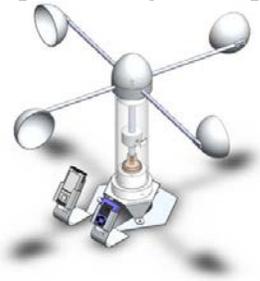
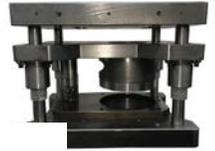


## Green and Sustainable Product Design

### Course Syllabus

Semester and Year: Fall, 2016  
 Course Sections: 1 & 11  
 Class codes: Tech (S1: 47341; S11: 47342)  
 ME (S1: 49293; S11: 49294)  
 Class day & Times: T 6:00 PM – 8:45 PM  
 R 6:00 PM – 8:45 PM  
 Class Locations: E 101 & 103; IS 119, 120 & 122  
 Instructor: Dr. Samuel C. Obi  
 Office Room: IS 105  
 Office Hours: T: 1:00-3:00 PM; & by arrangement  
 Office Phone: (408) 924-3218  
 Office FAX: (408) 924-3198  
 E-mail Address: Samuel.Obi@sjsu.edu  
 Web Address: <http://www.sjsu.edu/people/samuel.obi/>



**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. (Prereqs: Tech/ME 020, Chem. 1A or 30B, Math 71 or 30 or 30P. Lec. 2hrs, Lab 3 hrs.).

#### SolidWorks 2015-2016

This course will emphasize SolidWorks. Students may use other CAD software in conjunction with it, but SolidWorks is the official CAD software for the class.

#### Course SLOs

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 Materials**

1. Student Edition of 2015-2016 SolidWorks CAD software, available at any of the following sites:
  - a) [www.solidworks.com/sdk2012](http://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](http://www.creationengine.com/html/ss_spartan.html) (if you prefer to purchase from Spartan Bookstore's website)
2. Planchar, David and Planchar, Marie (2016). Engineering Design with SolidWorks: 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/1585039969>.
3. Obi, S. (2013) Introduction to Manufacturing Systems. Available at the bookstore and [http://www.amazon.com/Introduction-Manufacturing-Systems-Dr-Samuel/dp/1481701118/ref=sr\\_1\\_1?s=books&ie=UTF8&qid=1408561760&sr=1-1&keywords=introduction+to+manufacturing+systems](http://www.amazon.com/Introduction-Manufacturing-Systems-Dr-Samuel/dp/1481701118/ref=sr_1_1?s=books&ie=UTF8&qid=1408561760&sr=1-1&keywords=introduction+to+manufacturing+systems)
4. A minimum of 8 gigabyte flash drive
5. A digital caliper
6. Safety glasses
7. A scientific calculator with trig functions
8. Project fabrication materials which can not be provided in class or lab

## **Recommended Texts and Materials**

1. Planchar, David and Planchar, Marie (2016). Engineering Graphics With SolidWorks 2016. Available at [https://market.android.com/details?id=book-ptkPNCU7JW8C&feature=more\\_from\\_author](https://market.android.com/details?id=book-ptkPNCU7JW8C&feature=more_from_author).
2. Planchar, David and Planchar, Marie (2013). SolidWorks Tutorial. Available at [http://books.google.com/books/about/SolidWorks\\_2011\\_Tutorial.html?id=GV1JiaYwWhEC](http://books.google.com/books/about/SolidWorks_2011_Tutorial.html?id=GV1JiaYwWhEC).
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**)
5. Ashby, Mike, and Johnson, Kara (2009). *Materials and Design*. (2<sup>nd</sup> Ed). Butterworth Heinemann (Elsevier): New York. Paperback. ISBN-10: 0-7506-5554-2, ISBN-13: 978-0-7506-5554-5
6. Thompson, Rob (2007). *Manufacturing Processes for Design Professionals*. Thames & Hudson: New York. ISBN 0500513759, ISBN-13 978-0500513750

## **Course Content and Unit Outline**

Tech 140 is divided into five (5) instructional units. Each unit has associated contents and assigned readings. There are also two projects and lab activities designed to help ensure students learned 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

#### **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.

#### **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.

#### **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.

#### **Quizzes (6%)**

There will be three pop quizzes during the semester. 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.

#### **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. See course schedule for details. Also see the following link: <http://info.sjsu.edu/static/schedules/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.

