ME 301 Computer Aided Design (Spring 2020)

Meeting Times:
Section 1  T & TH  8:00-9:15   JEB 331
Section 2  T & TH  9:30-10:45  JEB 331
Section 3  T & TH  11:00-12:15

Office Hours:
MWF  11:00-11:50 or by appointment  EP 324D

Instructional Staff:
Faculty Instructor:
Joel Perry  (jperry@uidaho.edu)  EP 324D

TAs:
Sect 1: Sean Blatner, Cameron Eggart
Sect 2: Paul Riebe, Mackenzie Sexton
Sect 3: Phillip Flexer, Tiana Black

Course Coreq/Prereq: ME 223 or instructor permission

Course Website:  http://www.webpages.uidaho.edu/mindworks/solidworks.htm

Reference: (required)
MySolidWorks online resource (access to online videos that will serve as the basis for many of the daily quizzes). Details of login and access will be explained in class.

Other Course Materials:
SolidWorks Topic Reference Notes (via website), SolidWorks Tutorials (via SolidWorks software), SolidWorks software (provided as part of your lab fee will be distributed mid-way through the course), headphones, pencil, straight edge, compass, course binder (including notes, handouts, quizzes, homework, and projects).

Course Rationale:
This course introduces you to concepts and tools for effectively developing, communicating, and documenting engineering design work. You will learn to produce solid models and engineering drawing packages that can be efficiently manufactured in an engineering machine shop. You will develop skills in formulating documents that efficiently illustrate and explain your work and respond to key assignment-specific requirements. The knowledge, skills, and perspectives you develop will greatly enhance your senior design experience and will be highly marketable in the engineering workplace, including summer internships. The first two thirds of the course entails structured and interactive lab exercises surrounding a number of physical prototypes that have been previously produced in the UI mechanical engineering shop. Because design of parts is a thoughtful and intricate process that cannot be done at the last minute with acceptable quality, class preparation, quizzes, and assignments will be expected on time and will be evaluated in conjunction with almost every class period. The final one third of the course will engage you in a large-scale, team-based reverse engineering project. You will create an extensive, shop-ready drawing package and design report for fabricating a complicated assembly. Throughout the course, an important focus is placed on effective communication through clear and organized
documentation of coursework in your homework submissions. These submissions will summarize aspects of your work such as pre-CAD planning, the design process, and documentation of your final product(s). Specific requirements for each submission will be provided via the website with each assignment. Organizing your coursework throughout the course in a three-ring binder is strongly recommended, as it can be a valuable reference during the course, in future design activities, and in job interviews.

**Graphics-Related Learning Outcomes:**

**ME 301 (Computer Aided Design)**

1) Recognize when a hand sketch is an effective way to communicate a design idea and make a sketch that follows conventional engineering practices. Recognize proper time in a project to create a drawing package (part drawings, assembly drawings, detail drawings, and bill of materials).

2) Describe drawing intent based on details shown in an existing drawing and interpretations based on drawing standards/conventions including visible lines, hidden lines, dimension lines, extension lines, leader lines, centerlines, center marks, cutting plane lines, section lines, and break lines.

3) Make a detail drawing that follows standard practices for features such as dimensions, through holes, threaded connections, and radii. The drawing should provide all details necessary to manufacture the component in a machine shop.

4) Create and maintain an electronic drawing package following a departmental template and using thoughtful file management procedures.

5) Identify key tolerances associated with a part within an assembly and explain how to inspect parts to determine the degree to which the part matches the drawing.

6) Explode, animate, and render assemblies to illustrate design features.

**ME 424/426 (Senior Design)**

7) Estimate weight and cost (materials and labor) required to manufacture a part from a detail drawing.

8) Use standard references and online catalogs to locate and size components that are usually purchased rather than custom-made. Add call-outs for electronic components, circuit boards, and connectors to a detail drawing.

9) Prepare for and conduct a formal drawing review to receive constructive feedback on design for manufacturability.

10) Develop a plan for part fabrication based on its intended use and manufacturing equipment available, estimating time and budget needed for machining and assembly.

11) Gain hands-on experience creating machining plans for a simple assembly in a machine shop (selecting machine type, tooling, fixtures, and order of operations).

