

Introduction to Engineering Design with Professional Development I (ENGR 2050)

Fall 2017 Syllabus

Credit Hours: 4

COURSE DESCRIPTION

While the steps involved in the design process may change depending upon a variety of factors, most design experts agree that the design process starts with a thorough understanding of the problem, followed by a thorough exploration of possible concept solutions. Since design problems are by nature open-ended (meaning that there are many possible solutions) and multi-faceted (meaning that there are multiple levels of complexity), the process of problem definition followed by formulation of system concept solution is an iterative process that usually continues until a complete and unambiguous system solution is identified. Design is an iterative stepwise process that is best learned by doing. As a result, this is primarily a project-based course.

In the real world, resources are rarely considered infinite, so the best engineering designers learn how to implement the design process using the most efficient and effective methods available. This course will teach you some of these methods. The ultimate goal in the engineering design process is to meet or exceed customer wants and needs, while reducing cost and time. Teamwork and communication are essential elements of the engineering design process. Engineers who do not know how to communicate and work effectively with others are ineffective designers. Learning how to communicate in the context of the design process and learning how to work in a team environment are integral elements of this course.

COURSE OBJECTIVES

This course will teach you about the importance of teamwork and communications in the context of the engineering design process. Interactive professional development exercises will provide you with the knowledge and skills necessary for effective teamwork. Coursework is designed to challenge you to improve and expand upon your oral, written and visual communication skills.

LEARNING OUTCOMES

1. Students will have the capacity to solve engineering design problems, while instilling the importance of creativity in developing innovative solutions.
2. Students will know how to identify customer needs, establish design objectives, and translate these into engineering design specifications.
3. Students will exercise and improve important design skills of visualization, calculation, experimentation, and modeling.
4. Students will have skills in organizing people and ideas for successful design. Skills include teamwork, project management, verbal and written communication, and documentation.
5. Students will be able to function on multi-disciplinary teams and communicate effectively.
6. Students will understand professional and ethical responsibility.

Prerequisites: ENGR 1100 and either ENGR 1200 or ENGR 1400. Co requisite: PHYS 1200.

Course Coordinator: Mark Anderson, Sr. Project Eng., Design Lab, JEC 2027, email: anderm8@rpi.edu

Section Schedules and Instructors: Please see instructors for office hours, locations, phone numbers and email addresses.

Section	Days	Times	Instructors
1	MR	08:00 am-09:50 am	John Drazan / Casey Jakubowski
2	MR	10:00 am-11:50 am	John LaGraff / Glen Gross
3	MR	10:00 am-11:50 am	Paul Moon / Christine Allard
4	MR	12:00 pm-01:50 pm	Yuri Alan Gorby / Christine Allard
5	MR	12:00 pm-01:50 pm	Paul Moon / Glen Gross
6	MR	02:00 pm-03:50 pm	Peter Caracappa / Karyn Dyer
7	MR	02:00 pm-03:50 pm	Randolph Franklin / Casey Jakubowski
8	TF	02:00 pm-03:50 pm	George Gela / Amy Corron
9	TF	10:00 am-11:50 am	Rena Huang / Graham Knowles
10	TF	10:00 am-11:50 am	Bill Foley / Karyn Dyer
11	TF	12:00 pm-01:50 pm	Bill Foley / Amy Corron
12	TF	12:00 pm-01:50 pm	John Drazan / Susan Henry
13	TF	02:00 pm-03:50 pm	Asish Ghosh / Susan Henry
14	MR	10:00 am-11:50 am	Deanna Thompson / Judith Obiero
15	MR	12:00 pm-01:50 pm	Partha Dutta / Judith Obiero

COURSE ORGANIZATION

This course will consist of two major phases. The first phase will involve a short “warm-up” mini-project that is intended to familiarize you with the major elements of teamwork, communication and the design process. Students will work on the mini- project in teams of two or three for the first four weeks of the semester. Focus is on the design of a system that performs a simple measurable function. The second phase builds upon the teamwork, communication and the design process skills and involves a more complex system design project that will encompass the remainder of the semester. For this second project, teams will be organized into groups of five to seven students. Instructional aspects of the course will include video lectures to introduce concepts that will be used during the studio-lab sessions. Studio-lab sessions will include formal meetings and interactive exercises between student teams and instructors. Instructors will work with student teams on their projects and activities to help guide the team in the design process. Team members should come to studio-lab sessions prepared to discuss design work, project assignments, and team dynamics. On a day-to-day basis, your instructors may assign specific tasks to be completed by the team or by individual team members related to both the design process and the development of your team.

