COURSE DESCRIPTION

The Invention, Innovation & Entrepreneurship course is offered as part of AAFIE s Global Competence Program, an international initiative with a series of courses that uses world class senior professionals from the United States to prepare students to become international engineers.

The Invention, Innovation & Entrepreneurship is taught by a group of inventors, innovators and entrepreneurs from U.S. multinational companies. The goal of the course is to cultivate 21st century engineers in obtaining key skills for solving challenging engineering problems and designing innovative products in a global context.

In the course, students experience the complete process of developing new products from concept design to prototype, and interact with international entrepreneurs.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- Understand concepts of global invention, innovation, commercialization, and entrepreneurship;
- Understand how global engineering constraints, risks, ethnic, and engineering process affect new product design;
- Understand global engineering innovation models;
- Understand systematic innovation approaches such as SCAMPER and TRIZ, and their applications in solving real world global engineering problems and designing new products;
- Understand global engineering best practices and enabling technologies;
- Understand the roles of international patents, intellectual property, and venture capital in international entrepreneurship;
- Understand how invention and innovation principles are used in real-world global engineering projects;
- Understand how to writ international patents, form business models, and develop business plans.

In the class, students will interact with inventors and entrepreneurs from the United States, and work with the international senior engineers to create engineering solutions for solving real world engineering problems.

PREREQUISITES

Students are required to have basic understanding of engineering before taking the course.

INSTRUCTORS

The course is taught by AAFIE Global Engineering Lecturers Group, a group of senior professionals from U.S. multi-national companies.

METHODS OF INSTURCTION

video collaboration technology, the world-class professionals and senior engineers from the United States give real-time lectures to students, interact with the students, and guide the students in conducting international engineering projects.

Students will complete the entire coursework in the Gloer learning community, a platform specifically designed to promote global perspective, cross-cultural communication, international collaboration, and critical and creative thinking skills. In the Gloer learning community, students are guided by international mentors consisting of international senior engineers from multinational companies in the United States. Students submit their coursework to the global community, present their solutions to the global community, receive feedback from the global community, and complete projects with the global community, making students learn in a real global context.

TEXTBOOKS

The course is mostly about real-world international engineering experience, therefore, there are no textbooks, but students are required to read and research prior to class sessions. Students will leverage Internet contents for project assignments and use live recordings for class review.

COURSE COMPONENTS:

To complete the course, a total of 64 periods is required for lectures and student projects. The course is divided into two segments in each week:

Mindsets in Invention, Innovation and Entrepreneurship (Student deliverable: quiz & classroom discussion)
Project (Student deliverable: engineering documents)

COURSE GRADING POLICY

Classroom Participations/Responses: 30%
Project: 40%
Final Exam: 30%

Attendance is mandatory for all class sessions. Students are subject to losing points for absences unless prior approval is obtained from Instructors or Teaching Assistants. Students receiving excused absences are required to watch the class recordings online as well as to fulfill any/all course requirements associated with missed class sessions.

COURSE CREDITS

The recommended number of credits for the course is 3. To complete the course, a total of 64 lecture sessions is required. Students will have lectures twice a week, each lecture contains 2 sessions (45 minutes/session).

COURSE OUTLINE

The course is comprised of Mindsets and Project. The major contents of the Mindsets are outlined below.

Unit 1: Introduction to Innovation

1.1 Innovation Overview
1.2 Invention and Innovation
1.3 Entrepreneurship
1.4 The Global Innovation Center: Silicon Valley

Unit 2: Global Innovation Models

2.1 Innovation Model Overview
2.2 Product Innovation
2.3 Process Innovation
2.4 Marketing Innovation
2.5 Business Model Innovation
2.6 Service Innovation
2.7 Sustaining Innovation
2.8 Disruptive Innovation

Unit 3: Systematic Innovation

3.1 Gated Product Innovation Process
3.2 Concept Generation
3.3 Innovation with SCAMPER
3.4 Concept Selection
3.5 Rapid Prototyping

Unit 4: Engineering Innovation with TRIZ

4.1 TRIZ Concepts

4.2 TRIZ Problem Solving
4.3 TRIZ Tools for Creativity
4.4 TRIZ Process Overview
4.5 TRIZ Altshuller Parameters
4.6 TRIZ Contradiction Matrix
4.7 TRIZ 40 Inventive Principles
4.8 TRIZ Case Studies: Boeing 737

