COURSE SYLLABUS

ISE545: Technology Development and Implementation
(a.k.a.: Open Technological Innovation in Competitive Global Market)

Spring Semester, 2016

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Course Sections: 31545D (on-campus) 31745D (off-campus)

Course Unit: 3 Units

Prerequisite: A graduate student standing in engineering is required (or with a special approval by the instructor). *This is a degree required course for MSPDE (Master of Science in Product Development Engineering)*

Class Hours: Thursdays, 2:00pm to 4:50pm

Class Location: USC Olin Hall of Engineering (OHE) 100C

Office Hours: 1:00pm to 2:00pm, on Thursdays
- Face-to-face meetings held in DRB-260
- Phone meetings via 213-740-8429

Teaching Assistant: TBD
Email: TBD
Office Hours: TBD
Location: TBD

1. The Background:

Technology has been the key driver of world economy over the past few decades. Much of the recent economic growths (and bubbles) are the direct results of successes (and failures) of new technological products, services, and systems developed by engineers in the laboratory and implemented by

entrepreneurs on the market. In today's technology-based society and highly globalized economy, understanding the technological innovation process from laboratory developments to market implementations under open environments and global competitions has become a key challenge for the entire engineering profession.

While the mother of inventions is the curiosity of few individuals, the mother of innovations is the demand of many customers. A well-developed technology that performs high functions in the laboratory without a successful implementation to satisfy some human purposes on the market cannot result in good economic returns to sustain further developments. Hence, the subject of "technology development and implementation" must be studied with an integrated approach that focuses on the dynamic interplays between technology development and market competition. This integrated approach to technological innovation is inherently interdisciplinary between the conventional engineering and business curriculum. Traditionally, engineering students study the innovation process from a pure technical (or development) viewpoint, whereas business students learn the social (or implementation) side of the innovation process. Such a divided and separated "development-vs.-implementation" approach makes it difficult for students to gain a comprehensive understanding of the complete technological innovation process from laboratory development to market implementation that is so important to their professional careers.

The learning objective of ISE545, Technology Development and Implementation, is to overcome the above deficiency by providing a complete, holistic, interdisciplinary, and integrated view of the open technological innovation process in a competitive global market. The course blends both market and engineering perspectives to understand open technological innovation under global market competitions. It explains the key concepts of open innovations that utilize technical means to develop new products and services to compete on the global market. ISE545 students will learn how to (1) understand the industrial dynamics of technological innovation, (2) formulate technological innovation strategies for companies, and (3) determine functional requirements of breakthrough products and services. Through lecture assignments, classroom discussions, case studies, and team debates, students will develop a deep understanding of the realities of industrial practice, and the complex roles played by members of a technological innovation team. In addition to academic theories, the course also provides practical methods and real-world cases that can be put into direct uses for various technological innovation endeavors from laboratory to market.

2. <u>The Subject</u>:

The subject of "open technological innovation in competitive global market", which students will learn in ISE545 in spring 2016, consists of the following ten key questions:

1. What is innovation, how it differs from invention, and what are the characteristics and different types of technological innovation?
2. How do market globalization and information technology impact on open technological

innovation?

3. How do innovation and competition interact with each other on an open competitive global market (the S-curves)?
4. What is "crossing the chasm" during the innovation process (standard battle and dominant design of a new technology)?
5. What is the Segment-Zero Principle, and how does it impact on open technology innovation and global market competition?
6. How does market competition lead to technology/product commoditization on the market (outsourcing and off-shoring)?
7. What is variety management, and how to achieve an optimal level of customization while considering economic aspects?
8. Why does a particular product feature excite customers on the market (the Kano Customer Satisfaction model)?
9. How to go through a structured functional design process in order to systemically transform voices of customer to that of engineers?
10. What is the innovation story of Apple Inc.?
11. What is the innovation story of Amazon Inc.?

These key concepts will be explained systematically throughout the semester according to the planned weekly schedule (see the Course Schedule below). Students will learn these concepts in organized weekly "learning modules".

4. <u>Office Hours</u>:

Standard office hours are from 12:00pm to 2:00pm, on every Thursday. On-campus students can come to DRB-260 for face-to-face meetings. Group meetings, using Skype for example, with the Instructor during office hours are also possible in the same manner. As well, students are encouraged to meet with TA during the TA office hours.