#### **Design Projects (sub-assignments and portfolios) (30%)\***

Design projects will be done in groups of 3 students, as much as possible from different majors. There are two design projects which may change from semester to semester. 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.**

**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.

**Academic Integrity** - [http://www.sjsu.edu/senate/policies/pol\\_plagarism\\_acad\\_integrity/](http://www.sjsu.edu/senate/policies/pol_plagarism_acad_integrity/)

Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the university’s Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The policy on academic integrity can be found at [http://sa.sjsu.edu/student\\_conduct](http://sa.sjsu.edu/student_conduct).

Strict standards of academic honesty will be enforced in this class. Students who plagiarize any portion of their reports will receive an F (0) on that report with no chance of make-up and will also be reported to the University. Plagiarism constitutes copying any portion of your writing from textbooks, lab notes, work from previous classes or previous years, or the reports of other students. Verbatim copying from web sites is also plagiarism. We will discuss correct ways to use and cite references in class.

Any figures used from textbooks, the web, or other sources must be properly credited. Assignments that you turn in must have been worked out entirely by you. You can study with friends and work out the problems together, but you must then independently work them through and record your own work. Students who provide their homework or other work to other students so that they can be copied are also committing a breach of academic honesty. If you wish to help other students learn the material, studying together is acceptable as long as each individual goes on to produce their own independent work.

**Students with Disabilities** - Campus policy in compliance with the Americans with Disabilities Act:  
[http://www.sjsu.edu/president/docs/directives/PD\\_97-03.pdf](http://www.sjsu.edu/president/docs/directives/PD_97-03.pdf)

If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with EARC to establish a record of their disability.

**Department Policy on Computer Lab Use:** Use of the department and college computer labs is a privilege that can be lost by abuse. The following are grounds for loss of lab privileges:

- Unauthorized copying of software, either from the computer, or using the computer. To assure that you are not accused of this, you must obtain specific permission from the instructor of your class to do ANY copying of software in the lab.
- Installation of any software, media, or files that are not specifically required to do your class activities. You may not install messenger, music, gaming, or any other software program on computers in the lab.
- Abuse of computers or hacking or modifying the operating system, user interface, or desktop in any way.
- If you wish to work in a computer lab when another class is scheduled there, you must ask the instructor first for permission.

If you lose your computer lab privileges, you will have to arrange to meet your lab requirements outside of the campus computer labs. Since teamwork is a major part of this course, that would be difficult or even impossible. Guard your privileges carefully by behaving as a professional at all times.

**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:** Your grade will be based on performances in the design project, assignments, research report, homework, quizzes and final exam, as well as your participation in class and on your team(s). Your grade will depend greatly on the thoroughness and quality of your project portfolios. The format of the portfolios will be discussed in the class.

You may also turn in peer evaluations, indicating contributions by each member of your design teams.

**Grading Schedule:** The following assignments 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	<u>30*</u>
<b>Total</b>		<b>100</b>

**\*The design portions (and when appropriate, the production and report portions) can be substituted with a pass in the Certified SolidWorks Associate Exam if proof is provided. Students can only substitute for design portions of class assignments and projects for which they fully participated. Full participation is determined only by instructor’s observation of student’s work and availability in class. Proof that you passed the exam must be presented to the instructor before last day of this class.**

<b>Grade:</b>	97%	A+	93%	A	90%	A-
	87%	B+	83%	B	80%	B-
	77%	C+	73%	C	70%	C-
	67%	D+				
	63	D				
	60%	D-				
	59%	F				

The final course and laboratory grades may be normalized to a standard curve.