Unit 5: How Innovation Really Works

5.1 Innovation Case Studies
5.2 Jumpstarting Innovation
5.3 Global Best Practices in Innovation
5.4 Enabling Technologies for Innovation

Unit 6: Global Technology Transfer

6.1 Technology Transfer Basics
6.2 Global Commercialization process
6.3 International Intellectual Property (IP)
6.4 Stage of Development
6.5 Diffusion of Engineering Innovations
6.6 Engineering license

Unit 7: Entrepreneurship

7.1 Entrepreneurs and Startups
7.2 Starting a New Venture
7.3 Financing a New Venture
7.4 Writing Business Plan
7.5 Case Studies: A Path for Startups
7.6 High-tech Enterprise Incubation System

Unit 8: Innovation & Entrepreneurship Case Studies

8.1 IBM: Global innovation
8.2 General Motors: A century of innovation and leadership
8.3 General Electric: Open innovation
8.4 The National Aeronautics and Space Administration: Innovation projects
8.5 The Silicon Valley model: Apple
8.6 The Silicon Valley model: Google
8.7 The Silicon Valley model: Facebook

STUDENT PROJECT

Under the guidance of U.S. senior engineers, in this project students will apply the principles of global engineering innovation to solve a real-world engineering problem and develop a proposal for a new product.

1. Project Objectives

In this project, students will

- Apply the global engineering invention, innovation and entrepreneurship principles to the real world project;
- Learn how to succeed on multidisciplinary teams;
- Gain an understanding of professional and ethical responsibility;
- Learn how to communicate effectively;
- Acquire a broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- Develop an understanding of contemporary business and societal issues related to innovation and the innovation process.

2. Project Topic

Students are assigned to work as teams to solve the following real world engineering problem:

Automobile accident occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction. A number of

human error,

Design a system to avoid automobile accidents.

3. Project Hints

There are many approaches to solve the real world engineering problem, for example, students are encouraged to come up with innovative solutions from the following areas:

Mechanical System
Material
Sensor/Electronic System
Robot Vision
Vehicle Communication
Traffic Intelligence
Error/Injury/Loss Prevention
Computer Software

4. Project Tasks

The project tasks include Group Element and Individual Element.

(1) Group Element (to be completed as teams)

Problem Identification & Problem Statement: 4 Weeks
Research for Existing Solutions: 4 Weeks
Solution Proposal: 8 Weeks

(2) Individual Element (to be completed as individuals)

Each member within a team will complete a Personal Project Report, due at the end of the semester

Individual Evaluation/Comments on the Entire Group Project
Personal Contributions to the Project
Learning from the Project

5. Project Requirements

Project teams are formed with team names and team logos, and students must team members and to arrive at solutions, and then solutions to their international mentors in the global community, during which students will be asked questions in defense of their proposals.

Each team must complete the project with the following requirements:

- Follow all steps of the global engineering design process
- Solve the problem from a broadly interdisciplinary perspective and from global perspective 1 0 0 1 222.77 294.89 Tm[1 0 0 1 126.02 294.89 Tm[(g)6(lo6.094 0 1 12

- **Key Knowledge, Understanding, and Success Skills** students acquire global engineering skills such as creative thinking/problem solving, collaboration, and self-management of projects.
- **Sustained Inquiry** students engage in a rigorous, extended process of asking questions, finding resources, and applying information.
- **Student Voice & Choice** students make own decisions about the project, including project schedule and deliverables.
- **Reflection** students reflect on learning, the effectiveness of project activities, quality of work, obstacles and how to overcome them.
- **Critique & Revision** students give, receive, and use feedback to improve products.
- **Public Product** students make their project work public by explaining, displaying and/or presenting it to the whole class.

GENERAL ASSESSMENT

The following is a list of general assessments for all international engineering courses offered in the Engineering Excellence International Initiative:

1. Technical Skills: Students achieve global competency to pursue the full range of careers for all pathways in the program concentration.

2. Communications: Students use various communication skills in expressing and interpreting engineering information.

3. Problem Solving and Critical Thinking: Students define and solve engineering problems from global perspective, and use internationally recognized problem-solving and improvement methods and tools.

4. Information Technology Applications: Students use c1 0TmiK3(m)[4s(iv)1T/F4 12 Tf1 0 0 1 3

9. Entrepreneurship: