Human-Centered Design Methods

Syllabus

GENERAL INFORMATION

Faculty:

- *Alice M. Agogino*, Department of Mechanical Engineering, 415 Sutardja Dai Hall (CITRIS Building), (510) 642-6450, agogino@berkeley.edu

- *Co-instructors (TBA)*

Graduate Student Instructors: TBA

Reader: TBA

Designer-in-Residence: TBA

Class Meetings: F 1-4:00 pm

Office Hours and Optional Discussion/Workshops: TBA

COURSE OBJECTIVES

This course provides hands-on and real world experience in the development of innovative and realistic customer-driven engineered products, services or systems. Design methods and tools are introduced, and the student's design ability is developed in a capstone design project or equivalent. The course is organized around the following modules: design research, analysis & synthesis, concept generation & creativity, prototyping, communication & visualization. Students will be expected to use tools and methods of professional practice and use these tools to consider the social, economic and environmental implications of their products, services or systems. There is an emphasis on hands-on innovative thinking, teamwork, and effective communication.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

Reading Materials: theDesignExchange.org. Supplemental required course reading materials will also be available on bCoures.

bCourses Use: We will make extensive use of the course bCourses web site to both communicate information to you and to converse with you about your homework and your projects. You will find the course listed on http://bCourses.berkeley.edu/. Once you have formed your project groups, we will set up group pages on which we expect you to store your working documents for your project. The faculty will review the group pages regularly to provide feedback on your work. Our experience is that the teams that heavily use their bCourses pages and email connections do better in the class, and we strongly encourage you to use them.

DESIRED COURSE OUTCOMES

Students can expect to depart the semester understanding customer-driven design methods, tools and processes.

TOPICS COVERED

Design processes and methods, design roadmapping, triple bottom line, CAD/ solid modeling, customer/user needs assessment, personas and empathic design, framing and analyzing customer research, translating the "voice of the customer", concept generation, concept selection, concept development, concept testing, product architectures, design for variety, design for environment,

design for assembly/ manufacture, prototyping, visualization & information technologies, engineering ethics, entrepreneurship and innovation.

GRADING

Your course grade will be determined as follows:

> 10% on the quality of your preparation for and participation in class discussions
> 20% on the quality of your individual assignment solutions
> 10% on individual design portfolio
> 30% on the quality of your team's work on project-related assignments
> 30% on the quality of your team's final project presentation, report and prototype

CLASS PREPARATION AND PARTICIPATION

Readings are meant to guide your thinking about the class assignments. Readings are given in the class schedule; we expect you to come to class prepared to discuss the readings and the suggested questions.   In any given class session, a handful of students may be called upon specifically to speak about the readings and answer questions about them.   If you have prepared in advance according to the syllabus, you will have no problem responding when called upon.   Your individual class participation grade will be based upon your in-class remarks during discussions and will be judged by the teaching staff.

INDIVIDUAL ASSIGNMENTS

We have periodically assigned individual exercises to have you experiment with some of the concepts we are teaching. These are due at the start of each class, unless otherwise noted. Late assignments are discouraged but accepted, heavily penalized at 20% of the total score (20 points out of 100) for each day for late.

ALL INDIVIDUAL ASSIGNMENTS ARE TO BE SUBMITTED VIA THE BCOURSES "ASSIGNMENTS" TAB UNDER THE APPROPRIATE HEADING PRIOR TO THE START OF CLASS ON THE DAY THEY ARE DUE. YOU MAY WANT TO BRING ONE COPY OF YOUR HOMEWORK TO CLASS, AS WE WILL FREQUENTLY ASK YOU TO SHARE YOUR RESULTS (DIGITAL SHARING IS FINE).

WEBSITE USE:

We will make extensive use of the course Website to both communicate information to you and to converse with you about your homework and your projects.   You will find the course listed on http://bCourses.berkeley.edu/.   Once you have formed your project groups, we will set up email lists and folders where we expect you to store your working documents for your project.   The faculty will review the group pages regularly to provide feedback on your work.   Our research shows that teams that heavily use their shared documents and email connections do better in the class, so we strongly encourage you to use these group function.

JACOBS HALL

Jacobs Hall is well equipped for prototyping in the class. Students will be expected to get a Maker Pass ($75) in lieu of a textbook and go through appropriate safety and equipment training. More on equipment available at: http://jacobsinstitute.berkeley.edu/make/jacobs-hall/.

