University Of California, Berkeley
Department of Mechanical Engineering

ME 290H – Green Product Development: Design for Sustainability (3 units)

Graduate Course

Syllabus

CATALOG DESCRIPTION

The focus of the course is management of innovation processes for sustainable products, from product definition to sustainable manufacturing and financial models. Using a project in which students will be asked to design and develop a product or service focused on sustainability, we will teach processes for collecting customer and user needs data, prioritizing that data, developing a product specification, sketching and building product prototypes, and interacting with the customer/community during product development. The course is intended as a very hands-on experience in the "green" product development process. The course will be a Management of Technology course offered jointly with the College of Engineering and the Haas School of Business. In addition, it will also receive credit towards the new Certificate on Engineering Sustainability and Environmental Management program. We aim to have half MBA students and half Engineering students (with a few other students, such as from the School of Information) in the class. The instructors will facilitate students to form mixed disciplinary reams for the development of their "green" products.

COURSE PREREQUISITES

Graduate standing in Engineering or Information, or consent of instructor.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

The primary reading material for the class is the textbook *Product Design and Development* (Fourth Edition) written by Karl Ulrich and Steve Eppinger. This book is a very basic text that provides a step by step view of how new product development processes are to be conducted. Supplemental required course reading materials will also be available on bSpace or linked from our annotated version of the textbook at: http://www.k-grayengineeringeducation.com/textbooks/?p=1.

COURSE OBJECTIVES

The focus of the course is management of innovation processes for sustainable products, from product definition to sustainable manufacturing and financial models. Using a project in which students will be asked to design and develop a product or service focused on sustainability, we will teach processes for collecting customer and user needs data, prioritizing that data, developing a product specification, sketching and building product prototypes, and interacting with the customer/community during product development. The course is intended as a very hands-on experience in the "green" product development process. The course will be a Management of Technology course offered jointly by the College of Engineering and the Haas School of Business. In addition, it will also receive credit towards the new Engineering and Business Sustainability Certificate (currently under review by the Academic Senate). We aim to have half MBA students and half Engineering students (with a few other students, such as from the I-School) in the class. The instructors will facilitate students to form mixed disciplinary teams for the development of their "green" products. Students from the California College of the Arts (CCA) will also participate on the teams through a course taught

separately at CCA. Students can expect to depart the semester understanding "green" product development processes as well as useful tools, techniques and organizational structures that support sustainable design and environmental management practice.

DESIRED COURSE OUTCOMES

Students can expect to depart the semester understanding new product development processes as well as useful tools, techniques and organizational structures that support new product development practice in the context of the “triple bottom line” – economy, environment and society.

TOPICS COVERED

Product development processes and organization, product planning, triple bottom line, high performing teamwork, CAD/ solid modeling, customer/user needs assessment, personas and empathic design, translating the "voice of the customer", concept generation, concept selection, concept development, decision analysis, concept testing, taguchi method and experimental design, product architectures, design for variety, design for environment, life cycle assessment, design for assembly/ manufacture, prototyping, design costing, information technologies, design optimization, engineering ethics, universal design and entrepreneurship, innovation and intellectual property.

CLASS/LABORATORY SCHEDULE

Three hours of lecture per week, plus optional discussion section

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

Students will be expected to use tools and methods of professional practice (e.g., human-centered design, life cycle assesment, market analysis) and use these tools to consider the social, economic, environmental and political implications of their products. Both individual and group oral presentations will be required.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

Your course grade will be determined as follows:

- 10% on the quality of your preparation for and participation in class discussions
- 30% on the quality of your individual assignment solutions during the semester
- 10% for your final design journal
- 10% for your individual final report/ prospectus relating course to future research and/or
- professional goals
- 40% on the quality of your team’s project-related assignments, final presentation and
- Deliverables

Team Peer Assessments: At midsemester, we will ask for individual peer assessments of the contributions made by your team mates. This assessment will *not* be considered in preparing your final team grade; they are considered an “early warning” for struggling teams. There will also be an end-of-semester peer assessment, which could have an influence on individual grades.

