V. 10

ME110 Spring 2016

Introduction to Product Development

Class Schedule and Assignments

Alice M. Agogino (Mechanical Engineering) and Michael Borrus (Haas School of Business)

TEXTBOOK AND OTHER REQUIRED MATERIAL

The primary reading material for the class is the textbook: Karl Ulrich & Steve Eppinger. *Product Design and Development, fifth or sixth edition.* All students are expected to read the full text of all assigned readings (rental, digital and used hard copies available). Most of the additional readings will be available for free on the web or through bCourses.

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
1 T 1/19	**Introduction to New Product Development (NPD), Innovation and Entrepreneurship** 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. We will also introduce several start-up companies with new product development opportunities interested in participating in class and suggest other work on campus from which class projects might be sourced. **Read:** Ch. 1: Introduction to Product Design and Design Thinking **Read:** Bansal, Sarika. August 21, 2014. "Innovation Within Reach," New York Times, Opinion, http://opinionator.blogs.nytimes.com/2014/08/21/innovation-within-reach/ **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=fUz09EkIm64 **I-1. Individual Assignment Due:** Complete student profile survey at: https://www.surveymonkey.com/r/SKD6GZ3
2 Th 1/21	**Design Thinking Exercises** We will use waste material for a design project in a studio session today. 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 following thought questions: What role does technological research play in the product development process?. 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? Can design thinking be extended to

	a business concept as a whole? How might design thinking affect the activities of entrepreneurship? **Read:** Ch. 2: Development Processes and Organizations **Read:** Dumpster diving: an Introduction, http://www.kuro5hin.org/story/2003/1/29/215523/088
3 T 1/26	**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-id **Read:** "Designing for Humans: an Ethnography Primer," IDSA, 2010: http://www.aiga.org/ethnography-primer/ **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) (see below for more info on this typology). 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". **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 2/4.
4 Th 1/28	**Design Context, Product Planning and Defining a Venture-Backable Market Opportunity** Product planning involves developing a strategy for your products 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. Which of these matter in a start-up context? What makes for a good venture-backable startup idea? How are initial market opportunity hypotheses developed? Be prepared to discuss the components of a Mission Statement and how it might reflect the components of a Triple Bottom Line. **Read:** Ch. 4 Product Planning **Scan:** Google Preview of *The Triple Bottom Line*, Andrew Savitz and Karl Weber, http://bit.ly/npd-tbl **I-3. Individual Assignment Due:** Complete the Kolb learning styles survey available through a link that will be sent to you by email on 1/26. **I-4+. Optional Individual Assignment Due:** Project proposal (PDF format) as a one page document is due by class time. If you receive instructor approval to pitch, 3 slides of your proposal are **due by noon on 2/1** in order for us to compile and post for use on 2/2. Details of the required format and content are described below for 2/2 – but **due to us by noon on Monday 2/1**. Students who have an opportunity they would like to pitch are encouraged to meet with the instructors even earlier, at the start of the semester. (Note, students who do this optional assignment will be given credit for one more assignment.)

	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 and whether you think it presents a venture-backed start-up opportunity. 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 **not** 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. Your judgment about whether the opportunity could lead to a startup should be based on concepts developed earlier in class. Do not attempt to justify your judgment at this point – you will get a chance to reconsider down the road when we cover the issue of how to judge the venture-backability of a given market opportunity. **These proposals will be posted to a location where all participants in the class can see them.**
5 T 2/2	**Proposal Presentation and Voting** Faculty, company sponsors and students will be given an opportunity to pitch their project ideas in the studio. Details of the presentation below. **I-4+. Optional Individual Assignment Due:** Project proposal (3 slides **due by noon on 2/1** and presented today), 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 **NO LATER THAN noon on Monday 2/1** so that we can get the full presentation assembled for the studio today. **I-5: Project Preferences due by midnight, Wednesday, February 3. Via a surveymonkey form,** 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, 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 bCourses. 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.
6 Th 2/4	**Delta Design Game** You should have prepared for the role assignment you were given in class on Tuesday 1-26. 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).
7 T 2/9	**Project Launch** 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. We'll then 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 exercises to work on during the class. Be sure to bring your MBTI profile to class. **Read:** Collaborative Plan on bCourses (start on your individual plan to bring to class) **Read:** "The Trouble with Teamwork" on bCourses **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.
8 Th 2/11	**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:** Ch. 5: Identifying Customer Needs **Read:** An Introduction to personas and how to create them, http://www.steptwo.com.au/papers/kmc_personas/index.html **Watch Video**: Getting People to Talk: An Ethnography & Interviewing Primer, http://vimeo.com/1269848 **I-6. 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 5. **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.