DESIGN PORTFOLIO

Each individual in the class will be **required** to maintain a design journal throughout the semester that can be used to create a design portfolio at the end of the semester.   This design portfolio counts 10% towards your individual grade.

LAPTOP, TABLET AND SMARTPHONE POLICY

Class time will focus almost entirely on in-class exercises to bring to life project-based learning. You will need to give your full attention to your teammates, to the work you are being asked to do together, and to what you are taking away from that work. Please do not use your laptops or smart phones in class, unless it is for a class exercise or to take notes (no email, texting, web browsing, Facebook, etc.) Any violation of this policy will lead to a reduction in your participation grade. We love the way Adaptive Path, one of the design firms we work with, describes its policy along these lines:

HONOR THE GATHERING. In this ever more interrupt-driven digital world, it's a challenge to bring together all the right people at the same time to think, make and solve problems that are too complex for just a few people to figure out. Gatherings of this magnitude need opening ceremonies to acknowledge the value of the time we are about to spend together. Typically these ceremonies don't include marching bands or fireworks (although that would be cool), but there are small and simple actions that help us all recognize that this is a sacred time. These small things include sending out invitations ahead of time, providing food and drink, creating an environment where people can focus without laptops or smart phones, welcoming and orienting people to our day together, and having the client sponsor begin the workshop with essentially an opening blessing for the people gathered and the work we will accomplish.
(www.adaptivepath.com)

SCHEDULE

The schedule below provides learning goals for each session, along with required readings and individual (I) and team (T) assignments. Unless otherwise noted, the individual assignments should be submitted to the appropriate class bCourses assignments link and the team assignments to the relevant folder in your project bCourses. Unless otherwise noted, **ALL INDIVIDUAL ASSIGNMENTS ARE DUE BY THE BEGINNING OF CLASS ON THE DAY DUE**. The team project assignments labeled as "deliverables" **MUST** be turned in at the designated due date. Most of the team project assignments are labeled as "check-ins". These are "work in progress" team assignments to allow the teaching staff to give you feedback in class. We ask you to upload your "work in progress" on the due date, but they could be turned in or updated by the next class time. We have made every effort to provide you all course details in this syllabus, but we sometimes have to make changes due to unexpected circumstances, such as a change in the visit date of a guest lecturer. Please check bCourses announcements and assignment updates for changes to the schedule.

DAY	TOPIC
	I. MODULE ON DESIGN PROCESSES & MODELS

1 W
 	
8/24
	Introduction to Design and Innovation and Entrepreneurship Processes and Methods
	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, how innovation and entrepreneurship relate, and how new product development frames opportunities for entrepreneurship.
	Read: Dym, C.L., A.M. Agogino, O. Eris, D.D. Frey and L.J. Leifer, "Engineering Design Thinking, Teaching and Learning," *Journal of Engineering Education*, Jan. 2005, v. 94, no. 1, pp. 103-120. (bCourses)
	Read: Sara Beckman & Michael Barry. "Innovation as a Learning Process: Embedding Design Thinking", *California Management Review*. (bCourses)
	Read: John Kolko, "Design Thinking Comes of Age," Harvard Business Review, September, 2015, https://hbr.org/2015/09/design-thinking-comes-of-age
	
	Watch: *Video:* Nightline, "The Deep Dive" (aka, "the IDEO Shopping Cart" Video)
	
	      Part 1: http://www.youtube.com/watch?v=ooN05Q030Qo
	
	      Part 2: http://www.youtube.com/watch?v=y_kVSJ7eAw4
	
	      Part 3: http://www.youtube.com/watch?v=fUz09EkIm64http://opinionator.blogs.nytimes.com/2014/08/21/innovation-within-reach/
	
	I-1. Individual Assignment Due: Complete student profile survey at: <mark>TBA</mark>

