University of Houston Clear Lake

College of Science and Engineering
Engineering Department

Fall 2016
EMGT 5231: Engineering Management Planning

1. Course Information
Title: Engineering Management Planning
Course Number & Section: 5231-01
Classroom: D204
Time: 4:00 p.m. - 6:50 p.m. Monday 8/22 - 12/10, 2016.

1.1 Instructor Information
Professor: Xiaojun (Gene) Shan, Ph.D.
Office: Delta Annex 6
Office Phone: 281-283-3814
Electronic mail: Shan@uhcl.edu
Office hours: **10:00 AM – 12:00 PM on Monday and Wednesday** and others by appointment.

1.2 Teaching Assistant
TBD
Office: Delta Lab
Electronic mail:
Office hours:

Please use the email provided in Blackboard (BB) for any course-related subject. If you have any question beyond the scope of this class subject, you can contact me at Shan@uhcl.edu for my attention.

Office hours are always by appointment. The email is the preferred method of communication for this class – I am trying to be very responsive. If you leave a voice message, you should be sure to leave your name, the class name and section number, a return phone number and appropriate times for return phone calls.

1.3 UHCL Quality Enhancement Plan (QEP) Motto: Applied Critical Thinking (ACT) for Lifelong Learning and Adaptability

This course has been authorized by UHCL as an Applied Critical Thinking (ACT) Course which means that in addition to learning about the specified course content, students will be engaged with some or all of the Elements of Thought and Universal Intellectual Standards of critical

thinking. The objective of an ACT course is to develop the student's ability to become skilled at analysis and evaluation by applying a set of intellectual tools that may be effectively used across all disciplines (as well as to the student's personal life). Based on the Foundation for Critical Thinking model (http://www.criticalthinking.org/), critical thinking involves thinking for a *purpose*, asking *questions*, using *information*, applying *concepts*, drawing *inferences and conclusions*, identifying *assumptions*, anticipating *implications and consequences*, and recognizing *points of view*. The Universal Intellectual Standards that are applied to these Elements of Thought of critical thinking in order to develop Intellectual Traits include *clarity, accuracy, precision, relevance, depth, breadth, logic, significance,* and *fairness*.

Critical Thinking in Engineering Management in General and Product Development in Particular

Engineering management is an interdisciplinary field that integrates engineering-based problem-solving skills and all aspects of management and planning (e.g., team management, project management, etc.). For example, according to Wikipedia, it is defined as "the application of the practice of management to the practice of engineering." The ***solution*** derived from engineering has to take into account be various sources of ***information***, which is critical to the sustainability and profitability of a business. The answers to engineering questions have to be adjusted based on understandings of their ***assumption*** and ***consequences*** regarding people aspects of an organization. The strategically selected tools to accurately and precisely solve significant and relevant questions from the ***point of view*** of customers should be ***purpose***-driven.

For product development, a thorough understanding of customers' requirements is essential for developing a successful product or service. In particular, ***ask*** meaningful and relevant ***questions***, clearly communicate about customers' needs, solicit and ***use*** critical ***information***, draw ***inferences*** based on customers' survey/interviews, and fairly evaluate customers' feedback. Having a clear ***purpose*** is important in guiding every step of the product development process. A complete understanding of logic and ***concepts*** in both depth and breadth in product development process is necessary to ensure the process is completed in a cost-effective way by avoiding rework. An optimal ***solution*** in product design could be found by applying design of experiment, understanding its ***assumptions*** and the ***consequences*** of their violation, and drawing ***conclusions*** based on its solutions.

Please see Section 5 for more details.

1.4 Critical Thinking (CT) Tools

There are many CT tools and techniques.

One such technique is the identification, refinement, and application of Fundamental and Powerful Concepts (FPC):

- FPC is the core concepts that ground other concepts.
- FPCs provide a context for us to reason through a large number of problems, questions, theories and information.
- New information and concepts can then be viewed and analyzed through their relevance with FPC.