STUDIO-LAB SCHEDULE

Notes:

1. This is a tentative schedule and subject to change
2. *Italicized items are led by Archer Center instructors*
3. **Reading assignments & video lectures to be completed prior to taking the weekly quiz**
4. **Reading assignments and video lectures are due by end of Wednesday on the weeks shown**

Week	Assignments	Video / Lecture Slides	Monday/Tuesday Lab	Thurs/Fri Lab
1	First Assignments & Videos DUE FRIDAY			
	Mini Project Descriptions Ulrich & Eppinger Chapter 1: Introduction Chapter 2: Development Processes and Organizations Chapter 3: Product Planning	Videos: <ul style="list-style-type: none"> • Introduction • Gantt Charts 	Classes have not yet started!	Activity 01-02-1: <i>Team communication and process.</i> Safety guidelines, introduce mini-project and form teams, develop a GANTT chart. Activity 2-2: Conduct user needs/functional analysis. Brief lab / shop tour (if time allows). Homework Assignment: Take on-line safety quiz and collect statements of customer needs for mini-project (due on next lab session). Collect materials and supplies to work on mini-project next week.
2	Remaining Assignments, Videos/Lectures DUE WEDNESDAYS		Dates: 9/4 (no classes) & 9/5	Dates: 9/7 & 9/8
	Chapter 4: Identifying Customer Needs Chapter 5: Product Specifications MBTI: Complete the inventory at: http://www.humanmetrics.com/cgi-win/jtypes2.asp	Videos: <ul style="list-style-type: none"> • Customer Needs • Requirements • Benchmarking Lecture Slides: <ul style="list-style-type: none"> • Technical Writing Quiz #1 Opens	Activity 3-1: Develop list of engineering design requirements. Use needs-metrics matrix (see p 77 in text) to show one to one correspondence with customer needs (due on next lab session). OPEN LAB HOURS START TUESDAY DUE: MBTI 4 letter type to your PD1 instructor by end of day Tuesday	Activity 4-1: <i>Practice public speaking. Conduct audience analysis; organize presentation and delivery elements.</i> Activity 4-2: Establish specifications for your project.
3			Dates: 9/11 & 9/12	Dates: 9/14 & 9/15
	Ulrich & Eppinger, Chapter 6: Concept Generation Chapter 7: Concept Selection	Videos: <ul style="list-style-type: none"> • Design Creativity Tools • Concept Generation • Concept Selection Quiz #2 Opens	Activity 5-1: <i>MBTI activities and information (2 hours)</i>	Activity 6-1: Design creativity exercises: sketching, brainstorming, mind mapping, morphological chart, concept screening decision matrix. Activity 6-2: Technical Writing