## Course Schedule (Schedule subject to change with notice)

<u>Wk</u>	<u>Week of:</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. 25 (Thursday)	<ul style="list-style-type: none"> <li>• <b>Orientation to the class.</b></li> <li>• Overview of methods and expectations.</li> <li>• <b>Refresher assignment with SolidWorks</b></li> <li>• SolidWorks Commands</li> </ul>	<i>All readings are from the required texts: <b>Planchard (PL), Obi (Obi), and</b> Outside Materials provided in class</i>
2	Aug. 30	<ul style="list-style-type: none"> <li>• Lab: Description of lab activities and policies, team formation.</li> <li>• <b>Intro. to the 1<sup>st</sup> design project (Chair/Appliance and/or Mechanical product design project)</b></li> <li>• Intro to Materials for Green Product Design: metals, thermoplastics, thermosets, elastomers, additives, metals and others</li> <li>• SolidWorks Commands</li> </ul>	PL: Work on Assignment 1 Section Obi: Chapter 7 Outside materials Manual posted at: <a href="http://www.sjsu.edu/people/samuel.obi/Appendix%20B.pdf">http://www.sjsu.edu/people/samuel.obi/Appendix%20B.pdf</a>
3	Sep. 6	<ul style="list-style-type: none"> <li>• Material Processing Methods: Machining, Casting, Forming, Thermoforming, Rotational Molding etc.</li> <li>• <b>Composites post fabrication &amp; joining (DVD Call # <a href="#">XD0669</a>)</b></li> <li>• SolidWorks Commands</li> </ul>	Obi: Chapters 2, 4, 5 & 6
4	Sep. 13	<ul style="list-style-type: none"> <li>• Thermoplastic Polymer Processing: Injection and Extrusion Molding, design to avoid waste and reuse</li> <li>• <b>Compression molding (DVD Call # <a href="#">XD0668</a>)</b></li> <li>• <b>Liquid molding (DVD Call # <a href="#">XD0667</a>)</b></li> <li>• SolidWorks Commands</li> </ul>	PL: Work on Assignment 2 Section Obi: Chapters 2, 4, 5 & 6 <b>Assignment 1 Due</b>
5	Sep. 20	<ul style="list-style-type: none"> <li>• Stress, or Finite Element, Analysis: Incorporating stress analysis in product Design</li> <li>• DFM, DFA, &amp; DFX</li> </ul>	PL: Work on Assignment 2 Section Obi: Chapter 2 Outside materials
6	Sep. 27	<ul style="list-style-type: none"> <li>• Product teardown, benchmarking, specifications, and requirements: Understanding customer and environmental needs</li> </ul>	PL: Work on Assignment 2 Section Obi: Chapters 10 & 11 Outside materials
		<ul style="list-style-type: none"> <li>• Concept Development: Generation, Evaluation, and Selection.</li> <li>• Product life cycle.</li> <li>• Dynamics of team work</li> </ul>	<b>Assignment 2 Due</b>
7	Oct. 4	<ul style="list-style-type: none"> <li>• Thermosetting Polymers: Thermosets, elastomers, special applications, Thermosets in Green products</li> <li>• <b>Research paper introduced/begins</b></li> <li>• <b>First project portfolio due</b></li> </ul>	Obi: Chapters 2 & 10 Outside materials <b>1<sup>st</sup> project portfolio due</b>

8	Oct. 11	<ul style="list-style-type: none"> <li>• <b>Mid-Term exam</b></li> <li>• <b>Introduction of Second design project (Tool Design and/or Modular Concept Green Car Design)</b></li> </ul>	PL: Work on Assignment 3 Section Obi: Chapters 2 & 7 Outside materials
9	Oct. 18	<ul style="list-style-type: none"> <li>• Green Design for Manufacturing, Assembly</li> </ul>	Outside materials. Obi, chapter 2 Outside materials <b>Assignment 3 Due</b>
10	Oct. 25	<ul style="list-style-type: none"> <li>• Design for Environment and Sustainability: Polymers, Polymer Processing, and the Environment</li> </ul>	PL: Work on Assignment 4 Section Obi: Chapters 2 & 10 Outside materials
11	Nov. 1	<ul style="list-style-type: none"> <li>• Field Trip: Injection Molding company (Subject to cancellation depending on schedule)</li> </ul>	Obi: Chapter 6 <b>Assignment 4 Due</b>
12	Nov. 8	Mechanism Design I: Introduction to mechanisms, synthesis using graphical approach	PL: Work on Assignment 5 Section Obi: Chapters 2 & 11 Outside materials
13	Nov. 15	Mechanism Design I: Motion Analysis and Simulation: Animation and articulation	Outside materials. <b>Assignment 5 Due</b>
14	Nov. 22/ <del>24</del>	Scheduling Adjustment	Outside materials
15	Nov. 29	<b>Research Report &amp; Presentation Due</b>	<b>Research Report &amp; Presentation Due</b>
16	Dec. 6	<b>Second project portfolio due</b> <ul style="list-style-type: none"> <li>• Last Day of Class is December 8</li> <li>• Lab Clean-up</li> </ul>	Attendance mandatory <b>2<sup>nd</sup> project portfolio due</b>
	<b>Dec 20</b>	<b>Final exam is Tuesday, December 20</b>	<b>5:15 PM – 7:30 PM</b>

**THIS SCHEDULE IS SUBJECT TO CHANGES DEPENDING ON CIRCUMSTANCES IN THE COURSE OF THE SEMESTER**

**Posted Dates are Tuesdays Unless Specified.**

**All Assignments are Due on Tuesdays Unless Changed by Instructor.**

**Monday, September 5 is Labor Day (Campus Closed)**

**Friday, November 11 is Veteran's Day (Campus Closed)**

**November 23 – 25 is Thanksgiving Holiday (Campus Closed)**