9 T 2/16	**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:** "Get Inside the Lives of Your Customers" on bCourses. **Read:** Turn Customer Input into Innovation, http://hbswk.hbs.edu/archive/2815.html **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.
10 Th 2/18	**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. 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.
11 T 2/23	**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 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. We will again have a guest entrepreneur from a current venture-backed startup who will discuss how he translated the voice of his customers into the design of his first physical storefront and associated mobile app. Sam Ulloa from Listo Financial will join the class. **Read:** Ch. 6: Product Specifications
12 Th 2/25	**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. **Scan:** Ch. 7: Concept Generation **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.
13 T 3/1	**Concept Generation: Structured Methods** This class will focus on structured methods for concept generation, such as Morphological Matrices, Functional Decomposition, Biomimetic Design, etc. **Read:** The required reading for before class today will be sent via an email with an individualized link. This will be sent by 2/25. **Scan:** "Creax Function Database", http://function.creax.com/ **Scan:** "Biomimicry Institute", http://www.biomimicryinstitute.org/ **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.
14 Th 3/3	**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. **Scan:** Ch. 14: Prototyping **Read:** "Prototyping Is The Shorthand Of Design", http://www.ideo.com/images/uploads/news/pdfs/Kelley-Prototyping_Shorthand_DesignSummer-01.pdf **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 **T-6. Project Check-In:** Submit photographs of any prototypes you create in-class.
15 T 3/8	**Concept Selection, Prioritizing Risks and Defining Milestones** 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:** Ch. 8: Concept Selection **I-8. Individual Assignment:** Identify a 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.
16 Th 3/10	**Concept Testing and Market Validation** Chapter 9 describes how you can go further in testing the top concepts with low fidelity prototypes. We will also have a guest entrepreneur from a current venture-backed Web startup who will discuss how she developed and is validating design concepts for her start-up's website. Amanda Bradford from The League will join the class. **Read:** Ch. 9: Concept Testing **T-8. Project Check-in:** In class we will do an exercise to help you to identify your top 3-5 concepts for concept testing next week on 3-15. We will also ask you to identify and rank order the key business risks associated with your top 3-5 concepts. Which risk should you try to take off the table as your first milestone?
17 T 3/15	**Studio: Midterm Tradeshow on Concept Testing and Market Validation** **I-9. Individual Assignment Due: I-9. Individual Assignment Due:** Complete the on-line peer review and team assessment survey, as well as the Concept Generation survey (https://www.surveymonkey.com/r/7ZNQ7DV), as per instructions on bCourses. This can be

completed by Thursday, 3/17.