Week	Assignments	Video / Lecture Slides	Monday/Tuesday Lab	Thurs/Fri Lab
4			Dates: 9/18 & 9/19	Dates: 9/21 & 9/22
	Chapter 14, Patents & Intellectual Property <u>Course reading articles:</u> 5 Stages of Group Development, Team Performance Model	Lecture Slides: • Entrepreneurship • Intellectual Property Quiz #3 Opens	Activity 7-1: Mini-project reviews, presentations and sectional competitions	Activity 8-1: Mini-project reviews, presentations and sectional competitions
5			Dates: 9/25 & 9/26	Dates: 9/28 & 9/29
	Video: TED Talk by Simon Sinek for team formation	Quiz #4 Opens	Activity 9-1: Exploration of problem areas for team project	Activity 9-1: Exploration of problem areas for team project (continued) <i>Team formation / consultation</i>
6			Dates: 10/2 & 10/3	Dates: 10/5 & 10/6
	Chapter 12: Prototyping	Lecture Slides: • Application of Machine Elements • Materials Quiz #5 Opens	Activity 10-1: Continue discussion of potential problem areas, select focus area and write team statement of work. Brainstorm potential end user needs/wants and organize using affinity diagramming and prioritize.	Activity 11-1: <i>Continuation of team consultations</i> Activity 11-2: Requirements definition
7			Dates: 10/9 (no classes) & 10/10 Mon)	Dates: 10/12 & 10/13
		Lecture Slides: • Controls / Basic Electronics Quiz #6 Opens	Activity 12-1: Concept generation and selection	Activity 14-1: Milestone One: System Concept Reviews
8			Dates: 10/16 & 10/17	Dates: 10/19 & 10/20
	Chapter 13: Robust Design Course reading articles: The Johari Window and Modes of Conflict	Lecture Slides: • Robust Design • Risk Management Quiz #7 Opens	Activity 16-1: Conduct informal design reviews to evaluate safety, life cycle, manufacturing, and cost issues.	Activity 15-1: <i>Giving and receiving feedback</i> Activity 15-2: <i>Managing conflict, five styles of conflict management</i>
9			Dates: 10/23 & 10/24	Dates: 10/26 & 10/27
	Chapter 11, Ulrich and Eppinger, DFM	Lecture Slides: • Design for Mfg Quiz #8 Opens	Activity 17-1: Project work & <i>team consultations</i>	Activity 20-1: Apply Design for Manufacture methodology
10			Dates: 10/30 & 10/31	Dates: 11/2 & 11/3
	Chapter 15, Product Development Economics	Lecture Slides: • Engineering Economics Quiz #9 Opens	Activity 18-1: Project work & <i>team consultations</i>	Activity 19-1: Project work & <i>team consultations</i>
11			Dates: 11/6 & 11/7	Dates: 11/9 & 11/10
		Quiz #10 Opens	Activity 21-1: Informal Subsystem demos & <i>team consultations</i>	Activity 22-1: Informal Subsystem demos & <i>team consultations</i>
12			Dates: 11/13 & 11/14	Dates: 11/16 & 11/17
		Quiz #11 Opens	Activity 23-1: Project work & <i>team consultations</i>	Activity 24-1: Project work & <i>team consultations</i>
13			Dates: 11/20 & 11/21	Dates: 11/23 & 11/24
			Activity 25-1: Project work & <i>team consultations</i>	Thanksgiving – No Classes
14			Dates: 11/27 & 11/28	Dates: 11/30 & 12/1
			Activity 26-1: Project work & <i>team consultations</i>	Milestone Two: Project Demos
15			Dates: 12/4 & 12/5	Dates: 12/7 & 12/8
			Milestone Two: Project Demos	Milestone Three: Team Presentations
16			Dates: 12/11 & 12/12	
			Milestone Three: Team Presentations	

MBTI 4 Type Letters to your IED instructor Due – Wednesday, Week 2, end of day
Mini Project Memos Due – Monday, Week 5, start of day
Milestone 1 Memos Due – Wednesday, Week 8, end of day
Milestone 3 Reports Due & Peer Evaluations – Friday, Week 15, end of day. Submit Peer Evaluations AFTER the Report.
All Quizzes Open at noon and close at noon the next week unless specifically noted in the quiz.

Materials and Supplies: Students are expected to provide their own materials and supplies for their projects as needed. Kits for the line tracker and mousetrap car mini-projects will be available for purchase. Loaner 80-20 and motor kits are available for a deposit for the major team project. Students will typically need their textbook and laptop computer (with power supply / charger) and note taking tools (notebook / pens / pencils) for studio-lab sessions.

