Course Syllabus

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PennState
College of Engineering

MECHANICAL ENGINEERING

Penn State University
Department of Mechanical Engineering
ME440W - Mechanical Systems Design

Instructor Information

Instructor: Gary Neal

Location: 323 Leonhard Bldg.

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Course Information

Meeting Time/Location: Tu / Th 8:00-9:55 AM – 225 Engineering Design and Innovation Building

Office hours: by Appt.

Pre-requisites: ME 340

Concurrent: IE 312, ENGL 202C

Optional Text: *Product Design and Development, 4th, 5th or 6th Ed.,* by Karl T. Ulrich & Steven D. Eppinger. It is strongly recommended that you obtain the textbook for use in this course and as a reference on future design projects**.**

Select the arrow to review each section's information.

▾ Course Description

This course will apply fundamental design and analysis methods to **open ended** engineering problems. Students develop and practice skills and techniques for managing and executing engineering design projects. These skills are applied to an industry-sponsored project. Project teams perform all facets of product and process design. This includes problem identification; planning of the project; formulation of design specifications; development and evaluation of alternative conceptual designs; development of detailed designs; specification of manufacturing processes; prototyping of manufacturing processes and parts; and analysis and documentation of results. Students will visit industrial sites to gain an understanding of existing processes and problems and to assess the customer's needs. Students will present their design process and final design in several formats: oral presentations, poster presentations, web pages, and reports.

▾ Course Objectives & Student Outcomes

Course Objectives

Upon completing this course, students should be able to:

1. Interact with a customer (boss, co-worker, client) to formulate equitable design criteria (time, cost, quality) for a meaningful engineering project [SO2, SO5]
2. Develop an action plan to complete the project on time and within budget [SO2]
3. Conceptualize devices and systems to satisfy design criteria [SO2]
4. Analyze technical and economic merits of design alternatives [SO2]
5. Learn to use new evolving engineering tools for analysis, fabrication and management [SO3]
6. Work effectively in a team that includes co-workers, customers and vendors [SO5]
7. Communicate well using verbal, written and electronic methods [SO5]
8. Demonstrate professionalism in interactions with colleagues, faculty, and staff [SO5]
9. Demonstrate an appreciation of economic, global, societal, and ethical issues [SO2]
10. Demonstrate knowledge of contemporary issues [SO7]
11. Demonstrate ability to learn in less structured circumstances [open ended design] [SO7]

Student Outcomes (SO):

Upon completing this course, students should have:

1. SO2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
2. SO3: An ability to communicate effectively with a range of audiences.
3. SO5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
4. SO7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

▾ Instructor's Role

The instructor is a "coach" and mentor. The Instructor will NOT be the Project Manager, not tell you which option to use in your final design, nor make technical decisions for your team. Instructors are here to ensure you are following the proper design process, acting professionally in all interactions, and managing your project to success.

▾ Students' Role

It is the students' responsibility to manage and professionally and successfully execute the project. In addition to each student being an active engineer on their project, students will take on additional roles including Project Manager, Scheduler, Budget Keeper, etc. Students will define the problem by discussing with the sponsor, establish a project plan that maps required steps to success, and execute that plan to produce the project's required deliverables. Excellent student teamwork and communications are essential to your success!

▾ Grading

The final grade will be based on:

Assignment	Individual or Team Evaluation	Final Grade
Project Execution and Deliverables Evaluation	Individual & Team	60%
Project Reports	Team	20%
Project Presentations	Individual & Team	10%
Class Assignments	Individual & Team	10%

○ If a student feels that an assignment was graded unfairly or in error, bring it to the instructor's attention within one week after the graded material was returned. Scores will not be reconsidered afterward. The grading scale is as follows: **A** >93, **A-** >90-93, **B+** >87-90, **B** >84-87, **B-** >81-84, **C+** >78-81, **C** >72-78, **D** 63-72, **F** <63.

▾ Course Policies & Requirements

○ **Academic Integrity:** In this course, students are expected to work together with their team on most assignments. There are some assignments which are to be done individually (i.e., each student is required to submit his or her own original work). The expectations for each assignment will be made clear by the instructor and/or the assignment form. If you have any questions as to which assignments are to be done individually, please ask. Regardless of the nature of the assignment, Plagiarism is strictly prohibited. An example of plagiarism is submitting a written assignment that includes text taken directly from another source and/or pictures that are not properly referenced. If you have any questions about how to properly reference material taken from another source, please ask. When you utilize information gleaned from other sources, cite those sources appropriately within your document. Proper citation provides your document with credibility and allows you, as the author, to verify the source of your data or statements in the event anyone questions the validity. In the long run, source citation helps you and makes your document more professional.

Throughout all of your work in this class, please do not be a cheater. If you encounter others operating in an unethical manner and would like to bring this to my attention, please discuss this with me in person or send me an email. If you would like to do this anonymously, you can send anonymous emails from several online tools. I will do my best to investigate the situation and determine a proper course of action.

The University defines academic integrity as the pursuit of scholarly activity in an open, honest, and responsible manner. All students should act with personal integrity; respect other students' dignity, rights and property; and help create and maintain an environment in which all can succeed through the fruits of their efforts (refer to Senate Policy 49-20). Dishonesty of any kind will not be tolerated in this course. Dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Students found to be dishonest will receive academic sanctions and will be reported to the University's Office of Student Conduct for possible further disciplinary sanctions (refer to Senate Policy G-9).

○ **Professional Ethics:** The engineering profession must hold itself to high standards to ensure safety for the users of the products it designs. Engineers abide by several different codes of ethics, including the prominent American Society of Mechanical Engineers (**https://www.asme.org/getmedia/7cbbdb0b-93f9-476c-9632-c8a9370f6632/SocietyPolicies_15-7_Ethics.aspx** ⬚⇥ **(https://www.asme.org/getmedia/7cbbdb0b-93f9-476c-9632-c8a9370f6632/SocietyPolicies_15-7_Ethics.aspx)**) and the National Society of Professional Engineers (**http://www.nspe.org/resources/ethics/code-ethics** ⬚⇥ **(http://www.nspe.org/resources/ethics/code-ethics)**) Code of Ethics.

In addition to the safety aspect of your profession, also strive to be a trusted team member with integrity within your project team. You should understand your project role and task responsibilities. Most projects within this course do not have an over-abundance of personnel resources, as is typical in the professional world. The success of the project depends on competent contribution from every team member. Anyone that is not pulling their weight, regardless of cause, is causing the team's product to be inferior, thereby reflecting poorly on the team, the company, and in this setting, the University. Successfully executing a project requires every member's dedicated input.

○ **Team vs. Individual Assignments:** In this course, students are expected to work together with their team on most assignments including progress reports, written reports, and presentations. There are some assignments which are to be done individually where each student is required to submit his or her own original work. The expectations for each assignment will be made clear by the instructor and/or the assignment form. If you have any questions as to which assignments are to be done individually, ask.

○ **Deadlines:** As part of this course's mission to transition you from the academic setting into a professional setting, we will utilize as many professional nuances as possible. Deliverables in the professional world almost always have a defined deadline. So too will assignments in this course.   Late submissions will be penalized 50%/day. Early submissions are encouraged, accepted, and, at the instructor's discretion, may be rewarded bonus points!

○ **Attendance:** Attendance is expected at the start of each class. Inform your teammates and instructor in writing prior to any absences as unexcused absences will influence your professionalism grade. Illness or a job interview is a reasonable excuse, although abuse of excused absences (more than 1-2 in the semester) will warrant further investigation and documentation. Absences must be previously cleared with all team members and the instructor via email. An absence from presentations and when intensive teamwork is necessary is not permitted, so plan accordingly. See Faculty Senate Policy on Class Attendance (42-27).

○ **Work Load:** Consistent with University policies for a 3 credit course, this course requires 9-12 hours per week of individual effort outside of scheduled class times. Please plan accordingly. It is critical that you establish regular times when your team can meet outside of class and lab, since many activities are team-based. (Congratulations! To encourage team members to thoroughly read their assignments, your instructor has hidden secret bonus point opportunities within course materials, and you've found one! If you are the first in the class to send your instructor an email with the Subject "your class name and section (e.g. ME 440.001): Syllabus Bonus Points" and content "I found the hidden bonus point", then 5 bonus points will be added to an assignment grade.)

○ **Project Journal:** The team is responsible for organizing and maintaining a project journal. This journal can be handwritten or electronic using Microsoft Teams, Google Drive, OneDrive, Box, OneNote, etc. Drawings, concepts, ideas, & anything discussed regarding the project should be documented. The journal is a working document. Neatness is not critical, though the journal must be legible. The journal may be reviewed at Staff Meetings.

○ **Weekly Project Team Meeting:** Each project team must establish and attend a weekly meeting outside of normal class time. This meeting will give the team a defined occasion each week to coordinate their tasks and ensure all team members are actively engaged.

- **Professionalism:** Your conduct should meet high professional standards, and you should have ethical and positive interactions with the sponsor, team members, Learning Factory personnel, and instructor. Being a team player, acceptance of responsibility, and respect for others will be graded. Each absence at any out-of-class team meeting, failure to provide non-graded exercises, unexcused class tardiness, and texting or utilizing phones in class are examples of activities that will result in loss of points. Be in class when the bell rings, not walking in. Be prepared for class, ready to learn, with a way to take notes every day. Follow directions. Respect yourself and those around you. Use appropriate language and be sensitive to others.