PERSON(S) WHO PREPARED THIS DESCRIPTION

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): GREEN PROD DEVP;DSG
TIE CODE: LECS
GRADING: Letter
SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: Agogino, Beckman
DURATION OF COURSE: 14 Weeks
EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK: 9 Hours
IS COURSE REPEATABLE FOR CREDIT?
CROSSLIST: None

Class Schedule and Assignments
Alice M. Agogino

1 T 1/18	We will cover course logistics and requirements and then develop the motivation and framework for the course. Come to class prepared to discuss why new product development is important, what the key activities are and the role of sustainability in the design process. Ch. 1 Introduction to Product Design and Design Thinking (http://bit.ly/design-chapter1). *Individual Assignment Due:* Complete student profile survey at http://www.surveymonkey.com/s/9MJJ8RH
2 Th 1/20	We will use waste material for a design project in studio. Each student is asked to bring in two items that you find in your trash or dumpster. Or bring in something you just don't want, but can't figure out what to do with it. Come to class prepared to create new designs from these discards. Also make a note in your journal of what you did bring in, along with a list of other things you found but left in the trash. Consider the thought questions at the end of Chapter 2. How is the process described in this chapter similar to/different than the process you have used in other design projects in class or work? What is the role of a design journal in the design thinking process? Ch. 2 Development Processes and Organizations (http://bit.ly/design-chapter2). Ch.1, *Natural Capitalism, The Next Industrial Revolution* (http://www.natcap.org/sitepages/pid57.php). Dumpster diving: an Introduction, http://www.kuro5hin.org/story/2003/1/29/215523/088. *Individual Assignment Due:* Complete the Jung Typology Test and the learning styles survey available through the SurveyMonkey link. You will need to know your Myers Briggs profile in order to complete the survey. • The ***Jung Typology Test*** and information about it are available at www.humanmetrics.com. Read the background on the test and then take and score it. After you have the results of your test, go to the website specified on bSpace.
3 T 1/25	Product planning involves developing a strategy for your products in the context of your organizational goals and resources. The Tripple Bottom Line refers to considering three components to an organization's bottom line: profit, societal benefits, and environmental impact. Be prepared to discuss the components of a Mission Statement and how it might reflect the components of a Tripple Bottom Line. Ch. 3 Product Planning (http://bit.ly/design-chapter3). Google Preview of *The Triple Bottom Line*, Andrew Savitz and Karl Weber, http://bit.ly/npd-tbl 10xE Principles, Rocky Mountain Institute, http://www.rmi.org/rmi/10xe+principles

	Delta Design Task (on bSpace). *Individual Assignment Due:* Training for Delta Design Game. Roles will be assigned in class. The game will be played in the Studio on 1/27.
4 Th 1/27	You should have prepared for the role assignment you were given in class on Tuesday. Make sure that you thoroughly understand the role you are to play. Prepare any materials you believe you will need to play the role. _____ the other three roles with others in the class. Work hard to get to class on time as there is barely enough time to finish in the time allotted. At the end of the exercise, you will be asked to submit a sheet of paper for each team that provides all of the completed calculations for that team and a photo of your final design. The calculations must be submitted in class; the photo can be sent after class if you need time to transfer from your digital camera.
5 T 2/1	Ch. 10 Industrial Design (http://bit.ly/design-chapter10). Design Thinking and the Future, Fabio Sergio, Creative Director of Frog Design, http://bit.ly/ep-FrogDesignvideo *Individual Assignment Due:* List of 20 "bugs". *Individual Assignment Due*: Project proposal (first draft for feedback). See instructions for final due on 2/3. We will be joined by guest speaker Peter Michaelian, Associate Creative Director at Frog Design. We will first start with a review of Delta Design then relate to the role of industrial design in multidisciplinary teams. We are all capable of identifying market needs and thus generating ideas for new products, in part by noticing the deficiencies in the products we use in everyday life. To prove to yourself that you can identify market needs, generate a list of at least 20 "bugs." Designers at the product design firm IDEO use "bug lists" to record their observations of products and situations where products failed to meet the actual conditions of use. This list should include any observation or annoyance that comes to your mind. Note that we are looking for a list of "bugs" (e.g., my vegetable peeler hurts my hand when I peel potatoes) rather than a list of product solutions (e.g., a vegetable peeler with a soft handle). In other words, do NOT invent solutions to the problems you see – just state the problem. Upload your bug list to the course website under "assignments" and "twenty bugs".
6 Th 2/3	Students will be given an opportunity to pitch their project ideas in the studio. Details of the presentation below. *Individual Assignment Due:* Project proposal (final) *Project Preferences due by 5:00 pm, Friday, February 4* Your one-page proposals should include: • A brief, descriptive project title (2-4 words) • Your name, phone number, e-mail, and school/department affiliation • A description of the market opportunity you have identified. Your description may include any of the following: Documentation of the market opportunity, shortcomings of existing competitive products, and/or definition of the target market and its size. Please do ___ present *product ideas* at this point. Our strict focus in this phase of the course is on the *market opportunity* – the unfilled