T-9. Project Deliverables Due: Updated mission statement, customer/user needs data, market hypothesis, 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 and value proposition
    - Target market and market hypothesis
    - 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 noon on Monday 3/14**. 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 or design principles
- Business risk prioritization and next milestone
- 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.
18 Th 3/17	**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:** Ch. 10 Product Architecture
	Spring Break 3/21-25
19 T 3/29	**Team Feedback** This class session will be dedicated to giving you the feedback from your team survey and letting you process that feedback with your team. **T-10. Project Check-in:** Update your collaborative plan and upload to bCourses prior to the next class.
20 Th 3/31	**Low vs. High Fidelity Prototyping** Review of low and high prototyping methods. **Re-Read:** Ch. 14: Prototyping **Scan:** Build Methods on theDesignExchange: https://www.thedesignexchange.org/design_methods/method_category/2
21 Tu 4/5	**Design for Environment 1: DfE Design Methods** We will be joined by guest speaker Jeremy Faludi, a specialist in sustainable design, http://www.faludidesign.com 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? This class is the first of two workshops on sustainable design methods. It introduces you to The Natural Step. You will use an abbreviated version of it to reframe your product and consider new design strategies. **Read:** from bCourses: Kambrook Kettle case study: "Mainstream appliance meets eco-design" (*Journal of Sustainable Product Design*) **Read:** Ch. 12: Design for Environment **Optional:** Designing Cradle to Cradle Certified Products for the Circular Economy, http://education.c2ccertified.org/lms/ **I-10a.** This homework is in two parts; each part is due soon after class on Tuesday and Thursday. This

	homework is a survey on your experiences of the two green design workshops to be held this week. Your responses are not graded; you will get full credit if you just finish the surveys. Please do the survey twice--once for each workshop. You can find it here: http://tinyurl.com/ME110feedback. We would prefer that you do the survey for the Tuesday workshop as soon as possible after class on Tuesday. Same for the Thursday workshop. Both should be done no later than Friday, Apr 10, 11:59pm. The survey is at: http://tinyurl.com/ME110feedback **T-11a. Project Check-in:** Take photos of your table during the workshop, at the end of every activity. Turn in the photos you took. Please clearly name the files "Workshop_1_Step_1", "Workshop_1_Step_2", etc. If you have extra images, you can label them "Workshop_1_Step_1a" or as you see fit.
22 Th 4/7	**Design for Environment 2: Whole Systems Design Method** This is the second workshop on sustainable design methods. It introduces you to the Whole Systems + Life-Cycle Thinking method to design for sustainability. You will use an abbreviated version of it to generate sustainable redesign ideas for your product. You will have watched the video about the process before class; your questions will be answered and a brief lecture will summarize the method. Most of class will be spent with you performing the method 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. View Video: Whole Systems And Lifecycle Thinking http://academy.autodesk.com/library/whole-systems-sustainability/whole-systems-and-lifecycle-thinking Read: Life-Cycle Assessment Primer by Jeremy Faludi and Adam Mentor: http://faludidesign.com/MCAD_images/LCA_Primer_Autodesk-SWorkshop_Final.pdf **I-10b.** After class, no later than Friday, Apr 8, 11:59pm, remember to redo the survey at: http://tinyurl.com/ME110feedback **T-11b. Project Check-in:** Again, take photos of your table during the workshop, at the end of every activity. Turn in the photos you took. Please clearly name the files "Workshop_2_Step_1", "Workshop_2_Step_2", etc. If you have extra images, you can label them "Workshop_2_Step_1a" or as you see fit.
23 Tu 4/12	**Design for Production; Design for Scaleability** Whether you are designing a manufactured good, virtual product, software or service, product development teams must consider the produceability of their design and whether or not it can be scaled to their addressible market. Design for produceability originated in design for manufacturing concepts of the last century, and is one of the many "design fors" that a product development team must consider. 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 13, Design for Manufacturing. Be prepared to perform a class exercise in design-for-assembly. **Read:** Ch. 13 Design for Manufacturing
24 Th	**Assessing Entrepreneurial Opportunity: Market Quantitation, and Growth Trajectories** This week we take a step back to begin the assessment of whether your project might be turned into an actual start-up business and whether that business could be venture-backed. We'll cover basic