2 F 8/26	**The Role of Industrial Design and Innovation Opportunities for Start-ups** **Scan (Steps 1-32):** What is Industrial Design? Industrial Design Society of America (IDSA), http://www.idsa.org/education/what-is-idhttp://www.idsa.org/education/what-is-id **Read:** "Designing for Humans: an Ethnography Primer," IDSA, 2010: http://www.aiga.org/ethnography-primer/http://www.aiga.org/ethnography-primer/ 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. However, not all bugs, when solved, have the potential to ground a start-up business. Make a quick judgement about which of your bugs, if solved, might lead to improved features (F) of existing

	products vs. standalone new products (P) vs. form the basis of an entrepreneurial company (C). Upload your bug list to the course website under "assignments" and "twenty bugs". **I-2. Individual Assignment Due:** List of 20 "bugs". Please either bring the physical object or a photograph associated with at least one of your "bugs" to class to share with others during class. Identify, by putting the appropriate letter beside it, which of your bugs, if solved, potentially leads to a new feature (F), vs. a new product (P), vs. potentially a new company (C). **Read:** Delta Design Task (on bCourses). **At the end of class we will train** for Delta Design Game. Roles will be assigned in class. The game will be played in class on <mark>8/31 or 9/2.</mark>
3 W 8/31	**Delta Design Game** You should have prepared for the role assignment you were given in class on Friday 8/26. Make sure that you thoroughly understand the role you are to play. Prepare any materials you believe you will need to play the role. **DO NOT discuss** 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 and the photo must be submitted at the end of class. **Re-read:** Delta Design Task and Role (on bCourses).
4 F 9/2	**Design Context, Mission and Planning** Product planning involves developing a strategy for your product or service in the context of your organizational goals, skill-sets and resources. The Triple Bottom Line refers to considering three components to an organization's bottom line: profit, societal benefits, and environmental impact. Students break up into MEng Capstone teams or equivalent to set initial goals for their project within the context of this class. Begin work on identifying relevant technologies for a technology roadmap. During this class session, we will talk about team dynamics and interactions as being critical to new product development success. We will first start with a review of Delta Design then relate to the role of product managers, engineers, industrial designers, marketers and others in multidisciplinary teams. You will be given team launch exercises to work on during the class. **Read:** Collaborative Plan on bCourses (start on your individual plan to bring to class) **Read:** "The Trouble with Teamwork" on bCourses <mark>Read: reference on technology roadmaps.</mark> **T-1. Project Check-in:** Mission statement and value proposition, project plan (timeline for project assignments) and collaborative plan. This can be uploaded at the end of the class or before the next class if you need more time.
II. MODULE ON DESIGN RESEARCH
5 W 9/7	**Customer and User Needs Assessment** An introductory overview will be provided for a range of user design research methods. More details on specific methods will be provided in future classes. We will then work on developing a customer/user needs assessment plan that answers the following questions: • Who is your customer and is there an early adopter segment of your customer base? • How will you access your customers and how should your approach differ in a start-up vs. large company context? • What methods will you use to collect information (e.g., interviews, observations, surveys)? • What types of information will you gather? • How reliable is customer feedback in the early stages of development and how should it affect your decision-making? • How will you document your information gathering (e.g., notes, audio recording, photos)?

	You will have time to compare notes with your team members on the use of interviews for this purpose. **Read:** <mark>Assignments from theDesignExchange</mark> **Watch Video**: Getting People to Talk: An Ethnography & Interviewing Primer, http://vimeo.com/1269848http://vimeo.com/1269848 http://vimeo.com/1269848 **I-3. Individual Assignment Due:** Choose a product or service 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 or service 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 <u>interpret the data in terms of customer needs as described in</u> <mark>Analyze of theDesignExchange</mark>. **Pay particular attention to the guidelines provided for translating customer statements into needs statements.** Prepare a one-page summary of what you have learned about the interview process. Submit the transcript of the interview, interpretation of customer needs and your page of lessons learned to the assignments tab under customer interview.
6 F 9/9	**Guest Speaker from Industry <mark>(Portigal?)</mark>** **Read:** "Five Keys To Successful Design Research", http://www.core77.com/hack2work/2009/09/five_keys_to_successful_design.asp **T-2. Project Check-in:** Submit your Customer/User Needs Assessment Plan. This can be uploaded at the end of the class or before the next class if you need more time. **Read:** <mark>Assignments from theDesignExchange</mark>
7 W 9/14	**Advanced Research Methods** **Read:** <mark>Assignments from theDesignExchange personas</mark> **Read:** An Introduction to personas and how to create them, http://www.steptwo.com.au/papers/kmc_personas/index.htmlhttp://www.steptwo.com.au/papers/kmc_personas/index.html
	III. MODULE ON ANALYSIS & SYNTHESIS OF DESIGN RESEARCH
8 F 9/16	**Frameworks for Understanding Customer Needs** In this class we will present different ways of analyzing customer 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. We will also have a guest entrepreneur from a current venture-backed startup who will discuss how he developed the customer needs assessment for his start-up and how it frames his current activities and milestones. Ajay Kshatriya from Biota Technologies will join the class. **Read:** <mark>Assignments from theDesignExchange</mark> **Read:** "Get Inside the Lives of Your Customers" on bCourses. **Read:** Turn Customer Input into Innovation, http://hbswk.hbs.edu/archive/2815.htmlhttp://hbswk.hbs.edu/archive/2815.html
9 W	**Translating the Voice of the Customer (Creating Imperatives for Business Opportunities)** 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

