ENGR 296 (CRN 20179)
Fundamentals of Innovation Theory and Practice
(Representative syllabus - Subject to change)

Course: ENGR 296 – Fundamentals of Innovation Theory and Practice

Description: This course is designed to provide students with initial exposure to the fundamental patterns, mindsets, behaviors, attributes, tools, and methods employed in the innovative activity of individuals and organizations. Coursework prepares students to be leaders in responding to global technological, economic, and societal challenges. Students will participate in cross-disciplinary teams to design solutions to a technical challenge, in an experiential learning setting accounting for the full breadth of functional, social and emotional factors likely to shape its use and adoption. Case discussions of historical and contemporary innovations will be used to introduce techniques for the identification of opportunities, the design of solutions, and the launch, test, and iteration of such solutions. Emphasis will be placed on understanding and effectively utilizing techniques from various fields, such as business, design, problem-solving, engineering, and the social sciences.

This course can be counted toward the College of Engineering Minor in Innovation and Leadership Studies, as well as the Certificate in Entrepreneurship and Innovation.

Learning Objectives: Develop working knowledge of established innovation forms and motifs

Demonstrate ability to link innovation motifs to specific classes of problems

Understand the core aspects of an end-to-end innovation process

Recognize the mental models, mindsets and behaviors of innovators

Gain awareness of the approaches various forms of organizations take to systematically innovate

Acquire leadership and communication skills through cross-disciplinary teamwork, an oral presentation, and a written report.

ABET Standards:

Standard	Corresponding Course Content
A. Ability to apply mathematics, science and engineering principles	Team project involving designing and iteratively exploring assumptions underlying the solution to a real-world problem; lectures on design thinking and systems thinking
B. Ability to design and conduct experiments, as well as to analyze and interpret data	Team project involving designing and iteratively exploring assumptions underlying the solution to a real-world problem; lecture and hands-on application of planning-to-learn concepts
C. Ability to design a system, component, or process to	Team work sessions, individual deliverables, and lecture content in issue and ecosystem analysis and stakeholder

meet desired needs	definition; lectures on ethnography, systems thinking and right-sizing; team work session on ecosystems, and systems-level solution prioritization
D. Ability to function on multidisciplinary teams	Term-long project assignments (40% of students' grades); team work session and lecture on ideation best practices and organizing to innovate
E. Ability to identify, formulate, and solve engineering problems	Lectures on problem framing, hypothesis-driven problem solving, and leveraging structure and analogies to generate solutions; related team deliverables
G. Ability to communicate effectively	Lecture on persuasive communications, ghosting, storylines, and storytelling; team oral presentations and individual and team written assignments
H. The broad education necessary to understand the impact of engineering solutions in a global and societal context	Team project, course content, and deliverables centered around design and innovation that encompass the full breadth of functional, social and emotional factors likely to shape a solution's design, use and adoption
I. Recognition of the need for and an ability to engage in life-long learning	Team work session and lecture on planning to learn (and related team deliverable); emphasis on the value of pattern recognition and idea transferability across disciplinary boundaries
J. Knowledge of contemporary issues	Lectures on opportunity identification and multiple innovation case discussions
K. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Lecture and assignments on issue analysis, identifying barriers to uncover paths to opportunity, analogical reasoning, and right-sizing solutions

Engineer of 2020:

Desired Outcomes	Corresponding Course Content
Teamwork	Team based term project involving multiple team deliverables
Communication	Lecture on persuasive communications/ ghosting, storylines, and storytelling; Weekly team deliverables encompassing oral presentations, interim written assignments and a written report
Decision-making ability	Lecture and team working session on right-sizing solutions and systems-level solution prioritization
Synthesize engineering, business, and societal perspectives	Lectures, as well as team and individual assignments, on innovation forms and motifs, ecosystem analysis, issue analysis, ethnography, and systems thinking
Ability to synthesize engineering, business, and societal perspectives	Lecture and team deliverables on issue analysis, business model innovation for economic sustainability; and systems level prioritization
Analytical skills	See ABET standard A, B, C and E
Open-ended design and problem solving skills	See ABET standards A, C, E, and K; lecture on developing an outside-in perspective on solutions
Multidisciplinarity within and beyond engineering	Team based term project encompassing full breadth of functional, social and emotional factors likely to shape a

	solution's design, use and adoption
Integration of analytical, problem solving, and design skills	Team based term project; lectures on issue analysis, hypothesis driven problem solving, design thinking, systems analysis, right sizing solutions, and systems level prioritization
Innovative mindset	Lecture on forms of innovation and impact; case studies illustrating innovation forms and motifs
Adaptability in a changing environment	Team work sessions and lectures on ecosystem analysis
Entrepreneurial and intrapreneurial	Lecture and team deliverables on opportunity identification, ethnography, ecosystem analysis, ideation, business model innovation and organizing to innovate