Fundamental and Powerful Concepts (FPC) of this Course
In ACT vocabulary, fundamental and powerful concepts form the foundation that permeates and unites a course. In this course, these concepts are:
1. Product development principles
2. Problem solving techniques in product development
3. Risk in project management

1.5 Course Description
The objective of this course is to expose the students to the state-of-the-art issues, knowledge, and skills of 'product design and development process' in the context of the 'systems engineering process and management'. Topics include the techniques and knowledge to support the new product design and development processes and their management. These include Product Planning, Requirements Engineering, Product Specifications, Concept Generation/Selection and Testing, Product Architecture and related Design techniques. Students are also expected to produce a SEMP at their discipline. Individual assignments and a team-based project are required. ***Prerequisite:*** Foundation courses (3 CR)

1.6 Textbook and learning materials
Please note that two text book materials are posted on Blackboard

- (Primary) Product Design and Development, 5th edition, Ulrich and Eppinger
- (Required) SMC Systems Engineering Primer & Handbook
- (Secondary) NASA Systems Engineering Handbook
- (Required) ***The Decision Tools Suite***
    - This software will be used during Weeks 6, 7 and 13. You may use it for your team project too. Our computer lab at D119 has a full version.
    - However, students individually need to purchase and install it on their personal computers to use it at home at around $50.
    - Check (http://www.palisade.com/academic/students.asp). The software license is available for one year after installation. This software will be used to analyze your risk and optimize the risk management related parameters. These tools are working with Excel.

1.7 Course Learning Objectives and Outcomes (CLOO)
Upon completion of this course, students will be able to:
1. Apply product design and development process to develop an artifact.
2. Develop the technical management and planning skills.
3. Use @RISK modeling tool for sensitivity analysis
4. Develop team coordination skills through team-based works.

CLOO #1, #2, and #3
1. Apply product design and development process to develop an artifact. Clearly demonstrate the logical application of relevant ***concepts*** in product design and development. It requires students to understand those ***concepts*** in depth and breadth and their significance.

2. Develop the technical management and planning skills. Precisely formulate a project planning problem and accurately use project management tools for a ***solution***, which is fair to all stakeholders from the point of view of customers.
3. Use @RISK modeling tool for sensitivity analysis. Conduct relevant tests to arrive an accurate and precise solution to specific ***questions/problems*** using relevant information and explain it to show depth of knowledge of @RISK software and sensitivity analysis. The students will understand the underlying assumptions and consequences. The analysis will be driven by a purpose and conducted fairly.

1.8 Course Format

This course uses diverse formats to achieve the course learning objectives, and these formats may include lecture, discussions, computer simulation, group works, and student's presentation.

1.9 References and Software Requirements

- *System Engineering Management*, 4th Edition, Benjamin S. Blanchard, John Wiley & Sons, Inc.
- Visio and/or PowerPoint
  This course uses several system analysis and design tools such as the Functional Flow Block Diagram, IDEF0 and IDEF3.

2. Course Policies and Guidelines

2.1 Student Responsibilities

Time Commitment:

This is a 3-credit course conducted over 16 weeks. In order to meet accreditation standards, on average, students should expect to spend between 12 to 15 hours per week on course activities and assignments. Spending less time would be insufficient for success in this course.

Academic Honesty:

The University of Houston-Clear Lake has a "0" tolerance policy for academic dishonesty and if the student is in violation, an "F" the course will be applied. Please refer to the 11.4 ACADEMIC HONESTY POLICY in the Faculty Handbook.

Dropping Course:

Students may drop a course through the registration process and may receive a refund during the first week of classes. After the first week, students need to notify the instructor and then withdraw from the course as faculty will not drop or withdrawal students. Please refer to the academic calendar for the exact dates and also review the withdrawal policy

Counseling Services:

Counseling assistance will be available on Tuesday and Thursdays by appointment

Technical Assistance:
Help Desk Hours -
Monday through Thursday 8 A.M. to 10:30 P.M.
Friday 8 A.M. to 5 P.M.
Saturday 8 A.M. to 5 P.M.
Sunday Closed
Email: supportcenter@uhcl.edu
Phone: (281) 283-2828

From Student and Educational Services-Students with Disabilities:
If you wish to receive special accommodations as a student with a documented disability, please make an appointment with the Disability Services at ext 2626 or Students service building Room 1301

Attendance
Attendance is mandatory for all meetings. Based an emergency, you could request my permission for excuse in advance. However, you will not pass the class with more than three absences.

Course Progress:
Considering the diverse course format and intensity, it is strongly recommended that you are to complete all readings required prior to the class.

Late Assignment and Make-up Exam Policy:
No late assignment will be accepted, and there is no make-up exam allowed.

Incomplete Policy:
Incomplete grades may be given at the discretion of the instructor to students who fail to complete necessary work for final evaluation. When assigning the Incomplete ("I"), instructors should provide students with an outline of the work to be accomplished before the "I" can be converted to a final mark and should specify a deadline date; the outline constitutes an agreement between the instructor and the student. Students are encouraged to read the "Incomplete policy" at 11.3 Grading Procedures in the Faculty Handbook.

