CE 499: SPECIAL TOPICS: INNOVATION IN ENGINEERING DESIGN FOR GLOBAL CHALLENGES II

Instructors	**Coordinator**
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Units: 3
Spring 2019 Syllabus (Part 2)
Thursdays, 7:00pm – 9:50pm, VPD 105

1. COURSE DESCRIPTION

Today, there are numerous global crises that challenge the world and devastate populations, such as the refugee crisis with massive impact on higher education, economy, health and so on. Engineering innovation plays a critical role in solving many of the challenges brought about by these global crises. This course aims to teach engineering students how to lead the design of products, services and technologies with a human-centered approach to help solve the needs of the real people who are in the middle of these crises. The course is geared towards students who would like to create new solutions, are comfortable with focusing on wicked problems, and care about cultural, economic and geographic nuances. The course is built on the principles of "create, collaborate, innovate." The course provides students with an understanding of the design process, research methodologies and innovation strategies using a team-based project work through the process of observation, visualization, rapid prototyping and iteration.

This course has two parts: Part 1 (Fall semester) and Part 2 (Spring semester). Over the course of one year, several contributors (USC students in Los Angeles and refugees in a host nation) will form a taskforce to seek at least four life-saving or life-improving innovations aimed at the most vulnerable and hardest-to-reach people impacted by the refugee crisis. These innovations will involve connection to the private sector and input from affected communities in order to provide, supply, or locally generate solutions such as: safe drinking water and sanitation, provision of energy, education, life-saving information, shelter or services to help refugees living in camps and in urban squats.

2. LEARNING OBJECTIVES

Instructors will teach the students the process of product innovation, prototyping, fabrication and building sustainable business models in the initial stages of the course, then continue to mentor and guide teams as they are working on their projects. In this course, students will learn:
- The process of product/service development
- Design thinking and systems thinking approaches to development
- Identifying and validating a product need and use case via user research
- Prototyping concepts for user research and validation
- Building a Minimum Viable Product (MVP)
- Designing for manufacturing
- Understanding the product life-cycle
- Developing a sustainable business model
- Learning how to effectively use global collaboration tools and techniques
- Fundraising/crowdsourcing to fund product development
- Sourcing and managing prototyping and manufacturing vendors
- Rapid prototyping techniques and methods
- Building bill of materials

- Product distribution
- Entrepreneurship in restricted environments/lack of resources

3. METHODS OF TEACHING
A combination of design feedback sessions, lectures, hands on software sessions, experiments with new technologies and discussions. Guest lecturers may also be brought in to provide specialized guidance on specific topics to one or all of the teams. Additional out of class time required for team-based project work, course assignments and reviewing relevant material. Teams are expected to meet and collaborate outside of class, both in person as well as virtually with their global team members. Each team will share their progress, prototypes, findings, and challenges with the entire class weekly, while instructors mentor the teams and help them solve the challenges they encounter at each stage of development. The rest of the class will also participate in helping teams define the need for their product and work through development challenges.

4. ATTENDANCE
Continuous attendance is critical for success in this class in order to ensure that teams continue making progress on the development of their products. Attendance is part of the evaluation criteria. If a student misses a class, it is his/her responsibility to ask at the next class what he/she missed or find out about topics covered.

5. CLASS PARTICIPATION
Participation in the class is part of the evaluation criteria. This is a highly interactive class. There is continuous interchange between the instructors, guest lecturers, students and refugees. Questions and participation in discussions are highly encouraged.

6. CLASS COMMUNICATION
As teams will involve contributors outside USC without access to USC resources, teams will make use of free-to-use, globally available collaboration software including: Skype, Slack, Google Docs, Trello, Google hangouts and WhatsApp.

7. COURSE COORDINATOR
Due to the special needs of this course, Mr. Daniel Druhora will act as the coordinator for this course. His role and responsibilities include handling administrative tasks, coordinating stakeholders, logistical planning for travel and communication. He could be reached at: druhora@usc.edu

8. OFFICE HOURS
Instructors' Office Hours: Instructors will be available via email and course communication tools.

9. REQUIRED TRAVEL
This course will involve travel to overseas locations, which will be announced at the beginning of the semester. At least one of these trips will include a visit to a refugee camp (e.g., in Greece or Turkey).

10. ADDITIONAL RESOURCES
Due to the special nature of the course, several individuals/groups will also contribute to the class in addition to the instructors, course coordinator, students and refugees. These will include additional academic, industry/NGO advisors, as well as marketing and communication support. Student Clubs, such as Spark SC, Engineers Without Borders, will also provide support to the course.