▾ University Policies and Resources

- **Disability Resources:** Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The **Student Disability Resources (SDR) website (http://equity.psu.edu/sdr/disability-coordinator)** provides contact information for every Penn State campus. In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See **documentation guidelines (http://equity.psu.edu/sdr/guidelines)** . If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.
- **Counseling & Psychological Services (CAPS):** Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional well-being. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds and sensitive to differences in race, ability, gender identity and sexual orientation.
  - **Counseling and Psychological Services at University Park (http://studentaffairs.psu.edu/counseling/)** (CAPS): 814-863-0395
  - Penn State Crisis Line (24 hours/7 days/week): 877-229-6400, Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741
- **Educational Equity:** Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined on the **University's Report Bias webpage (http://equity.psu.edu/reportbias)** (http://equity.psu.edu/reportbias/).

▸ Global Project Time Zones

▾ Schedule

(Note: Course schedule subject to change)

Week	Date	Topic	Comments
0	Before 8/18	**Review list of projects (http://www.lf.psu.edu/projects/project-selector.aspx) on LF web site**	
	No Later Than: 8/18	Submit **project preferences (https://www.engr.psu.edu/lfprojectselection/)** via online preference website	
	~ Thur 8/22	*Members assigned to project teams*	
1	Tue 8/27	Meet & greet; Team organization workshop	Read Ulrich Chap 1-6, 16, 18
	Thu 8/29 **No class**	Free time for Project Kickoff meeting with Sponsor	
	No Later Than Fri 8/30	**Project Kickoff meeting between student team and sponsor** **GLOBAL PROJECTS ONLY: Video/teleconference with PSU and SJTU student teammates, SJTU/PSU faculty, and potentially sponsor (depending on previous contact history between sponsor and SJTU)**	Logistics arranged by student teams
		GLOBAL ONLY: SJTU on Winter Break (Actual Break = TBD)	
2	Tue 9/3	Staff Meetings (shortened)	- Project Kickoff meeting outcomes? -Have established team roles ready -Bring design journal proof
	Thu 9/5	Project planning workshop (in class) Cindy LF procedure class discussion at 8am	**-Bring MS Project software to class** -Read Ulrich Chap 7-8
3	Tue 9/10	Staff Meetings	
	Thu 9/12	Risk Management workshop (in class)	
4	Tue 9/17	Staff Meetings - Concept Design complete	
	Thu 9/19	Engineering Economics (Budget/BOM) workshop (in class)	Read Ulrich Chap 17

5	Tue 9/24	Staff Meetings - System Level Design complete	Read Ulrich Chap 15
	Thu 9/26	**Alpha prototype demonstration (in class)** SOW Presentation preparation	

6	Tue 10/1	Staff Meetings - Detailed Design complete	Read Ulrich Chap 14
	Thu 10/3	SOW presentations (in class)	

GLOBAL ONLY: SJTU return from Winter Break (Actual Break = TBD)

7	Tue 10/8	Staff Meetings – Manufacturing Process	Read Ulrich Chap 10-13
	Thu 10/10	Open time for team to work together on project	

8	Tue 10/15	Staff Meetings – Manufacturing Process	
	Thu 10/17	Open time for team to work together on project	

9	Tue 10/22	Staff Meetings – Analysis and Testing	
	Thu 10/24	**Beta prototype demonstration (in class)**	Read Ulrich Chap 9

10	Tue 10/29	Staff Meetings - Redesign, Construction, Testing	
	Thu 10/31	Open time for team to work together on project	

11	Tue 11/5	Staff Meetings - Redesign, Construction, Testing	
	Thu 11/7	Open time for team to work together on project	

12	Tue 11/12	Staff Meetings - Redesign, Construction, Testing	
	Thu 11/14	Open time for team to work together on project	

13	Tue 11/19	Staff Meetings - Redesign, Construction, Testing	
	Thu 11/21	**"Final" prototype demonstration / Mini Capstone Project Showcase (in class)**	NDA teams send poster to sponsor for approval

Thanksgiving Break

14	Tue 12/3	Staff Meetings - Project Close Out	
	Thu 12/5	End of semester details + Project work session	

15	Tue 12/10 **No regular class**	Project Design Showcase (Bryce Jordan Center)	
	Thu 12/12	Final Project Presentations (in class)	

16	Finals Week	Project Closeout	

Last day of SJTU Spring semester = TBD