5. <u>Reading Materials:</u>

There is no required textbook for this course, and some recommended reference books include:

- "*Strategic Management of Technological Innovation*", by Melissa A Schilling, the McGraw-Hill Irwin Company
- "*Strategic Management of Technology and Innovation*", (3rd edition), by Robert A. Burgelman, Modesto A. Maidique, and Steven C. Wheelwright, the McGraw-Hill Irwin Company.
- "*Product Design and Development*" (3rd edition), by Karl Ulrich and Steven Eppinger, the McGraw-Hill Irwin Company.
- "*Product Ideas to Product Success*", Matthew Yubas, Broadword Publishing, Inc.

- "*The Mechanical Design Process*" (3rd edition), David G. Ullman, the McGraw-Hill Companies, Inc.
- "*Axiomatic Design – Advances and Applications*", Nam Pyo Suh, the Oxford University Press.
- "*Product Design – Techniques in Reverse Engineering and New Product Development*", by Kevin Otto and Kristin Wood, Prentice Hall
- "*Creating Breakthrough Products – Innovation from Product Planning to Program Approval*", by Jonathan Cagan and Craig M. Voget, Prentice Hall
- "*Jack Welch and the GE Way*", by Robert Slater, McGraw-Hill Company.
- "*Execution – the Discipline of Getting Things Done*", by Larry Bossidy and Ram Charam, the Crown Business Books.

The instructor may recommend additional reading materials and website reference resources during the semester whenever appropriate.

6. Course Website:

Students' learning of this course is supported by a specially designed course website on Desire2Learn (https://courses.uscden.net/d2l/login). All registered students have access to this website (ISE545_20161). The website structure is implemented to support the specific organization of the course instruction as described in this syllabus. Students should browse the entire site to familiarize themselves with the various areas and functions.

7. Team Formation:

Collaborative learning within a small cohort is most effective for those courses in which "what you learn depends on with whom you learn". Because the case study and debate project are team-based in ISE545, the whole class will be assembled into six-eight teams, each with no more than 5 students of their own choices. Ideally, all teams should compose of members with different academic backgrounds and professional experiences. Coordinated by the TA, students are expected to organize their team membership for approval by week 2. Changes of team membership made after this date will only be granted on very special situations. To broaden the perspectives, off-campus and on-campus students are encouraged to team up to collaborate on case study and debate tasks. Teams are encouraged to use the DEN system for team meetings. Each team will be assigned a separate virtual meeting room, which only its members (and TA and Instructor) have access. Members can have interactive audio/video supports when conducting virtual meetings at times of their own choice.

8. Course Grading:

Students will be graded according to the following scheme:

- **30% -- team case study presentations and reports**

    - (15%) the first case study team presentation and report
    - (15%) the second case study team presentation and report
- **40% -- team debate projects and the final reports**
    - (15%) the first team debate performance
    - (15%) the second tem debate performance
    - (10%) the final team debate report
- **30% -- Individual final examination**

Note that, a total of 70% of students' final grades (i.e., 30% for the two case study and 40% for the debate project) are determined based on the performance of their teamwork. All work done by the team is first given a "team grade". This team grade is then weighted for each member based on a confidential self-evaluation by all teammates at the end of the semester. Each student will be asked to fill out a questionnaire, which evaluates every team member (including him/herself) for the percentage contribution to the teamwork in different categories. The evaluations are averaged in order to find each student's contribution and the weighting factor is made proportional to the average.

Each of the above learning components is described in more details below.

9. <u>Learning Components</u>:

- **Case Study by Teams (30%)**

Case study is a very important means of learning the interdisciplinary subjects, such as technology development and implementation, whose knowledge links directly to industrial cases and practices. Successful industrial cases can reveal important knowledge about the appropriate process and methodology of technological innovation and product development; while well-documented business failures from the past can also help to improve the strategies and practices in the future. The two (2) case studies counts for a total of 30% of the semester grade. Student teams are asked to study the case, prepare a written report and make an oral presentation to summarize their analysis/diagnosis and, and if appropriate, to propose a recommended plan of action. If relevant, teams are encouraged to employ those theories and models discussed in the class to support their case study reports and presentations.

The team case study report should be **up to 10 pages** in length, 12 pt, type, typewritten, double-spaced, with maximum 1" margins. These reports should be organized with:

- A brief review of the assigned article
- Your diagnosis/analysis of the case
- The recommended action plan (if appropriate), and
- The conclusion

Each team will be given a 15-minute slot (see the Course Schedule below) for presenting their case study findings and recommendations, followed by an interactive discussion led by the instructor. The case study reports are due one week AFTER the in class presentation and discussion. The case study report should be submitted as a WORD file. No credit is given for late submissions. Each case study presentation and report counts 15% of the final grade.