11. RECOMMENDED READING
- Design of Everyday Things, Don Norman
- The Lean Startup, Eric Ries
- Engineering for sustainable human development: A guide to successful small-scale development projects, Bernard Amadei

- Ten Principles of Good Design, Dieter Rams
- Convivial Toolbox: Generative Research for the Front End of Design, Liz Sanders
- The Field Guide to Human-Centered Design, by IDEO.org,
  http://www.designkit.org//resources/1
- Designing for People, Henry Dreyfuss

12. ASSIGNMENTS
Weekly Assignments: Please check the weekly schedule

Midterm Assignment:
> **Product to date:** Each team will present their product to date to the class
> **Report:** Each team will submit a short report summarizing their findings about user testing & validation, design refinement stages to date, product life-cycle map, and bill of materials

Final Assignment:
> **Final Product:** Production or pre-production model (your final prototype but made with low production techniques; might cost more otherwise it should look and function like the final product)
> **Business Plan & Pitch:** How you will get your product to distribution? (scalability, manufacturing plan, distribution models, business plan) and the pitch (the narrative behind the product, the story of real users using real products)

It is crucial that students turn in whatever they have on the due date. NO assignment will be accepted late. Assignments are due the beginning of the class as specified in the class schedule below. An incomplete grade will only be issued when a student is unable to complete the work because of documented illness. A letter from your physician will be required documentation.

It is important to note that each student will have a "Design Journal" in which they document their validation and decision process at every step, focusing on their processes. This journal will be submitted with reports, presentations, prototypes, etc. as outlined below.

13. GRADING SCHEMA
Individual's attendance & participation in class discussions: 10%
Weekly deliverables: 30%
Midterm: 30%
> Product to date: 15%
> Team report: 7%
> Individual's design journal: 4%
> Peer evaluation for team work: 4%

Final: 30%
> Final Product: 15%
> Business Plan & Pitch: 7%
> Individual's design journal: 4%
> Peer evaluation for team work: 4%

TOTAL: 100%

14. GRADING CRITERIA
It is important to note that the grading will not be primarily based on the ultimate success of the project, but on the development process, ability to learn from failure and adjust, and ability to work as a team both locally and with the global counterparts. Successful project teams will include both individuals who understand the unique context of the refugee crisis in a given nation, and those who are capable of developing, testing, refining and transitioning to scale their innovation to produce transformative impact. Projects are expected to take an integrated innovation approach, defined as the coordinated application of

scientific/technological, social and business innovation, to develop solutions to complex challenges. This approach does not discount the singular benefits of each of these innovations alone but highlights the powerful synergies that can be realized by aligning all three.

15. CLASS STRUCTURE & SCHEDULE:
* Class sequence, dates topics and guest speakers are subject to change.

PART 2: SPRING SEMESTER			
#	**Date**	**Topics**	**Weekly Assignments (Assignments are due the date they are listed)**
1	1/10	**RE-INTRODUCTION OF THE COURSE** (5 min by one person from each team) **LOGISTICS FOR THE SEMESTER** (Trip to Lesvos, grading criteria, expectations, etc.) **PRODUCT BRIEF INTRO** **PROTOTYPING / DESIGN ITERATION**	1. <u>Weekly deliverable lists</u> (development plan with concrete targets) for each of the next 5 weeks (through week 5) 2. <u>Describe what fidelity of model each team needs to test</u> (what are the required/non-differentiating features, what are the key differentiating features, what are all other features?) - 1 page
2	1/17	**PROTOTYPING / DESIGN ITERATION** Building a prototype: define what you are building - What is the specific purpose? - What are you testing/investigating/validating? - How long will it last?	3. Final product brief (to help defining the vision so the team has a unified vision of where they are going and to check if each step they take is moving them toward that goal) - 1 page 4. <u>Sketches, physical & digital prototypes, business plans/models</u> 5. <u>Prototype testing plan for Lesvos</u> - What will be tested? - How will we test? - What is needed? - How will we find users? - What data will we collect? - What are the evaluation metrics? - What needs to be arranged before we arrive?
3	1/24	**SYSTEMS THINKING** Business model, Manufacturing Distribution, Strategic partners (vendors, fabricators, assembly, distribution, sales, marketing, etc.), End of life thinking- How many uses does the product have? Can the product be repaired, how is it disposed of? Economics, Sustainability	6. <u>Sketches, physical & digital prototypes, business plans/models</u>

		PROTOTYPING / DESIGN ITERATION	
4	1/31	**USER TESTING/VALIDATION WITH MVP** Product use case evaluation Evaluation metrics Defining how the MVP will be tested What are you validating? **PROTOTYPING / DESIGN ITERATION**	7. <u>Final testing & evaluation plans (including the tasks for the team members staying)</u> 8. <u>Sketches, physical & digital prototypes, business plans/models</u>
5	2/7	**TRIP for USER TESTING**	9. <u>User testing</u>
6	2/14	**DESIGN REFINEMENT** Trip analysis: How did testing go? What did we learn? What are the next steps?	10. <u>User validation findings</u> and recommended refinement 11. <u>Weekly deliverable lists (development plan) for the next 5 weeks (through week 10)</u>
7	2/21	**CREATE A BILL OF MATERIALS** - How many parts? - What material are they made of? - Where does the material come from? - How is each part made? - What does each part cost? - What does each part weigh? - How will the parts be assembled? - How will the product be packaged? **PROTOTYPING / DESIGN ITERATION**	12. <u>Sketches, physical & digital prototypes, business plans/models</u>
8	2/28	**PROTOTYPING / DESIGN ITERATION**	13. <u>BOM (Bill of Materials)</u> 14. <u>Sketches, physical & digital prototypes, business plans/models</u>
9	**3/7**	**Midterm Assignment**	*Midterm:* **MVP ready**
	3/14	SPRING RECESS	
10	3/21	**MANUFACTURING** Sourcing Vendors Evaluating Vendors Managing Vendors **PROTOTYPING / DESIGN ITERATION**	15. <u>Weekly deliverable lists (development plan) for the next 5 weeks (through week 15)</u> 16. <u>Sketches, physical & digital prototypes, business plans/models</u>

