

San José State University
Aviation and Technology Department
Tech 140: Green and Sustainable Product Design, Fall 2017

Course and Contact Information

Instructor:	Dr. David P. Yan
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Office Hours:	Thursday: 2:30PM - 4:30 PM; (and by Arrangement)
Class Days & Time:	Tuesday (Lecture, i.e. Section 1): 6:00PM – 7:45 PM Thursday (Laboratory, i.e. Section 11): 6:00PM – 8:45 PM
Class Room:	E103 for both lecture and lab activities

Laboratories: Lab E-103 is not “open” lab and is not available except during the periods assigned to this class. An open computer lab is located on the 4th floor of the Engineering building, E-405. Get registered and use it! You will find it convenient to purchase and load a copy of a compliant solid modeling software package on your laptop and have it with you each class day.

Prerequisites: Tech 20, Chem. 1A, Math 71

Course Description

Advanced product and process design with a focus on green and sustainable design and on manufacturing green products. Analysis of process and material selection for environmental impact. Composite and advanced materials processing. Laboratory exercises and planning for green manufacturing.

Course Learning Outcomes

1. Demonstrate skills in the planning and design of manufacturing processes.
2. Describe the product life cycle and how products are manufactured.
3. Select, analyze and use polymers, composite materials, and materials in the design of manufactured products.
4. Integrate design, manufacturing, and materials into the design and development of new products

Certified SolidWorks Associate (CSWA) Exam (Recommended with Incentives) *
CSWA certification is intended for any industry professional or student with a minimum of six to nine months of SolidWorks experience and basic knowledge of engineering

fundamentals and practices. As a Certified SolidWorks Associate, you'll stand out from the crowd in today's competitive job market. CSWA certification is proof of your SolidWorks expertise and skills. SolidWorks recommends that applicants review the online tutorials on Parts, Assemblies, and Drawings as a prerequisite, and have at least 45 hours of classroom time learning SolidWorks or using SolidWorks with basic engineering design principles and practices. For information on CSWA exam, go to: <http://www.solidworks.com/sw/education/cad-certification-student-program.htm>.

Required Texts / Readings

Textbook

1. Planchard, David C., “**Engineering Design with SolidWorks 2017 and Video Instruction: A Step-by-Step Project Based Approach Utilizing 3D Solid Modeling**”. Available at Spartan Book Store and at: https://www.amazon.com/Engineering-Design-SOLIDWORKS-Video-Instruction/dp/1630570656/ref=sr_1_fkmr3_1?s=books&ie=UTF8&qid=1503201231&sr=1-1_fkmr3&keywords=Engineering+Design+with+SolidWorks+2017+and+Video+Instruction%3A+A+Step-by+Step+Project+Based+Approach+Utilizing+3D+Solid+Modeling
2. Obi, Samuel C., (2013), “**Introduction to Manufacturing Systems**”. Available at Spartan Book Store and at: https://www.amazon.com/Introduction-Manufacturing-Systems-Dr-Samuel/dp/1481701118/ref=sr_1_1?s=books&ie=UTF8&qid=1503201615&sr=1-1&keywords=Introduction+to+Manufacturing+Systems

Other technology requirements / equipment / materials

1. **Student Edition of 2017-2018 SolidWorks CAD software**, available at any of the following sites:
 - (a) www.solidworks.com/sdk2012 (contact your instructor for School License ID Code for a free download when available)
 - (b) <http://www.novedge.com/products/2928> (for a cheaper student edition with no hassles)
 - (c) http://www.creationengine.com/html/ss_spartan.html (if you prefer to purchase from Spartan Bookstore's website)
2. **A minimum of 8 gigabyte flash drive**
3. **A digital caliper**
4. **Safety glasses**
5. **A scientific calculator with trig functions**
6. **Project fabrication materials which cannot be provided in class or lab**

Recommended Readings / Equipment / Materials

1. Planchard, David C., “**Engineering Graphics with SOLIDWORKS 2017 and Video Instruction**”. Available at: <https://www.amazon.com/Engineering->