9/21	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. An example from frugal innovation will be covered as an example in class. **Read:** Assignments from theDesignExchange **Read:** Bansal, Sarika. August 21, 2014. "Innovation Within Reach," New York Times, Opinion, http://opinionator.blogs.nytimes.com/2014/08/21/innovation-within-reach/ **Read:** "Consumer Insight Maps: The Map As Story Platform In The Design Process", http://piim.newschool.edu/journal/issues/2011/01/pdfs/ParsonsJournalForInformationMapping_Erwin-Kim.pdf
10 F 9/23	**Peer Review: Mission and User Needs** 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. Translate these needs into specifications and imperatives. 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, customers and others. You should continue to update your Mission Statement as you gather new inputs (archiving the old ones on the Website). 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 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.

	T-3. Project Deliverables Due: Updated value proposition, updated customer/user needs analysis and, based on the latter, updated market hypothesis for further testing, As with all project deliverables, include a team short discussion of the process you used, lessons learned, and any observations you have about your team.
	IV. MODULE ON CONCEPT GENERATION & DEVELOPMENT
11 W 9/28	**Concept Generation: Creativity & Brainstorming** 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. **Read:** ==Assignments from theDesignExchange== **Read:** "Creative Thinking Techniques" (http://www.virtualsalt.com/crebook2.htm) **I-7 Individual Assignment Due:** Each team member is to INDIVIDUALLY generate 10 concepts and post to your website and bring to class. A "half-sheet" form will be provided on bCourses for you to use. ==Also each team member is to individually fill out the surveymonkey form at:== https://www.surveymonkey.com/r/7ZPZRTP **T-4. Project Check-in:** Submit your concepts to your team folder and the clustering exercise you did in class. Upload a spreadsheet of your collective concepts to your project folder. Add any new ones from the class activities today or before the next class if you need more time.
12 F 9/30	**Concept Generation: Structured Methods** This class will focus on structured methods for concept generation, such as Morphological Matrices, Functional Decomposition, etc. After reviewing your teams' original 10 individual concepts, double the number through brainstorming and structured methods (e.g., for a team of 5, you should strive for a total of 100 concepts). **Read:** ==Assignments from theDesignExchange== **Read:** "Morphological Charts", http://www.ifm.eng.cam.ac.uk/dmg/tools/concept/morph.html http://www.ifm.eng.cam.ac.uk/dmg/tools/concept/morph.html **Scan:** "Creax Function Database", http://function.creax.com/http://function.creax.com/ http://function.creax.com/ **T-5. Project Check-in:** Double the number of concepts through brainstorming and structured methods. After class in your next team meeting, expand your concepts using both brainstorming and structured methods and a spreadsheet with all of the concepts generated. We recommend that they be clustered into theme areas. A team of 5 should expect to have around 100 concepts. Upload an updated spreadsheet of your collective concepts to your project folder. Also submit any metaphors and related concepts generated during in-class exercise. Upload to bCourses before the next class.
13 W 10/5	**Biomimetic Design and Design for the Environment** We will be joined by guest speaker Jeremy Faludi, a specialist in sustainable design, http://www.faludidesign.com Whole Systems Design 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? The focus will be on how sustainability can be a driver for innovation. This class starts with an introduction to Whole Systems Mapping method. You will use an abbreviated version of it to reframe your product and consider new design strategies. You will also be

introduced to biomimicry methods.   You will use an abbreviated version of it to generate sustainable redesign ideas for your product.   Class will be spent with you learning the method and performing it on your product, in your teams.

