 30% Design Project
- 30% Examination

Student Learning Objectives

Upon completion of the course, students shall be able to:

- Create a 3D solid model of a complicated object with high degree of confidence.
- Extract 2D orthographic views from the 3D model for fabrication.
- Specify the proper dimensions, according to industry standards, for parts to be fabricated
- Extract section and auxiliary views.
- Understand the basics of assembly and associative constraints.
- Understand the basics of rapid prototyping, in particular 3D printing
- Understand the engineering design process and the implementation of different design phases.
- Work effectively as a member of a design team.

Weekly laboratory and homework assignments

All labs will be held in room 10 Jacobs. The lab period is 2 hours. During the labs, students will start by doing step-by-step solid modeling tutorials to learn different functionality. Then they will be given the lab assignment where they will apply what they've learned to model new geometries, assemblies, and products. There will be a focus on learning how to build a solid model to capture design intent and meaningful dependencies for ease of subsequent editing (project). You should be able to finish most of the lab assignment during the lab. If not, you must finish it before coming to the lab the following week (see due dates on syllabus or bCourse). Students will also learn how to set up for a 3D-print build, and 3D-print a geometry they design themselves. Homework problems will cover the theory behind the software, such as constraints and Booleans, and additional modeling problems that build on skills acquired during lab.

Lab assignments are due on Mondays by 11 pm. The due dates are indicated in the course syllabus and on bCourse.

Academic Honesty

All students should be familiar with the Code of Student Conduct and know that the general rules and students rights stated in the document apply to this class (see http://uga.berkeley.edu/SAS/osc.htm). With regard to laboratory work and homework assignments, not only are you allowed, but you are encouraged, to discuss the problems and techniques with other students; but each student must do his or her version of the solution. Submitting someone else's work as your own or knowingly allowing someone else to turn in your work as their own will result in a zero grade for the assignment for all involved and will be reported to the Office of Student Conduct. Cheating on the examinations will result in a failing grade in the course and your action will be reported to the Office of Student Conduct for administrative review.

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Course Schedule

Week	Dates	Topics	**Lab. work** Assignments
1	8/22	Wednesday	No lab this week
2	8/28	Introduction to the course Introduction to design project	Lab. work #1 – due Mon. 9/3 by 11:00 pm Sketching & Extrusion
3	9/4	Introduction to 3D modeling Parametric modeling, feature-based modeling, Design Intent	Lab. work #2 – due Mon. 9/10 by 11:00 pm Extrusion & Revolve
4	9/11	Solid modeling commands: Sketching, Extrusion , Revolve, fillet, pattern, …	Lab. work #3 – due Mon. 9/17 by 11:00 pm Sweep
5	9/18	Solid Modeling: reference geometry Sweeps and Lofts	Lab. work #4 – due Mon. 9/24 by 11:00 pm Loft
6	9/25	Aerodynamics of wind turbine Rotor blade design, angle of attack, profile, …	Work on the blade design as a group and turn in 2-3 pages of your concept designs (sketches) at the end of the lab. period (10 pts)
7	10/2	Wind turbine tower structure design Stiffness and strength consideration	Lab. work #5 – due Mon. 10/8 by 11:00 pm Wheel and screwdriver design
8	10/9	Assembly modeling; Top-down and bottom-up Mates in assembly, exploded view	Lab. work #6–due Mon. 10/15 by11:00 pm Assembly
9	10/16	Extracting 2D views from the 3D solid model. Dimensioning standards and conventions **Blade design due by Th. 10/18 midnight, upload to bCourse**	Lab. work #7–due Mon.10/22 by 11:00 pm Shop drawing
10	10/23	Introduction to Rapid Prototyping Three Dimensional printing	Work on the tower design, as a group, turn in 2-3 pages of your concept designs (sketches) before leaving lab (10 pts)
11	10/30	3D printing: FDM, STL, laser, .. Material: liquid and solid polymer, powder, paper, metal, ceramic,…Advantages and limitations	Lab. work #8 – due Mon. 11/5 by 11:00 pm Auxiliary and Section views
12	11/6	Engineering analysis with SolidWorks Introduction to Finite Element Analysis **Wind turbine design structure due by Fri. 11/9 midnight, email it to me**	Lab. work #9 – due Mon. 11/12 by 11:00 pm Finite element problem
13	11/13	Finite Element Analysis (FEA) cont. Project discussion	Lab. work #10 – due Mon. 11/19 by 11:00 pm Part modeling (spring and heat exchanger)
14	11/20	Stress and deflection of the wind turbine tower Simulation using SolidWorks	**Thanksgiving holiday** **No labs this week**
15	11/27	Engineering Design Process: Concurrent Engineering Design	Gluing the tower
16	12/4	Reading/Review/Recitation (RRR) week - no class **Wind turbine testing is scheduled for Tu. Dec. 4 from 9-12 and 1-4 in Hesse Hall basement**	

Final Exam (SolidWorks) – Wed. Dec. 12, 12:00–2:30, 3:00–5:30 and 6:00–8:30pm, all 3 exam slots will be in 10 Jacobs. You will be assigned to take the exam in one of the slots.

Project Report (One report per group)–Due Wed. Dec. 12 at the final exam

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