[Graphics-SOLIDWORKS-Video-Instruction/dp/1630570605/ref=sr_1_1?s=books&ie=UTF8&qid=1503202463&sr=1-1&keywords=engineering+graphics+with+solidworks+2017+by+planchard](https://www.amazon.com/Official-Guide-Certified-SOLIDWORKS-Associate/dp/1630570605/ref=sr_1_1?s=books&ie=UTF8&qid=1503202463&sr=1-1&keywords=engineering+graphics+with+solidworks+2017+by+planchard)

2. Planchard, David C., “**Official Guide to Certified SOLIDWORKS Associate Exams: CSWA, CSDA, CSWSA-FEA (SOLIDWORKS 2015 - 2017)**”. Available at: https://www.amazon.com/Official-Guide-Certified-SOLIDWORKS-Associate/dp/1630570702/ref=sr_1_4?s=books&ie=UTF8&qid=1503202023&sr=14&keywords=engineering+graphics+with+solidworks+2017+by+planchard
3. **Laptop/notebook computer with ample memory and speed (highly recommended)**
4. **A pack of 8 ½” x 11” printer blank white sheets of paper (highly recommended)**

Course Content and Unit Outline

Tech / ME 140 is divided into five (5) instructional units. Each unit has associated contents and assigned readings. Two projects and lab activities are designed to ensure students master those contents. This course will emphasize the following unit contents:

- **Unit 1:**
 - SolidWorks Commands
 - Materials for Green Product Design
- **Unit 2:**
 - Material Processing Methods for Metals, Plastics, Composites etc.
- **Unit 3:**
 - Design Process, DFM, DFA, and Rapid Prototyping Techniques
- **Unit 4:**
 - Green Design Principles and SolidWorks Sustainability
- **Unit 5:**
 - Mechanism Design I: Introduction to mechanisms, synthesis using graphical approach
 - Mechanism Design II: Motion Analysis and Simulation: Animation and articulation

Course Requirements / Assignments

1. Class assignments (30%)

There will be five (5) extensive SolidWorks-based design assignments which students will undertake during lab time. **Each assignment is worth 6% of the course grade.** The objective is to comprehensively familiarize students with SolidWorks commands, features and functionalities, as well as green manufacturing materials, equipment, and manufacturing processes. These assignments will be given on a bi-weekly or three-week basis and are due during the second week of each assignment as scheduled. Students must show sufficient evidence that they are the ones doing the designs and their associated reports. Late assignments will not be accepted.

2. Design Projects: sub-assignments and portfolios or Certified SolidWorks Associate Exam (30%)*

Design projects will be done in **groups of 4 students**, as much as possible from different majors. There are **two design projects** which may change from semester to semester and **each project is worth 15% of the course grade**. Each group should choose two from the list below. **One of the selected two must be modular green car design or tooling design**. See respective project handouts for the description, parameters, and constraints for each project.

- **Chair design project or Appliance design project** – Select one design project from the following options: Chair, bar stool, lounge chair, Small kitchen appliance such as blender, can opener, mixer, a small power tool such as drill, circular saw, or sander.
- **Mechanical product design project** – Mechanism design; Designing or redesigning a manual can crusher, an automatic can crusher, or wind turbine.
- **Modular Concept Green Car Design** – This project requires that a 90-100% green, 2-person car be designed using the criteria that will be prescribed. More information will be provided about this project.
- **Tooling Design** – This project involved design for molds, punch and die sets, jigs and fixtures etc. that will be used for mass production of an identified product. A 3-D printed product will be accepted.

***The design portions of these assignments and projects can be substituted with a pass in the Certified SolidWorks Associate Exam. Proof that you passed the exam must be presented to the instructor before credit can be awarded. Proof must be presented before last day of class.**

3. Mid-Term Exam and Final Exam (20%)

There will be **one mid-term exam and one final exam** in this class. The mid-term will be scheduled approximately mid way in the semester (see class schedule). **Mid-term exam will constitute 8% of course grade**. More information will be provided about this exam. The final exam will be as scheduled by the university on **December 14 from 17:15-19:30**. Also see the following link: <http://info.sjsu.edu/static/policies/final-exam-schedule-fall.html>. **The final exam will constitute 12% of course grade** and will be given during the scheduled final exam time. The exam will be comprehensive. More information will be provided about this exam.