	need or unsolved problem – and not on solution concepts. These proposals will be posted to a location where all participants in the class can see them. Come to class prepared to give a VERY SHORT (i.e., 1 minute), yet convincing, presentation of your project proposal. Please prepare three slides that you can present in 15 seconds each that clearly communicate the market need on which you would like your classmates to work with you. We will collect all of the slides into a single presentation that we will run with PowerPoint's timed presentation feature. Your slides should communicate the following: • The first slide MUST include your name and school/department affiliation. • A verbal and visual demonstration of the product opportunity you have described in your proposal. Given that the audience will be able to read your written proposal at their leisure, you might spend your time explaining the richness of the market opportunity or demonstrating existing competitive products. • The slides are due absolutely _____ so that we can get the full presentation assembled for the studio on 2/4. ***By 5 p.m. on Friday, 2/4 you must decide on your project preferences***. You should list the FIVE projects on which you would most like to work in order of preference. If you would like to work with a particular group of classmates, recalling that your group must contain engineering and non-engineering students please submit their names as well. They must submit your name as well for us to assign you all to the same team. Submit your preferences per the instructions on bSpace. We will process your preferences and assign teams. There is a good chance we will ask you to vote a second time after we have eliminated some of the projects in the first round, so stay tuned.
7 T 2/8	During this class session, we will talk about team dynamics and interactions as being critical to new product development success. We'll conduct a team launch exercise in which you and your teammates debrief your MBTI and learning style profiles and the other questions on the survey. You will be given team launch exercise to work on during the class. Be sure to bring your MBTI profile to class. Ch. 16: Managing Projects (http://bit.ly/design-chapter16). "The Trouble with Teamwork" http://www.leadertoleader.org/knowledgecenter/journal.aspx?ArticleID=80. *Project Deliverables Due:* Mission statement and project plan. This can be uploaded at the end of the studio.
8 Th 2/10	During this class we will go over methods for identifing customer needs. You will have time to compare notes with your team members on the use of interviews for this purpose. Ch. 4: Identifying Customer Needs (http://bit.ly/design-chapter4). *Project Deliverables Due:* Customer/User Needs Assessment Plan. As with all project assignments, include a short discussion of the process you used, lessons learned, and any observations you have about your team. This can be uploaded at the end of the class exercise. *Individual Assignment Due:* Choose a product that competes with or serves a similar purpose to the one your project team is developing. Interview a potential or current user of the product about what they like and dislike about the product. This interview can be done very informally in 5-10 minutes. Record what your interviewee says and interpret the data in terms of customer needs as described in Chapter 4.

	Prepare a one-page summary of what you have learned about the interview process. Submit both the record and interpretation of customer needs and your page of lessons learned to the assignments tab under customer interview.
9 T 2/15	In this class we will present different ways of analyzing cutomer and user needs data. In "design thinking" terms, we call this framing and reframing. We'll use this class time to work with you on applying some of the framing and reframing tools to your project data. Please bring all of your customer and user needs data – interview notes, photographs, etc. – to class with you to use in these in-class exercises. "Get Inside the Lives of Your Customers" on bSpace. "Framing Sustainability in Human-Centered Product Design," (with L. Oehlberg and S. Beckman), *Proceedings of the ASME 2009 International Design Engineering Technical Conference*, 2009. Also on bSpace.
10 Th 2/17	In this class we will move a little ahead of where your project should be to introduce you to the next step of the process – translating customer and user needs information into specifications and imperatives. We'll introduce the basic concepts of generating specs and imperatives, and then have you do some exercises with your project data to play with the concepts. Ch. 5: Product Specifications (http://bit.ly/design-chapter5)
11 T 2/22	Your project should now have completed a first pass at the following activities: Gather raw data on customer needs (through whatever means you deem most appropriate to your potential market). Generate a list of customer needs for your product and organize it hierarchically into primary, secondary and tertiary needs as described in your book. Identify three or four needs that you feel are important, but latent and not addressed by current products. Most of you will find that your Mission Statement continues to evolve throughout the product development process as you learn more about your target market and gather feedback from faculty and others. You should continue to update your Mission Statement as you gather new inputs (archiving the old ones on the Web site. This will be the first of three peer reviews you will have on your product development project. During class we will pair you up with another team or two to present and give feedback to one another. Come prepared to share: your mission statement, as is shown in your textbook, a brief review of the means used to collect customer and user needs information, a summary of the identified customer and user needs, one of your most interesting use scenarios, and a summary of lessons learned in the process to date. This is an opportunity to receive feedback from and give feedback to your classmates. It is also an opportunity to learn about new product development processes by observing what others have done on and learned from their projects. You might want to check out the Stanford Product Design alumni wiki on critique: http://stanfordpd.pbworks.com/Critique. Below is a summary of the guidelines CCA uses on engaging in critiques. WHAT WE CRITIQUE 1. Content: Does it make sense? Is it clear? Does it communicate what the designer claims? Is it interesting? 2. Process: Did the designer exploit the process(es) enough? Could more work have been done? 3. Grounding/defense: Can all of the designer's decisions be adequately defended?