Optional: To fully perform the method, you can use a free trial of life-cycle assessment software http://www.sustainableminds.com to perform the steps not done in class.

Read: <mark>Assignments from theDesignExchange</mark>

Read: from bCourses: Kambrook Kettle case study: "Mainstream appliance meets eco-design" (*Journal of Sustainable Product Design*)

Scan: "Biomimicry Institute", http://www.biomimicryinstitute.org/http://www.biomimicryinstitute.org/ http://www.biomimicryinstitute.org/

View Video: Janine Benyus TED talk: Biomimicry in action.   https://www.ted.com/talks/janine_benyus_biomimicry_in_action?language=en#

Optional:

- Designing Cradle to Cradle Certified Products for the Circular Economy: http://education.c2ccertified.org/lms/

 - Life-Cycle Assessment Primer by Jeremy Faludi and Adam Mentor: http://faludidesign.com/MCAD_images/LCA_Primer_Autodesk-SWorkshop_Final.pdf

- Autodesk Sustainability Workshop: http://sustainabilityworkshop.autodesk.com

- Autodesk Sustainability Workshop pages on biomimicry: http://sustainabilityworkshop.autodesk.com/products/biomimicry

T-11b. Project Check-in: Take photos of your table during the workshop, at the end of every activity.   Turn in the photos you took.

14 F 10/7	**Concept Selection and Testing** Chapter 8 describes concept screening and concept scoring matrices as a means of selecting among competing ideas for products you might develop. We will also introduce you to start-up concepts of product market fit assessment and continuous iteration via the build, measure, learn loop, which help to structure the on-going efforts of entrepreneurs in a startup. Appropriately adapted, these concepts are equally useful in the new product definition context. **Read:** <mark>Assignments from theDesignExchange</mark> **Read:** "Extremely Rapid Usability Testing", (http://grouplab.cpsc.ucalgary.ca/grouplab/uploads/Publications/Publications/2009-ERUT.JUS.pdf) **I-8. Individual Assignment:** Review and list your prioritized list of your top 5 needs. Identify 2 competitive products that best meet these 5 needs for a benchmarking exercise in class. Upload to bCourses as an individual assignment and bring to class to share with your team. **T-7. Project Check-in:** You should now have 80 concepts for a 4 person team and 100 concepts for a 5 person team. These should be in your project bCourses/Concept Generation folder. By class time you should have organized the concepts you have to date into a spreadsheet, removing redundant or infeasible ones. You should also have a prioritized list of your top 5 needs. If your users haven't prioritized triple bottom line needs to the top list, include those that your team feels is important. In class today, your team will have an opportunity to build on the individual concept selection assignment. Upload your combined matrices to the project bCourses/Concept Selection folder.
15 W 10/12	**Product Architecture and Product Platforms** 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 image 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. **Read:** <mark>Assignments from theDesignExchange</mark>
16 F 10/14	**Design Roadmaps** Design Roadmapping parallels existing product roadmapping and technology roadmapping processes. It leverages three needs we have observed in organizations as they use existing roadmapping processes: (1) to focus on development of customer and user experiences, not just on features; (2) to increase engagement of designers early in the planning process; and (3) to provide a means for rapidly responding to changes in the environment. Design Roadmapping is an attempt to reconcile differences that arise when customer/user needs are not considered simultaneously with technology choices. The proposed Design Roadmapping process assists project prioritization and selection. The process aggregates design experience elements along a timeline that associates key user needs with the products, services and/or systems the organization wishes to deliver. The five-step Design Roadmapping procedure is provided along with detailed information. The decisions from the Design Roadmapping process have been incorporated into the company's commercial plans. We will present case studies of design roadmapping in industry then allow teams to apply to their own capstone project. A longer workshop will be scheduled for teams who want to further develop their design roadmap. **Read:** E. Kim, S. Beckman, J. Chung, A.M. Agogino, "Design Roadmapping: A framework and case study of planning development of high-tech products in Silicon Valley," ASME DETC, 2016.
	V. MODULE ON PROTOTYPING AND BUILDING
17 W 10/19	**Prototyping: Low-Fidelity** We will introduce tools and techniques for prototyping and testing your product concepts. Bring to class more discarded items that would normally go to landfill to add to our supply of prototyping materials. **Read:** <mark>Assignments from theDesignExchange</mark> **Read:** "Prototyping Is The Shorthand Of Design", http://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdfhttp://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdf **T-6. Project Check-In:** Submit photographs of any prototypes you create in-class.
18 F 10/21	**Medium to High Fidelity Prototyping** Review of low and high prototyping methods. We will have guests present examples of medium to high fidelity prototyping. We expect all students to be familiar with solid modeling. If you do not, we will offer special workshops. **Read:** <mark>Build Methods on theDesignExchange:</mark> https://www.thedesignexchange.org/design_methods/method_category/2 **Read:** Sandhu, Jaspal S. "Measure early, measure often: rapid, real-time feedback in design for social innovation". Jan. 2013: http://poptech.org/e3_jaspal_sandhu
19 W 10/26	**Guest Speaker from Industry**

