Syllabus Description and Summary

Description

Focus on engineering modeling in 3D and technical drawing in 2D using advanced CAD tools. Hands-on course work will allow students to ideate and model mechanisms. Course will focus on design tools for subsequent classes and industrial best practices. Topics will include ideation, design of machine components, and introduction to design for prototyping, machining, manufacture, assembly and repair. 2 credits.
Prerequisites by topic: none

Summary of Course Topics

1. **Design Process**: ideation, concept selection and sketching
2. **Basic Part modeling in CAD**: setting up datum planes, defining the coordinate systems, feature selection, parent/child relationships, dimension driven 3D sketching (e.g. protrusions, revolving and fillets etc), and visualization (e.g. hidden lines, shaded, and perspective views)
3. **Complex Parts and Surfaces**: Curved surfaces and blends, shelled/molded parts, adding ribs and bosses, and apply threads to holes
4. **Detailing and Blueprint Creation**: Orthographic projections, line and text forms, coordinate dimensioning and tolerancing principles and standards, geometric dimensioning and tolerancing (GD&T), section and part-section views, compliance with ANSI and ISO standards
5. **Assembly**: Assembly constraints (e.g. mating planes and coordinates, aligning, orienting etc), exploded views, creating a Bill of Materials (BOM), interference and clearance checking, and orthographic assembly drawings
6. **Engineering Documentation**: export/import of files, rendering, document control, and drawing printing
7. **Introduction to Kinematics**: Mechanism Analysis using CAD (e.g. angular position and velocity plots) and creating animations
8. **Introduction of Design for X**: Connection between design and prototyping, machining, manufacture, assembly and repair using BOM for costing analysis of a mechanism.

LEARNING OBJECTIVES & PRINTING

Course Goal

- Develop the ability to create three-dimensional engineering models and two-dimensional drawings using CAD
- Use dimensioning and tolerancing techniques to create manufacturable parts
- Conduct motion analysis of a mechanism
- Understand the connections between CAD design with prototyping, machining, manufacture, assembly, and repair

Course Learning Outcomes

Upon completing this course, students will be able to:

- Convey ideas through sketches and other graphical means
- Create and analyze solutions to design problems in accordance to professional standards
- Create two dimensional drawings incorporating basic conventions of geometric dimensioning and tolerancing of components and mechanisms using CAD
- Create three dimensional models of components and mechanisms using CAD
- Conduct a motion analysis of a mechanism
- Understand CAD practices that facilitate iteration and change
- Document and communicate a design process in written and oral form

Drawings & Prints (For On-Campus Students only)

Throughout the semester you may be asked to bring in prints to class and to the EPIC machine shop.

- For class, prints should be no smaller than a B size (11x17") paper. The BU print service, MyPrint, does not print B size paper. You MAY NOT tape together prints.
- B sized Prints or larger can be printed at FedEx Office Print & Ship Center, Boston University, 115 Cummington Mall, Boston, MA 02215 US https://local.fedex.com/ma/boston/office-5012/ B-size prints are self-serve and cost normal print charges (~0.50). Larger prints take longer and are more costly (~$5).

ASSESSMENT & ASSIGNMENTS

Course Assessment

- Weighting
  - Project Assignments 60%
  - Quizzes 40%
- Grading Scale
  - A = 94–100%
  - A– = 90–93.99%
  - B+ = 87–89.99%
  - B = 84–86.99%
  - B– = 80–83.99%
  - C+ = 77–79.99%
  - C = 74–76.99%
  - C– = 70–73.99%
  - D = 60–69.99%
  - F = 0–59.99%

Project Assignments

- Seven project assignments will be given, and details will be discussed as they are assigned
  - There will be (3) CAD model and drawing projects
  - There will be (4) components to the 4-Bar Linkage project
- All assignments will be submitted via Blackboard
- Video of an assignment may be required to validate its operation
- Student solutions should be original; plagiarism will not be tolerated

Quizzes

- All quizzes will be given on Blackboard and will have the same deadline for all sections
- The lowest quiz score will be dropped from the quiz average calculated in Blackboard
- All Blackboard quizzes will offer two attempts
- Some quizzes may require the submission of a screenshot or video capture

Class Participation

- Class participation is based on each student's professional, active and constructive participation in the solution of the example problems in class, responses to general questions and your regular attendance of the class lectures. Remote students can show their attendance by actively participating on discussion boards.
- You MUST act in a professional manner to all students while in the classroom and for all group projects. Class discussions can be passionate and opinionated but should never make other students feel poorly. Bullying or belittling will not be tolerated. Attack the idea, not the person. Being able to take and give criticism is a skill and it will be developed in this class.
- BU's academic Conduct Code: http://www.bu.edu/academics/policies/academic-conduct-code

Course Schedule

Week	Date	Tutorial Topic	Tutorial Length	Quiz Topic	Project Topic	Due Date
0	8/30-9/5	• Solidworks Installation		None		9/5 @ 11:59pm
1	9/6-9/12	• Introduction to Solidworks	60 minutes	Class Materials & Solidworks Installation		9/12 @ 11:59pm
2	9/13-9/19	• Lesson 1: Parts • Fillets	75 minutes	Extrude		9/19 @ 11:59pm
3	9/20-9/26	• Revolve & Sweep • Patterning Features • Lesson 3: Drawing	75 minutes	Revolve		9/26 @ 11:59pm
4	9/27-10/3	• Adv Drawings: Creating Drawing Views • Adv Drawings: Detailing	60 minutes	Part Drawing	CAM Model & Drawing	10/3 @ 11:59pm
5	10/4-10/10	• Lesson 2: Assembly • Toolbox	45 minutes	Part Section View Drawing		10/10 @ 11:59pm
6	10/11-10/17	***No Classes (Labs Only)*** ***Indigenous Peoples' Day***		PROJECT	BLOCK Model & Drawing	10/17 @ 11:59pm
7	10/18-10/24	• Assembly Mates	60 minutes	Assembly Modeling		10/24 @ 11:59pm
8	10/25-10/31	• Adv Drawing: Assembly Drawing Views	30 minutes	Assembly Drawing	4-Bar Linkage Assembly	10/31 @ 11:59pm
9	11/1-11/7	• Lofts • Import/Export	30 minutes	Assembly Exploded View	4-Bar Linkage Part Drawings	11/7 @ 11:59pm
10	11/8-11/14	• PhotoView 360 & Appearances	30 minutes	Assembly Rendering	4-Bar Linkage Assembly Drawing	11/14 @ 11:59pm
11	11/15-11/21	• Animation • Kinematics	30 minutes	Sweep & Pattern		11/21 @ 11:59pm
12	11/22-11/28	***No Classes - Thanksgiving Break***				11/28 @ 11:59pm
13	11/29-12/5	Kinematics	***No Tutorial***	***No Quiz***	4-Bar Linkage Motion Study	12/5 @ 11:59pm
14	12/6-12/10	CAD in Industry	***No Tutorial***	***No Quiz***	CAP Model & Drawing	12/10 @ 11:59pm