	HOW WE CRITIQUE B E C O N S T R U C T I V E . We're all guilty of delivering too many barbed comments. Try to be constructive in your criticism (Something like "This part is successful because—; this part isn't because—; Maybe you could think about—"). Don't say every piece of work is great. The result is that nobody learns anything. It's not about "good" and "bad", more "successful" and "unsuccessful." (Reserve "good" and "bad" for your dog.) THE GREAT BIG NO-NO The phrase "I like it" without an explanation is forbidden. Learning to talk clearly and perceptively about other people's work takes effort and practice. The more you do it, the more eloquent you will become. FINALLY, It is far easier to determine if a concept, typeface, size, color, position, relationship, etc. is appropriate, awkward, elegant, oblique, or nasty if you have something to compare it to. You will learn more quickly (and become a better designer) if you make a habit of bringing multiple solutions to class for critiques. *Project Deliverables Due:* Updated mission statement, customer/user needs analysis, and the usual short discussion of the process you used, lessons learned, and observations you have about your team.
12 Th 2/24	This class session will focus on brainstorming and "ideation" techniques used by new product development teams to generate product ideas from their understanding of customer wants and needs and of the available technologies. We will use in class exercises to help you move from your individual concept ideas to team ones. Ch. 6: Concept Generation (http://bit.ly/design-chapter6) "Creative Thinking Techniques" (http://www.virtualsalt.com/crebook2.htm) *Individual Assignment Due:* Each team member is to INDIVIDUALLY generate 10 concepts and post to your website and bring to class. A form will be provided on bSace for you to use. *Project Deliverables Due:* Upload metaphors and team concepts generated during in-class studio.
13 T 3/1	Lionel Mohri from IDEO will join us today to introduce tools and techniques for prototyping and testing your product concepts. "Prototyping is the Shorthand of Design" (http://bit.ly/ep-84086B33-F723-4B8A-A609-D766810B0329) *Project Deliverables Due:* Top ten concepts to use for developing early prototypes. Summarize lessons learned. Load images of ther prototypes developed in class to your project dropbox.
14 Th 3/3	We will focus our discussion in this session on the definition of product architecture and the implications of product architecture decisions for product development, marketing, customers, etc. How might your product benefit from a product architecture/ platform strategy? Identify product platforms you are familiar with and bring them or an impage to class. Be prepared to discuss the relationship between product architecture and mass customization. You might want to scan Pine's classic article on mass customization on Google Books: http://books.google.com/books?id=2_3PMy4LQHkC&source=gbs_navlinks_s. We will also begin our collaboration with Autdesk's Sustainability inititiative this semester with the video: *Design for Product Lifetime*, http://bit.ly/autodesk-lifetime

