COURSE SYLLABUS

ISE545: Technology Development and Implementation

(a.k.a.: Open Technological Innovation in Competitive Global Market)

Fall Semester, 2019

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Course Section:	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:	Mondays, 6:40 pm to 9:20 pm • 6:40 pm to 7:50 pm (70 minutes) – session I • 7:50 pm to 8:10 pm (20 minutes) – session break (optional) • 8:10 pm to 9:20 pm (70 minutes) – session II
Class Location:	Ronald Tutor Hall (RTH) 115
Office Hours:	5:00 pm to 6:00 pm, on Mondays Email request is required for the appointments out of the office hour window • Face-to-face meetings held in DRB 258 • Bluejeans (https://bluejeans.com/9518920713/) • The email is usually replied within 48 hours
Teaching Assistant:	TBD

Course material and syllabus content per Prof. Stephen Lu, used with permission.

Course Background:

Technology has been the single most important driver of the world economy in recent years. Much of the modern economic growths (and bubbles) are the direct results of successes (and failures) of new technology products, services, and systems developed by engineers in the laboratory and implemented by entrepreneurs on the market. In today's technology-based economy and the highly-globalized society, understanding the dynamic process from technology development to implementation has become a key challenge for the entire engineering profession. This is the key motivation and main focus of ISE545 on Technology Development and Implementation, which is one of the two degree-required courses of the Master of Science in Product Development (MSPDE) program.

The technology development and implementation process have been evolving continuously due to the changing nature of market competitions over the past few decades. In the past, when markets for technology products, services and systems were "undersupplied", this process was carried out mostly from the laboratory to the market sequentially. Recently, however, many technology markets, at least in terms of functions and performances, have become "oversupplied" due to intensive competitions. For these hyper-competitive situations, the traditional linear process of development-and-implementation becomes inadequate to deal with the dynamic nature of rapid technology and market changes. Rather than developing new technologies and then implementing them for the undersupplied "Red-Ocean Market." Companies must now strategically set the technology development targets first by using unique insights of social-economical-technological (SET) trends to uncover or stimulate new customer demands to create a brand new "Blue-Ocean Market." This new challenge calls for a fundamental change of the technology development and implement process from linear to cyclic and from static to dynamic. The term of "technological innovation" has been used to represent this new cyclic and dynamic process.

Against the above background, the goal of ISE545 has also evolved accordingly to focus on the topic of "Open Technological Innovation for Competitive Global Market." Technological innovation is very different from invention. While the mother of invention is the curiosity of few individuals in the laboratory, the mother of innovation is the demand of many customers on the market. The learning objective of ISE545 is to provide a holistic, interdisciplinary and integrated view of the open technological innovation process in a competitive global market. It blends both market and engineering perspectives, so that students can develop correct understandings of how technological innovations impact on market competitions and how market competitions, in turn, can change technological innovations. ISE545 students will learn how to (1) understand the cyclic dynamic interactions between technological innovation and market competition, (2) formulate winning technological innovation strategies for highly competitive markets, and (3) develop breakthrough innovative technological products and services for the new Blue-Ocean Market. Through lectures, discussions, and assignments, ISE545 students will be able to 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.

Learning Modules:

The course of "Open Technological Innovation in Competitive Global Market" is organized in the following 11 learning modules, each will be delivered in a three-hour lecture.

1. Course introduction and subject overview
2. The big picture : Characteristics of open technological innovation in competitive global market
3. The S-Curves: the lifecycle of technological innovations with market competitions
4. The early market: discover unmet demands and choose functional requirements
5. The early market: battle for the dominant standard to cross the market chasm
6. The mainstream market: rational competition to irrational hyper-competition
7. The mainstream market: the Segment-Zero principle of market competitions
8. The late market: use performance surplus to perform product modularization
9. The late market: use global outsourcing to survive technology commoditization
10. Breakthrough innovation: how to create new products for a blue-ocean market?
11. Breakthrough innovation: the Innovative Design Thinking (IDT) framework

Special Talks:

Some invited guest speakers will give special talks. Topics would be related to start-up company implementation, angel/venture investment, crowdfunding, design innovations, or engineering management.