12) Generate tool paths, create fixtures, and calibrate CNC equipment for making precise parts.
ME 421 & ME 521 (advanced CAD)

13) Gain familiarity through structured use of the following CATIA workbenches: part design, assembly design, generative surface design, sheet metal design, generative drafting, DMU, photo studio, and advanced machining.

14) Navigate CATIA’s on-line help system to learn about new workbenches, cultivating transferable software learning skills.

15) Use ‘save management’ to successfully copy, update, and organize solid modeling documents. Follow some best practices in file organization and PLM.

16) Employ relational features, such as functions and parameters, in part design and assembly modeling for easier product development, maintenance, and reuse.

17) Create 2D drawing documents and 3D model-based definitions as guides for manufacturing.

18) Create a catalog of parts based on a design table, facilitating part family design.

19) Within the CAD environment, generate instructions for common CNC operations.

20) Implement environments, materials, light sources, and camera techniques for impactful visualization of design products.

21) Based on introductory experience with generative surface design, explain the advantage of using surfaces as the starting point for solid model construction.

22) Create/update electronic learning objects (videos, quick references, tutorials, and exemplars) for future use by yourself and other students in acquiring and sustaining best practices associated with engineering graphics, manufacturing, and product lifecycle management.

23) Advance organizational knowledge in one of the following areas surrounding a locally meaningful synthesis project: kinematic modeling, large-scale relational design, surface metrology, direct generation of CNC code, design visualization, and production process modeling.

Grading:

65% Daily Quizzes & Assignments
- Quizzes (mostly individual; no make-ups)
- Tutorial Exercises (including tutorial journals)
- Homework Assignments (must be submitted; must be on-time)
- Mini-Projects (work products & supporting documentation)
- Leadership/Participation in Class Activities

35% Project Work
- Reverse Engineering Project
- Major Drawing Package (assembly, sub-assembly, and part drawings)
- Electronic portfolio (renders and animations)
- Lessons Learned (about the artifact, about SolidWorks, about teamwork)
- Peer Review (individual performance within a design team)
Rubric for Scoring Quizzes/Assignments/Project Elements

<table>
<thead>
<tr>
<th>Score</th>
<th>Attributes</th>
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<tbody>
<tr>
<td>4</td>
<td>Exemplary, insightful, worthy of sharing with entire class</td>
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<tr>
<td>3</td>
<td>Complete, correct, long-term reference value to self</td>
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<tr>
<td>2</td>
<td>Complete, numerous errors, limited reference value to self</td>
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<td>1</td>
<td>Incomplete, major errors, no supporting documentation</td>
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Computing Your Grade
Your grade on the 4-pt scale can be calculated at any time during the semester as follows:

\[
\text{(Your 4-pt Grade)} = \left( \frac{\text{Your total points earned}}{\text{Total points possible so far}} \right) \times 4
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<tr>
<th>Grade</th>
<th>4-pt Score (S₄)</th>
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<td>3.25 &lt; S₄ ≤ 4.0</td>
<td>81.25 &lt; S₅ ≤ 100.0</td>
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<td>B</td>
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<td>68.75 &lt; S₅ &lt; 81.25</td>
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Example* Number of Assignments and Relative Grading Weights

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<tr>
<th>In-class Quizzes / OTs</th>
<th>HW1</th>
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<th>HW4</th>
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<th>Mini-Projects</th>
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<th>Final Project</th>
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* Updated grading weights will be posted on the course website under day 1 In-Class Activity.

Data Collection for ABET:
- Graphical communication – engineering drawings
- Use of modern engineering tools

Article II, Section 1 of the University of Idaho Student Code of Conduct:
Cheating on classroom or outside assignments, examinations, or tests is a violation of this code. Plagiarism, falsification of academic records, and the acquisition or use of test materials without faculty authorization are considered forms of academic dishonesty and, as such, are violations of this code. Because academic honesty and integrity are core values at a university, the faculty finds that even one incident of academic dishonesty seriously and critically endangers the essential operation of the university and may merit expulsion.

Disability Access and Resources:
- Reasonable accommodations are available for students who have documented temporary or permanent disabilities. All accommodations must be approved through the Center for Disability Access and Resources located in the Bruce M. Pitman Center, Suite 127 in order to notify your instructor(s) as soon as possible regarding accommodation(s) needed for the course.
- Contact: 208-885-6307; cdar@uidaho.edu; www.uidaho.edu/current-students/cdar