Scope: This course involves lectures, case studies, in-class working sessions, take-home assignments, and a semester-long team-based term project with an oral presentation and a written report.

Pre-requisite: None

Academic instructor: Professor Joe Sinfield Office: HAMP G231 Phone: 6-2742

Class hours: One 50 minute class and one 110 minute class per week

Location: Varies by semester

Grading: Team Assignments 40%
Individual Assignments 60%

Textbooks: **Innovator's Guide to Growth: Putting Disruptive Innovation to Work**
by Scott D. Anthony, Mark W. Johnson, Joseph V. Sinfield, and Elizabeth J. Altman

Assignments: No assignments can be missed without penalty, unless the missed assignment is authorized by the instructor.

Attendance: Due to the nature of this class, class participation is a must. In order to receive course credit and a full grade, a student must:

1. Have no more than two unexcused absences.
2. Satisfactorily complete **ALL** assignments.

Three unexcused absences will result in a grade reduction of one letter grade. Four unexcused absences will result in a grade of 'I' or 'F', depending on whether or not the student is considered to be passing in all other aspects at the time of the fourth absence. Failure to complete **ALL** assignments will result in a grade of 'I' or 'F', depending on whether or not the student is considered to be passing in all other aspects.

Group Multiple group projects are pursued throughout the course. The group work tests the

projects: students' understanding of the principal concepts covered in the course within the context of "real-world" problems. It also provides an opportunity to develop collaboration and communication skills required to work in a project team context. Each project activity receives a single group grade, but the individual student's project grade depends on his/her peer evaluation of and by the students within the team.

Ethics: Students are expected to uphold all university policies and regulations on academic integrity and conduct. Academic dishonesty will not be tolerated, and any acts of academic dishonesty will be dealt with on a case by case basis. Penalties for violations will be levied at the discretion of the instructor and may include but are not limited to reduction in the grade received for an assignment or exam, loss of credit for an assignment or exam, reduction in the FINAL grade for the course, and/or failure of the course.

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COURSE OUTLINE – REPRESENTATIVE

Week	Month	Class 1	Class 2
1		Course overview; Achieving Leadership through Innovation	Innovation Motifs/ Defining Impact
2		Design Thinking and the Novice to Expert Continuum	Innovation Case Study #1
3		Project Focus, Team Definition	Project Team Planning Session
4		Issue Analysis; Hypothesis Driven Problem Solving	Project Team Working Session: Issue Analysis
5		Framing a Problem Stakeholder Definition / Ecosystem Analysis	Project Team Working Session: Ecosystem Analysis
6		Making a Problem Personal – Jobs-to-be-Done and Ethnography	Identifying Barriers to Uncover Opportunity
7		Developing an Outside-in Perspective on Solutions	Leveraging Structure and Analogies to Generate Solutions
8		Systems Thinking/ Patterns of Innovation Success	Innovation Case Study #2
9		Focusing on Circumstance to "Right Size" Solutions	Project Team Working Session: Ideation Stimuli Development
10		SPRING BREAK	SPRING BREAK

11		**Ideation Best Practices**	**Project Team Working Session: Group Solution Ideation**
12		**Business Model Innovation to Facilitate Economic Sustainability**	**Project Team Working Session: BMI Development**
13		**Planning to Learn**	**Project Team Working Session: System-Level Solution Prioritization**
14		**Persuasive Communications/ Ghosting, Storylines, and Storytelling**	**Innovation Case Study #3**
15		**Organizing to Innovate**	**Project Team Working Session: PTL Development**
16		**PROJECT/PAPER PRESENTATIONS**	**PROJECT/PAPER PRESENTATIONS**

FINALS WEEK

Reading assignments will be assigned throughout the semester. The course outline may be adjusted to adapt to students' interests and learning progress.