

COURSE SYLLABUS

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

Fall Semester, 2017

Chu-Yi Wang

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Course Section:	31545D (on-campus) 31745D (off-campus)
Course Unit:	3 Units
Prerequisite:	<p>A graduate student standing in engineering is required (or with a special approval by the instructor).</p> <p>This is a degree required course for MSPDE (Master of Science in Product Development Engineering)</p>
Class Hours:	<p>Mondays, 6:40 pm to 9:20 pm</p> <ul style="list-style-type: none">• 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:	<p>5:00 pm to 6:00 pm, on Mondays</p> <p>(Email request/confirmation is required for all appointments)</p> <ul style="list-style-type: none">• Face-to-face meetings held in BHE B13• Skype (Skype Username: chuyee0101)• Google Hangouts (Account: chuyiwan@usc.edu)
Teaching Assistant:	<p>Xiang Gao</p> <p>Email: xiangg@usc.edu</p> <p>Office Hours: 12:30 pm to 2:00 pm, 5:30 pm to 6:00 pm, on Thursdays</p> <p>Location: Ronald Tutor Hall (RTH) 319</p>

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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

Reading Materials:

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

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.uscdcn.net/>). All registered students have access to this website (Fall 2017

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> 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:

- 20% -- individual participation in active learning activities
 - (10%) on time completion of quizzes
 - (10%) the sharing of technological innovation tips
- 30% -- team project and the final report
 - (10%) the progress report and presentation
 - (10%) the final presentation
 - (10%) the final report
- 20% -- two individual case study reports (each 10%)
- 10% -- midterm examination
- 20% -- final examination

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. 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. Two (2) case studies will be assigned to the class for a total of 20% of the grade. Students are asked to study the case and prepare a written report to summarize their analysis/diagnosis and, if appropriate, and to propose a recommended plan of action. 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., type, typewritten, double-spaced, with maximum 1" margins. These reports should be organized with:

- a short introduction
- your diagnosis/analysis of the case
- the recommended action plan (if appropriate), and
- the conclusion

The ISE545 midterm exam is scheduled from 7 pm to 9 pm on Monday, October 16, 2017, and the final exam is scheduled from 7 pm to 9 pm on Monday, December 11, 2017. Both are **closed book** exams and limited to the materials that have been discussed in the class and case studies. 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.

Course Schedule:

Week	Date	Learning Activity and Subject	Assignments and Notes	Due
1	08/21	M1. Course Introduction and Subject Overview		
2	08/28	M2. The big picture : Characteristics of open technological innovation in competitive global market	First Case Study Assigned (C1)	
3	09/04	Labor Day (University Holiday)	Innovation Tip Sign-up	
4	09/11	M3. The S-Curves: the lifecycle of technology innovations with market competitions	Teams assembly completed; Quiz Assignment starts (Q)	T1
5	09/18	Team Project Subject Description and Discussion M4. The early market: discover unmet demands and choose functional requirements		Q1, T2
6	09/25	M5. The early market: battle for the dominant standard to cross the market chasm		T3
7	10/02	The First Team Project Progress Presentation	Progress Report Submission (P1)	C1
8	10/09	M6. The mainstream market: rational competition to irrational hyper-competition		Q2, T4
9	10/16	Midterm Examination (7 pm to 9 pm)	Range: M1-M5	P1
10	10/23	M7. The mainstream market: the Segment-Zero principle of market competitions	Second Case Study Assigned (C2)	T5
11	10/30	M8. The late market: use performance surplus to perform product modularization		Q3, T6
12	11/06	M9. The late market: use global outsourcing to survive technology commoditization		T7
13	11/13	M10. Breakthrough innovation: how to create new products for a blue-ocean market?		Q4, T8
14	11/20	M11. Breakthrough innovation: the Innovative Design Thinking (IDT) framework	(11/22-26 thanksgiving)	T9
15	11/27	The Final Team Project Presentation	Final Report Submission (P2)	Q5, C2
16	12/04	University Study Day (no class)		
17	12/11	Final Examination (7 pm to 9 m)	Team Debate final report due	P2

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.

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.