2.2 Grading Policy
Your grade will be determined by the following four components:

- Individual Assignments (7 IAs) (30%)
- Team Assignments (9 TAs) (40%)
- Team Project (20%)
- Participation and Attendance (10%)

2.2.1 Grading Scale and guidelines:
The class participation grade is somewhat subjective and reflects both the quantity and quality of your contribution to discussions.

A	93-100%	A-	88-92.9%	
B+	86 – 87.9%	B	83-85.9%	B- 80-82.9%
C+	77 – 79.9%	C	73-76.9%	C- 70-72.9%
F	<69.9%			

2.2.2 Assignment

Individual Assignment (IA): 30%

- See the course schedule and assignment schedule below.
- Note that based on your request and an instructor's approval, you could finish some assignments with a partner (*a pairing option*). See the assignment schedule to check which assignment is eligible for the pairing option.
- It should be recognized that most IAs require a five to ten minute-presentation.
- There are *three individual online quizzes*, considered as an individual assignment.

Team Assignment (TA): 40%

- See the course schedule and assignment schedule below.
- There are multiple small team assignments. Basically, each team member will have the same weight. However, your individual grade may change based on the team member evaluation at the end of each assignment. Basically, your peer evaluation covers 25% of any team assignment grade.

Team Project (TP): 20%

- A team of three to five people is formed, and each team is required to submit a comprehensive documents showing all application of the new product design and development processes covered in the class.
- Each team needs to select an artifact (a product or service product) and needs to apply the product design and development processes for that artifact and show its development procedures.
- More detailed project descriptions will be provided by an instructor as the class progresses.
- Each team needs to submit final document as well as the power point presentation at the end of the semester.

Class Participation (CP): 10%

- Class participation is a subjective measure. Your team member evaluation performance will be reviewed again by an instructor. On top of this, it will include the class attendance and actual participation such as presentations

3. Course Schedule

*Note that the following schedule can be changed to suit the needs of the class at instructor's discretion.
**Note that the due date of each activity is different from module to module. You should really check the Blackboard for the due date of each assignment.

Weeks	Contents
Week 1 (8/22 M)	**Introduction and Product Development Process (Product Design and Development)** CH1: Introduction CH2: Development Processes and Organizations **Activities:** • Read chapters • Individual Assignment #1 • Project Team Setup • Quiz #1
Week 2 (8/29 M)	**Systems Engineering Processes (SMC SE Primer & Handbook)** CH1: SMC Systems Engineering Primer CH2; How does Systems Engineering Work? **Activities:** • Read chapters • Individual Assignment #2 • Quiz #2
Week 3 (9/12 M)	**Opportunity and Product Planning (Product Design and Development)** CH3: Opportunity Identification CH4: Product Planning **Activities** • Read chapters • One Team Assignment #1 • Team Topic Selection • Peer Evaluation
Week 4 (9/19 M)	**Requirements Engineering I (Product Design and Development & others)** • CH5 Identifying Customer Needs • Other materials from instructor **Activities** • Read materials • One Team Assignment #2 • Peer Evaluation
Week 5 (9/26 M)	**Requirements Engineering II (Product Design and Development & others)** • CH 6 Product Specifications of Product Design and Development • Other materials **Activities:** • Read materials • Customer Need Identification (Team Assignment) #3 • Peer Evaluation
Week 6 (10/3 M)	**Concept Generation (Product Design and Development & others)** • CH 7 Concept Generation • Function Models • @RISK Model **Activities:** • Read materials • Watch video clips for FFBD/IDEF models/@RISK • Individual Assignment (@RISK model practice) #3

	• Concept Generation Team Assignment #4
Week 7 (10/10 M)	**Concept Selection (Product Design and Development)** • CH 8: Concept Selection • CH 9 Concept Testing **Activities:** • Read materials • Individual Assignment (@RISK Model) #4 • Concept Selection Team Assignment #5 • Peer Evaluation
Weeks 8 (10/17 M)	**Product Architecture** • CH 10 Product Architecture of Product Design and Development of Product Design and Development • CH 2 How does Systems Engineering Process Work? of SMC SE Primer & Handbook **Activities:** • Read Materials • One Team Assignment for Product Architecture #6 • One Team Assignment for Product Specification #4 • Peer Evaluation
Weeks 9 (10/24 M)	**Industrial Design (Product Design and Development)** • CH 11 Industrial Design **Activities:** • Read Materials • Watch the video clip • One Team Assignment for Industrial Design #7 • Quiz #3 • Peer Evaluation
Week 10 (10/31 M)	**Design For Manufacturing (Product Design and Development)** • CH 13 Design for Manufacturing **Activities:** • Read Materials • One Team Assignment for DFM #8 • Peer Evaluation
Week 11 (11/7 M)	**Robust Design (Product Design and Development)** • CH 15 Robust Design **Activities:** • Read Materials • One Individual Assignment for Taguchi Method #5 • One Team Assignment for Parametric Diagram #9 • Peer Evaluation
Week 12 (11/14 M)	**Product Development Economy (Product Design and Development)** • CH 17 Product Development Economics • Appendix A: Time Value of Money and the Net Present Value Technique **Activities:** • Read Materials • One Individual Assignment for Quantitative Revenue Model #6
Week 13 (11/21 M)	**Managing Project** • Appendix B: Modeling Uncertain Cash Flow using Net Present Value **Activities:** • Read Materials • One Individual Assignment for Decision Tree Based Longest Path Problem #7 • One Individual Assignment with @RISK model #8
Week 14	**Final Team Project Preparation**