20 F 10/28	**Animations I** We will be joined by guest speaker Professor Dennis Lieu you will provide a module allows you to build on solid models to create animations with 3D Studio.
21 W 11/2	**Animations II**
22 F 11/4	**Animations III**
23 W 11/9	**Animations IX**
F 11/11	**Non-instruction Day (Veterans Day)**
24 W 11/16	**CAD to Systems Design and Analysis** **T-X Animation Deliverable**
VII. VISUALIZATION & COMMUNICATION	
26 F 11/18	**Communicating Actionable Design Research** This starts our module on methods and tools for communicating actionable design research., design results that can have impact. (Liz Goodman, guest speaker?) **Read:** Roschuni, C., E. Goodman, A.M. Agogino, "Communicating Actionable User Research for Human-Centered Design, Special Issue on Studying and Supporting design Communication, *Journal of Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, Vol. 27 (Special Issue 02, 2013), pp. 143-154. doi:10.1017/S0890060413000048. (on bCourses) **Read:** Communicate Methods on theDesignExchange:
W 11/23-25	**Non-Instructional Day (Thanksgiving)**
27 W 11/30	**Visualization and UX Design** Design portfolio exercise.
28 W 12/2	**Studio: Presentations, Storytelling and Pitching** As you approach the end of the semester, you should start thinking about how you will communicate your project outcomes to clients and potential invenstors. In this session we'll review good presentation and storytelling techniques, and let you start practicing applying them to your capstone

	projects. Be prepared to pitch your product today as a class exercise. **Read:** Chapter 1, "What Sticks?" in *Made to Stick,* http://www.heathbrothers.com/download/mts-made-to-stick-chapter1.pdf (you may need to register for free)
29,30 W/F 12/7/9	**Reading Review Recitation Week** Teaching staff will be available ==Presentations during Design Showcase?== Prepare a 10-minute presentation that describes your final product that will convince the judges that there is a viable market for your product, and that your proposed solution will be successful in that market. Remember that most of the judges will not be familiar with your project at all, never having seen any of your previous work, so you have to tell them a story about why there's a need, how you focused on the customer to discover the detailed needs, and how you benchmarked and explored a wide range of potential solutions to come up with the best product. The presentation should be of the quality to convince a top management group to purchase the rights to your product or a venture firm to fund its development and launch. An effective presentation includes a slide presentation along with a display of a working prototype. Be sure to include all areas covered in the judging form (to be posted on bCourses). Typical questions a judge might want answered. • How did you come up with this idea? • Who are the competitors and what products are out there now? • What need or needs are lacking in the current products out there? • Is there a large enough market for your product to make it successful? • Define what success is – financial, societal, environmental, etc. • What are your costs and can you make a reasonable profit, or if a non-profit, is it viable financially? • What ideas did you discard, and will your final product idea meet the customer needs? What made you decide on that idea?
Th ==12/12== 3-6 pm	**Final Reports (Online or in-Person 415 Sutdarja Dai Hall)** ● **==I-12. Individual Deliverables*: Design Portfolio==** ● **T-16. Final Project Deliverables:** Turn in your final presentation (or the documentation of your tradeshow display), summary report (no more than 10 pages), photo of your prototype and/or the actual prototype, if appropriate. As required for all Project Deliverables, include a team lessons learned as well.