4/14	principles of quantitative market assessment (TAM, SAM and SOM), market structure, competitive dynamics and growth trajectories. How do you go about sizing a market and its growth prospects? Why are new technology markets particularly difficult to assess? What kinds of markets can support venture growth trajectories? **Read**: • Blog post by by Shyam Jha, Cayenne Consulting, October 21, 2013 on TAM/SAM/SOM at: http://www.caycon.com/blog/2013/10/understanding-market-size-or-demystifying-tam-sam-and-som/ • Christopher Steiner, "Pop goes the algorithm, " The Futurist v.47, June, 2013, at: http://www.wfs.org/futurist/2013-issues-futurist/may-june-2013-vol-47-no-3/pop-goes-algorithm **T-12. Develop a hypothesis about whether your project presents a business opportunity best characterized as a feature (F), product(P) or start-up Company (C).** In no more than one page of bullet points, present your hypothesis, describe what quantifiable market data would permit you to test your hypothesis, and answer (yes or no) whether, by reference to growth trajectory concepts, you believe your project idea is venture-backable. Do no actual quantification or market research beyond that done in earlier classes. Instead, this exercise is intended to get you to think about what kinds of data would be useful in assessing the kind of business opportunity your project represents – not to search for that data.
25 T 4/19	**Testing and Refinement: Robust Design** 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. **Read:** Ch. 15 Robust Design *In-class exercise: Taguchi method*
26 Th 4/21	**Entrepreneurship, Business Models and the Start-Up Ecosystem** There are many different business models that underlie successful entrepreneurial ventures, only some of which rely on traditional concepts like intellectual property protection. What kind of business model is appropriate for your project, if you were to transform it into a real entreprneurial venture? Can and should your project be protected as intellectual property ? We will have a preliminary business model canvas for your project. We will be assisted by experts from industry in business models and strategy, Sue Cook, Bill Crandall and Mike Northcott at Spearfish Innovation will join us. **Read:** UC Berkeley Disclosure Form, http://ipira.berkeley.edu/invention-disclosure-informationhttp://ipira.berkeley.edu/invention-disclosure-information **Read:** Business Model Canvas, http://www.businessmodelgeneration.com/canvas **T-13: Project Check-in Business Model Canvas**: Upload the business model canvas you developed during class.
27 T 4/26	**Product Development Economics and Costing** In this class we will go over basics of engineering economics and product costing. We will be joined by Dr. Mark Martin, President of Design4X. **Read:** Ch. 17 Product Development Economics **T-14. Project Check-in:** Financial models and manufacturing costing, triple bottom line strategy. Turn in before the next class.

28 Th 4/28	**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 the judges who will be present at the final tradeshow. If your team also believes that your project is the potential basis of an entrepreneurial start-up, you will also want to think about how to pitch to investors.. In this session we'll review good presentation and storytelling techniques, and let you start practicing applying them to your 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) **Read:** Make Your Presentation Stick, http://www.heathbrothers.com/download/mts-making-presentations-that-stick.pdf (you may need to register for free)
29 Tu 5/3	**Reading Review Recitation Week** We will be holding office hours to give you feedback on your project this day**.** Meeting with us is optional.
30 Th 5/5	**Project Presentation** We will hold a final tradeshow on this day from 10:00 am – 2:00 pm (10:-11:00 am set-up; 11:00 am - 1:00 pm tradeshow; and 1:00-2:00 pm cleanup) . You will have an opportunity to present your final project to the class and to external judges. **T-15. Team Deliverables:** As with the midterm tradeshow prepare a three-slide summary of your project. Include Mission/ Value Proposition, Market Opportunity and final Product or Service. This is due on W 5/4 by noon. Include documentation for the following directly after the tradeshow, details below: Your tradeshow "booth" presentation can be of any form, but should describe 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 some kind of visual 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, market hypothesis and business model 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 address the needs and differentiate your product o Triple bottom line analysis: financials, societal and environmental o A demonstration of your product prototype o A list of the most important lessons you learned about the NPD process and teams **I-11. Individual Deliverables*:*** Turn in the journal you have been keeping throughout the semester. It will be returned after grading. Note rubrics for grading are on bCourses.
Th 5/12 3-6 pm	**Final Reports (Online or in-Person 415 Sutdarja Dai Hall)** • **I-12. Individual Deliverables*:*** Complete the team evaluation survey to be sent individually by email. • **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.