4. Participation in Class and Team (10%)

There must be sufficient evidence that each student is participating in class activities. This is evidenced by the amount of time students spend in class working on their course-related assignments, projects, team work, participation in discussions, obeying class and lab rules, completing assignments and such likes. Students who are in class but cause disturbance instead will receive reduced scores in this. A combination of peer- and instructor-observed process is used to arrive at each student's score.

5. Quizzes (6%)

There will be **three pop quizzes** during the semester. **Each quiz is worth 2% of the course grade** These quizzes may not be announced, but will be given on assignments and topics discussed in class. No make-up will be given on any missed quiz.

6. Research Paper (4%)

The topic of the research paper will be related to the design projects selected. They will be on different manufacturing processes such as extrusion, forging, milling, casting, injection molding, rotational molding, etc. Format for this assignment will be discussed in class.

7. Policy on Exam, Assignment and Report Due Date: There are no makeup exams, assignments, reports or paper. The missed items are excused only with **written** documentation of unanticipated personal emergencies or by prior **written** permission of the instructor.

8. Participation in Class and Team Work: Team work and class participation are an integral part of the philosophy and learning. Your ability to participate in class, function as a team member, and to identify and carry out work as part of your team, will form a significant part of your grade. Anonymous peer evaluations are used to assist the instructor in validating problems in team performance. Take individual and team work seriously, and as part of the curriculum. Always work to do more than your share, and communicate often, professionally, and effectively with your team mates.

Grading Information

Your grade will be based on your performances in the assignments, design projects, exams (mid-term & final), participation (in class & team), quizzes, and research paper.

Grading Schedule: The following items and percentages are used to determine your course grade:

Item	Number of items evaluated	Total Percentage
• Class assignments	5	30
• Participation in class and team	2	10
• Quizzes	3	6
• Research paper	1	4
• Mid-Term	1	8
• Final exam	1	12
• Projects* (sub-assignments and portfolios)	2	30*
Total		100

Determination of Grades:

A+ : $\geq 97\%$	A : $\geq 93\%$	A- : $\geq 90\%$
B+ : $\geq 87\%$	B : $\geq 83\%$	B- : $\geq 80\%$
C+ : $\geq 77\%$	C : $\geq 73\%$	C- : $\geq 70\%$
D+ : $\geq 67\%$	D : $\geq 63\%$	D- : $\geq 60\%$
F : < 60	(0.5 - 0.9) = 1	(0.1 - 0.4) = 0

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo) at <http://www.sjsu.edu/gup/syllabusinfo>"

Tech 140 / ME 140: Green and Sustainable Product Design, Fall 2017, Course Schedule (Schedule subject to change with notice)