(11/28 M)	**Activities:** • No Face-to-Face class this week • Use this week for your final team project • Submit both PPT and Report
Week 15 (12/5 M)	**Final Team Project Presentation**

4. **Rubric for Individual/Team Assignment**

a. **Participate, on time.** 50 points

Unexcused lateness will be penalized

b. **Meet each task specified by your professor in their instructions** 35 points
c. **Show any or all of the following:** 15 points

1) **Critical thinking***
2) **Original thinking***
3) **Researched examples**

***Critical/original thinking**: Demonstrate new approaches and/or ability to "push back" rather than simply reproducing another's thoughts. Use direct quotations sparingly and judiciously. Properly identify any sources and integrate into own thoughts and ideas.

Typically, the third item is used for extra credits. In other word, when you submit your assignment on time with on target criteria, you will earn 85%. Item 3 will be used for students with above target criteria.

5. Applied Critical Thinking (ACT)

5.1 Vocabulary of Critical Thinking

We use the vocabulary of critical thinking described by Drs. Richard Paul and Linda Elder, including the eight elements of thought and nine universal intellectual standards:

Eight elements of thought

1. purpose
2. question at issue/problem
3. information
4. interpretation and inferences/solution
5. concepts
6. assumptions
7. implications and consequences
8. point of view

Nine universal intellectual standards for critical thinking:

1. Clarity
2. Accuracy
3. Precision
4. Relevance
5. Depth
6. Breadth
7. Logic
8. Significance
9. Fairness

For more details, see:

1) Paul, R. & Linda Elder, L. 2014. The miniature guide to critical thinking-concepts and tools (Thinker's guide), 7th edition, Foundation for Critical Thinking.

2) Paul, R. & Linda Elder, L. 2011. Critical thinking: Tools for taking charge of your learning and your life, 3rd edition, Prentice Hall.

5.2 Critical Thinking Process (CTP)

According to the ACT vocabulary we used, there are four major aspects of the ACT process, termed as the 4 C's: curiosity, connections, creativity and communication. In this course the C in the student learning objectives is connection.

Making connections to a particular issue or problem: students will connect the concepts and methodology discussed in the lectures to practical questions/problems in product development.

5.3 Critical Thinking Activities and Assessment

There are two assessment activities (AA) for critical thinking in this course. The assessment of these activities is used to evaluate how well critical thinking is integrated into the course. These assessments will be used as input to the UHCL Critical Thinking database for internal assessment of Critical Thinking, and will not affect your grade for this course.
1. Individual Assignment #5: Understand and apply Taguchi method for robust design. The IA requires students to have a clear understanding of the ***concept*** of Taguchi method for robust design and then accurately apply it to ***solve*** relevant design ***problems***.
2. Individual Assignment #7: Apply @RISK model to evaluate risks in project management. The IA requires students to have a clear understanding of risk, which is a key ***concept*** in project management and obtain in-depth knowledge of @RISK software. Also, the students will have hand-on experiences in applying it to ***solve*** relevant ***problems***.

The course assesses connection out of the four C's. The related Student Learning Outcomes (SLO) and Fundamental and Powerful Concepts (FPC) are as follows:

Activity	CLOO	FPC
AA #1	1, 2	1, 2
AA #2	3	3

The assessment criteria for the AAs:

Assessment Activity	Assessment Outcome		
	Unacceptable	Acceptable	Excellent
AA #1	[0%,85%)	[85%,95%)	[95%,100%]
AA #2	[0%,85%)	[85%,95%)	[95%,100%]

Overall, if 70% or more of students are evaluated to be acceptable or excellent in each activity and the average of all activities, the outcomes will be considered acceptable. Otherwise, the instructor will evaluate the ACT content, activities, and assessment of the course and make necessary adjustment.