11	3/28	**ECONOMICS** Manufacturing, Quality Control Packaging, Logistics (shipping), Product Distribution, Marketing, Sustainability (will the product be profitable enough to be worth the effort?) **PROTOTYPING / DESIGN ITERATION**	17. Sketches, physical & digital prototypes, business plans/models 18. Vendor criteria document/Vendor list/ Quotes/Vendor down selection
12	4/4	**REFINE PROTOTYPE & FINALIZE END-PRODUCT** Tweaking designs Scalability studies Distribution models Business plans Financing (crowdfunding; sales – are people willing to pay for it?)	19. Sketches, physical & digital prototypes, business plans/models 20. Final business plan (max 20 pages)
13	4/11	**REFINE PROTOTYPE & FINALIZE END-PRODUCT** Tweaking designs Scalability studies Distribution models Business plans Financing	21. Sketches, physical & digital prototypes, business plans/models
14	4/18	**REFINE PROTOTYPE & FINALIZE END-PRODUCT** Tweaking designs Scalability studies Distribution models Business plans Financing	22. Sketches, physical & digital prototypes, business plans/models
15	**4/25**	**Final project presentations & assessments**	
		Final Assignment	**Final* **is due on the schedule date of the final exam***

16. ACADEMIC RESPONSIBILITIES
Students with Disabilities
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. Your letter must be specific as to the nature of any accommodations granted. DSP is located in STU 301 and is open 8:30 am to 5:30 pm, Monday through Friday. The telephone number for DSP is (213) 740-0776.

Academic Integrity
The University, as an instrument of learning, is predicated on the existence of an environment of integrity. As members of the academic community, faculty, students, and administrative officials share the responsibility for maintaining this environment. Faculties have the primary responsibility for establishing and maintaining an atmosphere and attitude of academic integrity such that the enterprise may flourish in an open and honest way. Students share this responsibility for maintaining standards of academic performance and classroom behavior conducive to the learning process. Administrative officials are responsible for the establishment and maintenance of procedures to support and enforce those academic standards. Thus, the entire University community bears the responsibility for maintaining an environment of integrity and for taking appropriate action to sanction individuals involved in any violation. When there is a clear indication that such individuals are unwilling or unable to support these standards, they should not be allowed to remain in the University." (Faculty Handbook, 1994:20)

Academic dishonesty includes: (Faculty Handbook, 1994: 21-22)
1. **Examination behavior** – any use of external assistance during an examination shall be considered academically dishonest unless expressly permitted by the teacher.
2. **Fabrication** – any intentional falsification or invention of data or citation in an academic exercise will be considered a violation of academic integrity.
3. **Plagiarism** – the appropriation and subsequent passing off of another's ideas or words as one's own. If the words or ideas of another are used, acknowledgment of the original source must be made through recognized referencing practices.
4. **Other Types of Academic Dishonesty** – submitting a paper written by or obtained from another, using a paper or essay in more than one class without the teacher's express permission, obtaining a copy of an examination in advance without the knowledge and consent of the teacher, changing academic records outside of normal procedures and/or petitions, using another person to complete homework assignments or take-home exams without the knowledge or consent of the teacher.

The use of unauthorized material, communication with fellow students for course assignments, or during a mid-term examination, attempting to benefit from work of another student, past or present and similar behavior that defeats the intent of an assignment or mid-term examination, is unacceptable to the University. It is often difficult to distinguish between a culpable act and inadvertent behavior resulting from the nervous tensions accompanying examinations. Where a clear violation has occurred, however, the instructor may disqualify the student's work as unacceptable and assign a failing mark on the paper.

Return of Course Assignments
Returned paperwork, unclaimed by a student, will be discarded after a year and hence, will not be available should a grade appeal be pursued following receipt of his/her grade.

Statement on Academic Conduct and Support Systems

Academic Conduct:
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" https://policy.usc.edu/scampus-part-b/.   Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems:
Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. https://engemannshc.usc.edu/counseling/

National Suicide Prevention Lifeline - 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. http://www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.
https://engemannshc.usc.edu/rsvp/

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. http://dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. https://diversity.usc.edu/

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, http://emergency.usc.edu

USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.
Provides overall safety to USC community. http://dps.usc.edu