<u>Wk.</u>	<u>Date:</u>	<u>Topic (lecture content)</u>	<u>Recommended Readings and Assignment Due Dates</u>
	<i>Class meets</i>	<i>When there is no lecture specified, you are expected to be working on your design projects and/or assignments.</i>	<i>All assignments due as scheduled unless stated otherwise.</i>
1	Aug. 24 (Thursday)	<ul style="list-style-type: none"> • Orientation to the class. • Overview of methods and expectations. • Refresher assignment with SolidWorks • SolidWorks Commands 	All readings are from the required texts: <i>Planchard, D. (PL) & Obi, S. (Obi)</i> and Outside Materials provided in class
2	Aug. 29	<ul style="list-style-type: none"> • Lab: Description of lab activities and policies, team formation. • Intro. to the 1st design project (Chair/Appliance and/or Mechanical product design project) • Intro to Materials for Green Product Design: metals, thermoplastics, thermosets, elastomers, additives, metals and others • SolidWorks Commands 	PL: Work on Assignment 1 Section Obi: Chapter 7 Outside materials: SolidWorks Lab Manual posted at: http://www.sjsu.edu/people/samuel.obi/Appendix%20B.pdf
3	Sep. 5	<ul style="list-style-type: none"> • Material Processing Methods: Machining, Casting, Forming, Thermoforming, Rotational Molding etc. • Composites post fabrication & joining (DVD Call # XD0669) • SolidWorks Commands 	Obi: Chapters 2, 4, 5 & 6
4	Sep. 12	<ul style="list-style-type: none"> • Thermoplastic Polymer Processing: Injection and Extrusion Molding, design to avoid waste and reuse • Compression molding (DVD Call # XD0668) • Liquid molding (DVD Call # XD0667) • SolidWorks Commands 	PL: Work on Assignment 2 Section Obi: Chapters 2, 4, 5 & 6 Assignment 1 Due
5	Sep. 19	<ul style="list-style-type: none"> • Stress, or Finite Element, Analysis: Incorporating stress analysis in product Design • DFM, DFA, & DFX 	PL: Work on Assignment 2 Section Obi: Chapter 2 Outside materials
6	Sep. 26	<ul style="list-style-type: none"> • Product teardown, benchmarking, specifications, and requirements: Understanding customer and environmental needs • Concept Development: Generation, Evaluation, and Selection. • Product life cycle. • Dynamics of team work 	PL: Work on Assignment 2 Section Obi: Chapters 10 & 11 Outside materials Assignment 2 Due
7	Oct. 3	<ul style="list-style-type: none"> • Thermosetting Polymers: Thermosets, elastomers, special applications, Thermosets in Green products • Research paper introduced/begins • First project portfolio due 	Obi: Chapters 2 & 10 Outside materials 1st project portfolio due
8	Oct. 10	<ul style="list-style-type: none"> • Mid-Term exam 	PL: Work on Assignment 3 Section Obi: Chapters 2 & 7

9	Oct. 17	<ul style="list-style-type: none"> • Introduction of Second design project (Tool Design and/or Modular Concept Green Car Design) 	Outside materials
10	Oct. 24	<ul style="list-style-type: none"> • Green Design for Manufacturing, Assembly 	Outside materials. Obi, chapter 2 Outside materials Assignment 3 Due
11	Oct. 31	<ul style="list-style-type: none"> • Design for Environment and Sustainability: Polymers, Polymer Processing, and the Environment 	PL: Work on Assignment 4 Section Obi: Chapters 2 & 10 Outside materials
12	Nov. 7	<ul style="list-style-type: none"> • Field Trip: Injection Molding company (Subject to cancellation depending on schedule) 	Obi: Chapter 6 Assignment 4 Due
13	Nov. 14	Mechanism Design I: Introduction to mechanisms, synthesis using graphical approach	PL: Work on Assignment 5 Section Obi: Chapters 2 & 11 Outside materials
14	Nov. 21	Mechanism Design I: Motion Analysis and Simulation: Animation and articulation	Outside materials. Assignment 5 Due
15	Nov. 28	Research Report & Presentation Due	Research Report & Presentation Due
16	Dec. 5	Second project portfolio due <ul style="list-style-type: none"> • <u>Last Day of Class is December 11</u> • Lab Clean-up 	Attendance mandatory 2nd project portfolio due
	Dec 14	Final exam is Thursday, December 14	5:15 PM – 7:30 PM

THIS SCHEDULE IS SUBJECT TO CHANGES DEPENDING ON CIRCUMSTANCES DURING THE SEMESTER

Posted Dates are Tuesdays Unless Specified.

All Assignments are Due on Tuesdays Unless Changed by Instructor.

Monday, September 4 is Labor Day (Campus Closed)

Friday, November 10 is Veteran's Day (Campus Closed)

Wednesday, November 22 is Non-instructional holiday (no classes held)

November 23 – 24 is Thanksgiving Holiday (Campus Closed)