	Ch. 9 Product Architecture (http://bit.ly/design-chapter9)
15 T 3/8	We will explore metaphors further in class and illustrate how biological analogies (biomimicry) can be used to frame product ideas. The Biomimicry Institute defines biomimicry as "the science and art of emulating Nature's best biological ideas to solve human problems. Carbon-sequestering cement inspired by corals and energy efficient wind turbines inspired by schooling fish are examples of biomimicry happening today." We will be joined by Tom McKeag, who is team-teaching another course this semester titled "How Would Nature Do That?" Biomimicry Institute (http://www.biomimicryinstitute.org/) *Project Deliverables Due:* Upload metaphors/ analogies and team concepts generated during in-class studio.
16 Th 3/10	Chapter 7 describes concept screening and concept scoring matrices as a means of selecting among competing ideas for products you might develop. Chapter 8 describes how you can go further in testing the top concepts with low fidelity prototypes. Ch. 7: Concept Selection (http://bit.ly/design-chapter7) Ch. 8: Concept Testing (http://bit.ly/design-chapter8) *Project Deliverables Due*: Prioritized list of top 5 needs. Identify 2 competitive products that best meet these 5 needs for benchmarking. How do the rank against your Tripple Bottom Line goals? Summarize lessons learned. *Individual Assignment:* Using your team's top 5 user needs, individually rank your concepts using concept scoring and selection. Upload to bSpace as an assignment and bring to class to share with your team.
17 T 3/15	Review of low and high prototyping methods. Ch. 12: Prototyping (http://bit.ly/design-chapter12).
18 Th 3/17	*Individual Assignment Due:* Complete the on-line peer review and team assessment survey as per instructions on bSpace. This can be completed by Friday, 3/18. *Project Deliverables Due:* Updated mission statement, customer/user needs data, concepts and early prototypes. Summarize lessons learned. Be prepared to show these in a mini-tradeshow format. Session objectives: • Update your classmates as to progress on your product development effort. • Make the first "public" presentation of your "proof-of-concept ideas". • Gather feedback from classmates on your concept design and mockups. For this session:

	1. Prepare a THREE-SLIDE summary of your: • Mission statement • Target market • Salient customer needs Plan to orally present your concepts briefly at the beginning of the class in 1 minute, 20 seconds per slide. Submit the slides to your project folder no later than 9 p.m. on Wednesday 3/16. This will bring the entire class up to speed on your project before they review your work and allow you to get peer feedback. 2. Prepare your "proof-of-concept" sketches, product renderings and early prototypes so that everyone can understand your ideas. After the brief review at the beginning of the class, we will spend about 50 minutes in a "tradeshow" environment during which you will wander around the classroom to look at the work. You are welcome to bring portable computers to set up your images. You should plan to handle any arrangements for using computers on your own. To support your concepts, you should have the following materials available. (Each team will likely have done different versions of these. Use what you have already developed.) • Customer/user needs hierarchy • Mapping of customer needs to specifications • Concept sketches • Product renderings or mockups (3D renderings, early physical or web mockups) • Concept screening and scoring matrices • Reason for choosing the concept(s) you have developed for today You should plan to have group members rotate responsibility for showing the concepts so that other group members can circulate. Think about the best way to efficiently and effectively collect feedback from your classmates. You may wish to have a mini-survey available for them to complete following the examples we covered in Concept Testing. Remember that each student will only have about 5 minutes to spend reviewing your work; so make your presentation as succinct as possible. From this point forward, your focus will be on developing and testing your product concept with your customer base, obtaining feedback, incorporating it into your product, and preparing intermediate and final product prototypes.
	3/21-25
19 T 3/29	This class session will be dedicated to giving you the feedback from your team survey and letting you process that feedback with organizational design experts.
20 Th 3/31	Design for manufacturing is one of the many "design fors" that a product development team must undertake. In this class session we'll talk about the various "design for x" activities, including manufacturing. Consider thought questions 1 and 2 at the end of Chapter 11. Be prepared to perform a class exercise in design-for-assembly. We will be joined by guest speaker Roby DeManche from Apple

	Computer. Ch. 11 Design for Manufacturing (http://bit.ly/design-chapter10). *In-class exercise:* Assessing product manufacturability; Prototyping lab. See demonstration of FDM (fused deposition modeling).
21 T 4/5	We'll cover product testing with exploration of a specific tool for product design – design of experiments. We'll do an in-class exercise to help you understand how the tool works. Ch. 13 Robust Design (http://bit.ly/design-chapter13). *In-class exercise: Taguchi method*
22 Th 4/7	(Guest Speaker: Eric Masanet from Lawrence Berkeley National Lab – LBNL) In the first reading (Cradle to Grave), click through each of the six stages and read the first page that pops up. Following the links on each page is encouraged but entirely optional, except for the three additional links under the "emissions" page, which you should follow. What does designing products for environmental soundness entail? How might you make tradeoffs among cost, quality, features and environmental soundness when designing a product? What is sustainable design? What is the difference between the the "cradle to grave" perspective and the"cradle to cradle" alternative? How might you redesign or manufacture your product with this perspective in mind? from bSpace: Kambrook Kettle case study: "Mainstream appliance meets eco-design" (*Journal of Sustainable Product Design*) "The Cradle to Cradle Alternative" Design for Disassembly & Recycling, http://bit.ly/autodesk-recycling
23 T 4/12	We will also hold a tutorial on using a Life Cycle Analysis software tool and have you apply it to your projects. We will hold a hands-on lab using the software and going over some case studies. This may be in in 2105/207 Etcheverry Hall if we can't find a CAD lab in Wurster to use. EIO-LCA Tutorial, http://www.eiolca.net/tutorial-j/tut_1.html EPA tutorial "Life Cycle Assessment: Principles and Practice". Designer's Field Guide to Sustainability, http://www.lunar.com/fieldguide/tips.html
24 Th 4/14	Introduction to optimization and how it can be used in the design process. It provides a foundation for our studio next week on light weighting and its connection to sustainable design. bSpace readings on optimal design - Optimization Thery, Constrained Optimization by Don Johnson. *In-class exercise:* Optimization problem; connection to Lunar's Design for Environment guide.