Textbooks (available at the campus bookstore):

1. Product Design and Development, 6th edition, by Karl Ulrich and Steven Eppinger, McGraw-Hill
2. Introduction to Myers-Briggs Type (7th edition), Author: Isabel Briggs Myers (revised by Linda K. Kirby & Katharine D. Myers)

Grading: Overall course grades will use grade modifiers (A-, C+, etc.). Grades will be based upon a combination of:

1. The quality of system design responses to the challenges and objectives of the overall course and individual projects. This includes both the breadth and depth of understanding and development that communicates the technical, economic, social, and environmental impacts of engineering design.
2. Willingness and ability to work in a team environment to explore existing and new approaches that present innovative and practical solutions for engineering system design problems.
3. Individual Contribution Factor - The individual contribution factor (ICF) represents how much each student contributed to the team's success. Instructor in-class observations and the student peer evaluations are the major elements in determining this factor.

While time and effort expended toward work often reflects positively in the quality of project results, it cannot be, in itself, a guarantee of a high grade. Students will receive feedback at the end of every major assignment in the course. Those not doing satisfactory work will receive a written notice with an evaluation of what steps might be taken to improve. The following weightings will be used to compute the final course grade:

Major Element	Rubric	% Rubric Element		% Final Grade
Mini Project 25% of final grade	Competition	10%		2.5%
	Presentation	30%		7.5%
	Memo	60%		15.0%
		100%		25%
Team Project 50% of final grade * ICF	MS 1 - System Concept Presentation	40%		4.0%
	MS 1 - System Concept Memo	60%		6.0%
	MS 2 - Demonstration	100%		15.0%
	MS 3 - Design Review Presentation	40%		10.0%
	MS 3 - Design Review Report	60%		15.0%
	100%		50%	
Attendance 10% of final grade	Classroom			10.0%
Quizzes 15% of final grade	On-line (LMS)			15.0%
				<u>100%</u>

ICF = Individual Contribution Factor

ICF for an individual member of a team may be less than, equal to, or greater than one.

Final Grade = Mini project + (ICF * Team Project) + Attendance + Quizzes

The following numerical to letter grade mapping will be used:

Grade Letter	0-100	Grade Letter	0-100	Grade Letter	0-100
A	92-100	C+	77-79.99	F	0-59.99
A-	89-91.99	C	74-76.99		
B+	86-88.99	C-	71-73.99		
B	83-85.99	D+	68-70.99		
B-	80-82.99	D	60-67.99		

Quizzes:

During the first eleven weeks of the semester there will be a series of quizzes administered via LMS on topics covered in your textbook and during class. Each quiz is cumulative and may cover any course material to date. These LMS quizzes will be available for one week only, from 12:00PM on the Wednesday shown on the schedule to the following Wednesday at 10:00AM unless otherwise stated/announced. You should take **all** of the weekly LMS quizzes. The highest ten out of eleven total quiz scores will be averaged to calculate your final quiz grade. The lowest quiz score will be dropped. As the quizzes are available for a week, there are no make-up quizzes.

Shop Access:

Students will have supervised access to the shop at various hours. The shop schedule will be posted on the shop door and on LMS.

Attendance, Class Policies, and Academic Integrity:

Attendance at studio-lab sessions is mandatory. A student may miss part or all of a studio-lab only if prior notice and/or acceptable reason is given. Students are responsible for all missed content and work. If a student misses more than two studio-labs, grades will be affected accordingly. Class presentations, criticisms, and discussions are essential to the development of ideas in the context of the design and team processes. Missing an assignment or design review without an authorized excuse will result in a grading penalty. All work submitted for grading should represent the student's own effort. Work that builds upon the prior work of others should be properly acknowledged. Collaboration with other students is expected and essential within the contexts of design and team development and on designated team assignments. Student should be mindful that the work they submit truly represents their own efforts. Students found submitting work for a grade that is not their own will result in course failure. If students are at all confused about the application of this policy, they should seek clarification from their instructor.

See this link for excused absences:

<http://studentlife.rpi.edu/student-experience/excused-absence/>

Mobile Devices:

All mobile devices (cell/smart phones, computers, pagers, etc.) must be stored securely away during studio-labs and are not to be used unless specifically directed otherwise by the instructor.