Reading Materials:

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

- "*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.
- "*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
- "*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.
- *"Business Planning and Market Strategy"*, by Erhard K. Valentin, SAGE Publications.
- "*The Mechanical Design Process*" (3rd edition), David G. Ullman, the McGraw-Hill Companies, Inc.

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

Course Website:

Students' learning of this course is supplemented by a course website (the new Desire2Learn System) on DEN instruction system (https://courses.uscden.net/). All registered students have access to this website (Fall 2019 > ISE545). Students should browse the entire site to familiarize themselves with the various areas and functions.

Course Grading:

Students will be graded according to the following scheme:

- 40% -- To understand core concepts
  - (20%) Four After-Class Quizzes (Q)
  - (20%) Final Examination
- 10% -- To broaden students' exposure to relevant fields
  - (10%) Case Study Report (C)
- 50% -- To learn by doing and collaboration
  - (25%) Project Midterm- Investment Pitch (P1)
  - (25%) Project Final- Product Exhibition (P2)
- 5% -- Extra Credit Opportunity
  - (5%) Create your own Innovation Method (M)

Lecture Quizzes (20%)

Before each lecture, lecture slides will be posted on course website as reading materials for students to preview the lecture content. Four quiz assignments are designed to increase the class interaction and to check students' understanding of the core concepts. The question types would include multiple choice, match, and simple answer questions. The assigned and due dates are shown in the course schedule.

After-Class Quiz (Q): The questions of each quiz will be given on the course website before the corresponded lectures, and students will have one additional week to submit answers after the set of corresponded lectures, and the assignment will be graded in a few days after it is due.

The questions of the four quizzes are correlated to the four sets of lectures divided from the learning modules:

Q1. The big picture and S-curve
Q2. Early market
Q3. Mainstream market
Q4. Late market

Final Exam (22%)

The ISE545 final exam is scheduled from 7 pm to 9 pm on Monday, December 16, 2018. It is a **closed book** exam and limited to the materials that have been discussed in the class and case study. Questions may be 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.

Case Study Report (10%)

Case study is a very important means of learning for inter-disciplinary subjects, such as technology development and implementation, whose knowledge links directly to industrial cases and practices. This case study assignment (C) is designed to help students apply learnt knowledge to a practical case and broaden their exposure to relevant fields. Students are asked to study the assigned article, find a target company (case), and then use the theories/questions to diagnose/analyze the case and to give a recommended action plan. If possible, students are encouraged to employ those theories and models discussed in the class to support their case study reports.

The case study report should be **up to 10 pages** in length, 12 pt., typewritten, double-spaced, with maximum 1" margins. The report should be organized with (as grading rubrics):

- a succinct summary of the assigned article (10%),
- a short introduction of the case (10%)
- your diagnosis/analysis of the case (30%)
- the recommended action plan (30%), and
- the conclusion (10%).
- (The remaining 10% is the report format.)

Team Project (25% P1 and 25% P2)

This class emphasizes the importance of learning by doing, the team project assignment aims to help students understand the methods and important concepts taught in class by practice. The assignment is throughout the semester, and two milestones are set to check students' learning. Students must follow the instructions to analyze the product, develop a new product, and strategize the product's lifecycle plan.

Scenario: Each team is a company, which just launched a product. Team members will elect a CEO to lead the team. Each team will give a short presentation of the product to win the investment in the investor meeting (midterm). The team will be funded successfully. After some time, each team develop a next generation of the product to sustain their business, and they will present their next gen product in a consumer's technology exhibition (final) to increase the exposure of the new product and to collect consumers' feedback.

Project Midterm (P1): In the first half of the semester, each team requires to analyze the product selected from the given list*. In the midterm, each team will prepare a written report of the analysis (10% of the semester grade) and a 5-minute pitch of showing the value of the product (15% of the semester grade). The report will be graded based on the completeness of the required content and the quality of the report. The pitch will be graded by the rank of the received 'investment'.