25 T 4/19	We'll learn basic principles of design optimization for lightweighting. After a discussion of where you see lightweighting strategies at work in the world around you, we'll do a hands-on exercise showing how software tools like finite element analysis and parametric optimization can be used to reduce material use in your designs. Adam Menter and Thom Tremblay from Autodesk will join us for a hand-on lab in 2105/207 Etcheverry Hall. Autodesk website on Lightweighting: http://students.autodesk.com/?nd=sustainable_course&course_id=2 Design for Durability, http://bit.ly/ep-design_for_durability
26 Th 4/21	Bring in your questions about the intellectual property of your project. We will also discuss possible funding opportunities. We will also go over basics of engineering economics and product costing and the use of a spreadsheet to help you out in your projects. Ch. 14 Patents and Intellectual Property Ch. 15 Product Development Economics (http://bit.ly/design-chapter15).
27 T 4/26	In this class we will go into more depth on the use of CAD and materials databases for use in greening the produc development and manufacturing process. We will be joined by Prof. Dave Dornfeld, ME Department Chair and Director of the Laboratory for Manufacturing and Sustainability. Adam Menter and Thom Tremblay from Autodesk will join us as well to help teams go into more depth using Inventor and the Granta's Eco-Selector materials database in 2105/207 Etcheverry Hall. Ch. 15 Product Development Economics (http://bit.ly/design-chapter15). Granta Eco-Selector background reading (bSpace) How sustainability fuels design innovation, http://www.innovationtools.com/Articles/EnterpriseDetails.asp?a=600 *Project Deliverables Due:* Business plan and rough financial models. Summarize lessons learned.
28 Th 4/28	As you approach the end of the semester, you should start thinking about how you will communicate your project outcomes to the judges who will be present at the final tradeshow. In this session we'll review good presentation and storytelling techniques, and let you start practicing applying them to your projects. Chapter 1, "What Sticks?" in *Made to Stick (*http://www.madetostick.com/excerpts/).
29 T, 30 Th 5/3,5	*Team Deliverables:* Prepare a 10-minute presentation that describes your final product and the process you went through to arrive there. The presentation should be of the quality to convince a top technical or investment group to purchase the rights to your product or to fund its final development and launch. An effective presentation includes a slide presentation along with a display of the prototype. Your presentation should not only attempt to sell your prototype to the audience, but should also make clear

	the process you went through to develop the prototype. Your presentation should include: o Your mission statement o A summary of your customer/user needs analysis o A couple of concepts you considered as alternatives to the one you developed, along with a justification for your final selection o Key design or technical features that addess the needs and differentiate your product o Tripple bottom line analysis: financials, societal and environmental, including a rough life cycle analysis of your product o A demonstration of your product prototype o A list of the most important lessons you learned about the NPD process and teams • ***Individual Deliverable:*** Turn in the journal you have been keeping throughout the semester. It will be returned after grading. • ***Individual Deliverable:*** Complete the team evaluation survey. • ***Team Deliverables:*** Turn in your final presentation, photo of your prototype and the actual prototype, if appropriate.
5/6	We hope to provide you an opportunity to present your final product to a broader audience of guests from campus and industry, joined by students in other human-centered design classes.
5/9	Each of you have different reasons for taking this course. This final deliverable is an exercise in integrating materials you learned in this course into a prospectus or plan for future work. This might take the form of integrating material into an MS or PhD thesis. Or it might relate to professional practice. (5 page limit)