- **Team Debate by Teams (30%)**

There are no black-and-white or yes-and-no answers to the questions addressed in this course. The best way to learn the subject of open technological innovation in competitive global market is to engage in team debates of real-world cases. A set of debate subjects related to innovations in various industries will be announced in the first lecture. Each team must choose a specific subject and debate position by the week 3. All teams will engage in two (2) live-debate sessions, and then develop a comprehensive report by the end of semester. The TA will coordinate with all debate teams and lead the live debate sessions. The instructor and TA will assist teams to formulate their project scopes and define their debate positions during all stages.

Live Debates: Debate teams will prepare for two live debate scheduled on March 10th and April 28th, 2016. The performance of each live debate counts as 15% of the grade. The goal is to convince the *judges* (i.e., the instructor, the TA, and the rest of the class) of their positions and views by providing supporting evidences with logical analyses and convincing arguments. Meanwhile, teams can challenge the opponent team's positions by pointing out flaws in their arguments and reasoning. Specific debate procedures will be announced one week in advance. Each debate team should arrange for ALL its members to take on some representing/responding roles during the debate presentations.

The rest of the class (i.e., all students except for those who are part of the two opposing teams of a topic) will act as the "judges" of these debates sessions, whose scores will contribute partly to the grading of each team. For all debate teams, an electronic copy of their presentation materials in PowerPoint file format, and other optional supporting materials, are due one week after the live debates.

Debate Final Report: the final team debate reports are due right before the final exam. These final reports, which count as 10% of the final grade, should summarize all findings and recommendations of the debate team throughout the semester. The reports should be prepared professionally with supporting facts. The reports are to be **up to 20 pages** in length (excluding the appendix), double-spaced, 12 pt., typewritten. Paper length is strictly enforced. Your debate project final reports are graded based on: (1) creativity/innovativeness, (2) professionalism of presentation and writing, (3) depth of literature, methodology, analysis, (4) quality of recommendations, and (5) likelihood of and steps for implementation.

- **Final Examination by individuals (40%)**

The ISE545 final exam is scheduled from 2:00pm to 4:00pm on Thursday, May 12th, 2016. The final exam is **closed book** and limited to the materials that have been discussed in the class, case studies, and/or debate projects. Questions are open-ended, but are made brief and point specific as much as possible. They often require only short answers that show your comprehension of the concepts, definitions, approaches, and tools covered.

Make-up exams will only be offered, when there is absolute proven need for the students. Should you have to miss your exams, an individual oral exam will be scheduled with the instructor. No written make-up exams will be available. Final grades are due within 72 hours after the prescheduled "official final" exam date. Therefore, students must contact the instructor personally, ahead of time, to make arrangements to complete their make-up exams ahead of this prescheduled "official" final exam date.

10. Course Schedule:

A tentative course schedule, which includes weekly learning subject and activities, is as follow. The Instructor reserves the right to change this schedule during the semester to better fit students' learning needs and progresses.

Week	Date	Learning Activity and Subject	Case Study and Debate
1	01/14	Course Introduction and Subject Overview	Case study 1 handout assigned
2	01/21	Definition and characteristics of open technological innovation in competitive global market: the big picture	Teams assembly completed Debate subjects announced
3	01/28	The dynamic interaction between technological innovation and market competition: the S-curves	Team debate subject chosen
4	02/04	Standard battles to shape the dominant design of a new technology: cross-the-Chasm and timing of entry	
5	02/11	Company's competitive strategies in different market segments: the Segment-Zero Principle	
6	02/18	Case Study 1 Presentation | Case Study 1 Discussion	
7	02/25	Modularization and commoditization of technology on a competitive market: out-sourcing and off-shoring	Case study 1 team report due Case study 2 handout assigned
8	03/03	Blue-ocean strategy to innovate new breakthrough products: the Kano Customer Satisfaction model	
9	03/10	Team 1 Debate Exercise	
10	03/17	Spring Break (University Holiday)	
11	03/24	Business and legal strategies to guard and protect your technology innovation results on competitive global markets	
12	03/31	Case Study 2 Presentation	
13	04/07	Discussion of Case Study 2	Case study 2 team report due
14	04/14	A systematic framework for breakthrough innovation: Innovative Design Thinking (IDT)	
15	04/21	Transform customer voices to engineer voices: Quality Function Deployment (QFD) and House of Quality (HOQ)	

16	04/28	Team 2 Debate Exercise	
17	05/05	University Study Day (no class)	
18	05/12	Final Examination (2:00pm to 4:00pm)	Team Debate final report due

Academic Integrity:

"The Viterbi School of Engineering adheres to the University's policies and procedures governing academic integrity as described in SCampus. Students are expected to be aware of and to observe the academic integrity standards described in SCampus, and to expect those standards to be enforced in this course."

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 (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213)740-0776.