Project Final (P2): In the second half of the semester, each team requires to develop a new product based on the selected product, and then plan market strategies for the company. In the final, each team will prepare a written report of the development and the implementation plan (10% of the semester grade) and a presentation of advertising the next-generation product (15% of the semester grade). The report will be graded based on the completeness of the required content and the quality of the report. The presentation will be graded by the rank of the 'pre-sale'.

Mock Investor Meeting: Everyone in the meeting represents an investor. Each student has two coins, and instructor, TA, or each invited guest has three coins. After the pitch session, there will be an investment session. For each company (team), each investor can decide to invest** 0-3 coins as long as he/she has enough coins, but he/she cannot invest his/her team.

Mock Technology Exhibition: Everyone in the meeting represents a consumer. Each team CEO, instructor, TA, or each invited guest has three coins, and each team member has two coins. After 5-minute presentation of each team, each CEO can decide to buy additional advertisement, 3 minutes/coin. After the advertisement, we will hold the pre-order session. For each company (team), each consumer can decide to preorder** 0-3 products (1 product per coin) as long as he/she has enough coins, but he/she cannot buy his/her product.

* Cooperated companies will provide their products/ product information to assist students analyze.

** The students in the classroom will receive physical coins. DEN students will send the private message to the instructor through WebEx to tell their decisions. The student who is absent during the meeting/exhibition cannot participate the activity.

Extra Credit: Innovation Method (5%)

Student who creates his/her own innovation method can receive 5% extra credit, which would promote his/her semester grade up to one level. The innovation method means a method that help the user(s) create innovation ideas. It can be a framework, a process, a tool, a mindset, or a technique. The method must be original (i.e., can not be found elsewhere), and the description of the method must be clear and succinct. Non-original method will result in zero credit for this opportunity.

Grading Scale

Course final grades will be determined using the following scale

A	91%-100%
A-	86%-90%
B+	81%-85%
B	76%-80%
B-	71%-75%
C+	66%-70%
F	65% and below

Late Assignments

Late Assignments are accepted except the extra credit assignment and team project report and slides, but they are with the following deductions. Do not wait until the last minute to upload. Unless there an emergency (in which case exceptions will be made) late assignments will have the following grades.

- 1 second to 5 minutes after deadline: -5% of assignment grade
- 5 minutes to 24 hours after deadline: -10% of assignment grade

- 24 to 72 hours after deadline: -25% of assignment grade
- 3 to 7 days after deadline: -50% of assignment grade
- More than 1 week after deadline: -75% of assignment grade

Please note that all emergency situations will require documentation (doctors note, police report, etc.). Losing internet access or power outages do not classify as an emergency. (be sure to submit before the deadline to account for things like internet outages)

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	Assignments and Notes	Due
1	08/26	M1. Course Introduction and Subject Overview	Case Study Assigned (C)	
2	09/02	Labor Day (University Holiday)		
3	09/09	M2. The big picture: Characteristics of open technological innovation in competitive global market	Q1	
4	09/16	M3. The S-Curves: the lifecycle of technology innovations with market competitions	Project subject selection completed	
5	09/23	M4. The early market: discover unmet demands and choose functional requirements	Q2	Q1
6	09/30	M5. The early market: battle for the dominant standard to cross the market chasm		
7	10/07	Guest Talks: Start-up Company, Hardware Product		Q2
8	10/14	Project Midterm- Mock Investor Meeting	P1 Visual Aids Submission	
9	10/21	M6. The mainstream market: rational competition to irrational hyper-competition	Q3	P1 report
10	10/28	M7. The mainstream market: the Segment-Zero principle of market competitions		
11	11/04	M8. The late market: use performance surplus to perform product modularization	Q4	Q3
12	11/11	M9. The late market: use global outsourcing to survive technology commoditization		
13	11/18	M10. Breakthrough innovation: how to create new products for a blue-ocean market?		Q4
14	11/25	M11. Summary of the lecturers	(11/27-12/01 thanksgiving)	C, M
15	12/02	Project Final- Mock Technology Exhibition	P2 Visual Aids Submission	
16	12/09	University Study Day (no class)		P2 report
17	12/16	Final Examination (7:00pm to 9:00pm)		

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.