ME340: Mechanical Engineering Design Methodology SPRING 2019 Syllabus

Catalog Description: The product design process; Development of design problem definitions by evaluating customer inputs, technology, and competitive products; Generation of conceptual design using structured and unstructured approaches; Evaluation of concepts using engineering modeling and decision matrices; Product detail design including design for manufacturability and profitability; Effective communication: oral, written, and graphical.

Credits: 3 | nominally taken in 5th or 6th semester
Prerequisites: EDSGN 100 + ME360 concurrent + ME320 concurrent | Note: ME340 is a pre-req for ME440/441W
Location: 101 Thomas Bldg (Lecture) + 239 Reber (Lab Sections 1,5,6,7,8) or 314 Hammond (Lab Sections 2,3)
Time: 12:20 – 1:10 Mondays and Wednesdays (no Friday lecture) + 3 hr Lab Section (see PSU Class Schedule)
Instructor: Timothy W. Simpson | Paul Morrow Professor of Engineering Design & Manufacturing | tws8@psu.edu | 205 Leonhard Bldg | @PSUMakerProf | https://www.linkedin.com/in/timothy-w-simpson-2a5ab04/

Lab Instructors:
Joseph Fisher | Graduate Student | Mechanical Engineering | jwf23@psu.edu | Lab Section 1
Lauren Ryan | Graduate Student | Mechanical Engineering | lur310@psu.edu | Lab Sections 2 and 3
Chris Hendrick | Graduate Student | Mechanical Engineering | cmh698@psu.edu | Lab Sections 5 and 7
Jen Bracken | Graduate Student | Mechanical Engineering | jeb85@psu.edu | Lab Sections 6 and 8

Writing Support: Michael Alley | Associate Professor of Engineering Communications | mpa13@psu.edu | Supports all labs
Office Hours: Varies by lab instructor – days/times will be announced in class and lab sections once teams are formed

Other things you must acquire: Shop safety glasses are highly recommended.

Course Objectives:
- Develop proficiency in design skills and methodologies
- Gain first-hand experience of the design process in the context of a ‘real’, open-ended multidisciplinary design project
- Work effectively and professionally in a team while executing a design project
- Apply engineering analysis tools in the design process
- Understand the holistic context of design, including global, societal, ethical, economic and environmental concerns
- Improve proficiency in professional communication skills
- Understand that it takes a minimum of 3-5 iterations to get a design, or a written document right
- Realize that the first idea is almost never the best

Course Outcomes: After completing this course, each student should be able to:
1. Formulate a design problem by translating customer needs into design objectives and constraints
2. Construct and modify a Gantt chart and use it to plan, manage, and execute a project
3. Function effectively in a team environment and identify, assess and resolve team problems
4. Generate multiple design concepts and select and refine the best design concept using appropriate qualitative and quantitative techniques (including brainstorming, decision matrix, and economic analysis)
5. Use a solid modeling CAD package to represent the geometry of a part or an assembly of parts
6. Produce professional-quality reports, oral presentations, web pages, and graphical illustrations for design communication and documentation purposes
7. Access multiple sources of design information, including patents, previous courses, catalog data, reverse engineering, web search, consumer focus groups, empirical tests, etc.
8. Demonstrate professionalism and ethical conduct
9. Assess the ergonomics and aesthetics of a design
10. Identify the environmental, safety and societal implications of a design
11. Assess the manufacturability and assembly of a product and suggest improvements
12. Model and analyze design solutions and correlate to actual performance
13. Produce physical prototypes
Course Requirements:

Academic Integrity: We expect academic honesty of all of you. If you have problems getting assignments done on time, please speak to me as soon as possible so that we can agree on a way to deal with the problem. Please do not put yourself into a position where lack of preparation tempts you to use the work of others as your own. In the event that evidence of academic dishonesty comes to my attention, I will deal with it immediately according to the rules of the University (see: http://www.engr.psu.edu/ug/acad_int/docs/policies.pdf).

Class Participation: Preparation, on-time attendance and active participation are expected at all times. As a professional courtesy, please notify the TA (by email) of any expected absence from lab. You will be expected to make up any missed lab sessions or team duties on your own. Students are allowed a maximum of two unexcused absences from lab. Each additional absence will result in a partial letter grade deduction (i.e., from A to A-, B+ to B, etc). These two absences (personal days) are provided to accommodate all legitimate professional or personal reasons including university sanctioned activities, illness, etc. Any additional absences needed for personal emergencies should be discussed with the TA as soon as possible. Make-up quizzes will not be given. An opportunity will be provided to earn extra credit which can be used to make up missing quiz grades. Missed lab activities cannot be made up outside of the week they are given. It is your responsibility to make arrangements to visit another lab section if you miss an activity on your lab day.

Late Assignments: All assignments are due at the time and on the date specified. Late submittals within 24 hours will receive an automatic 50% grade reduction. Items will not be accepted more than 24 hours after the due date.

Reading Assignments: Deep reading (not just skimming) is still one of the most effective ways of learning on your own and is an essential professional skill that will directly benefit your career. In order to practice this skill, you will be required to complete regular reading assignments from the text and other handout materials. Lab sessions are too valuable to spend on things which you can do on your own. Lectures and lab sessions will be used to add further examples not covered in the reading, for group activities, and to apply the material in realistic situations. Quizzes will be given to demonstrate your mastery of the reading assignments. Check carefully quiz opening and closing times as they are posted.

Assignments: Assignments based on the class lecture/discussions, lab activities, and readings will be given as needed. Most assignments will be related to the lab activities and final design project.

Project: There will be a semester-long project in this class. Working in teams of 3-4, you will design, prototype, and test a mechanical system that must include both traditionally machined and 3D printed parts. More details will be given in class.

Design Journal: One of the most difficult challenges you will face in your professional lives is managing information. To help you develop this skill, each individual is required to keep an electronic design journal for the class and team project. This journal should contain answers to reflection question for all lab assignments and other information as requested by TAs and instructors. Design Journals will be reviewed by the Lab Instructors at least twice during the semester. The reviews provide feedback on your engagement of the material. The reviews will be graded and recorded. Additional guidelines will be provided in class.

Learning by Doing: The best way to learn design is by doing it. Hands-on activities will be the primary instructional tool in this course. Most of the work will be team-based and project-oriented. The first several weeks consist of applications that illustrate the important issues in the design cycle. The last half of the semester will be devoted to a significant design activity, culminating in a design showcase and competition. The output of the design activity will be a hardware system and several written memos and presentations. The final project presentation and report provide an opportunity for you to demonstrate your proficiency with the concepts learned in this course.

Team Effectiveness: Many of the activities in this course will be done in teams and will thus receive a team grade. Each individual is expected to participate fully and equally in all team activities. Periodically, each individual will complete a peer evaluation of their team members which will be a factor in the final grade. We will use an on-line survey tool (www.CATME.org) to perform periodic team health surveys.

CANVAS: A CANVAS website will be used for posting of course materials, schedule, lab assignments, and grades. Please make sure that you forward all email sent from the CANVAS website to your regular email account. Please use CANVAS when emailing the instructors about the course (or labs) so that a record is kept in CANVAS with the class.
Calculation of Final Grade: A weighted average grade will be calculated as follows:

<table>
<thead>
<tr>
<th>Individually Graded Items</th>
<th>Team-Based* Assessment Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Journal 10%</td>
<td>Customer Needs Memo + Pitch 10%</td>
</tr>
<tr>
<td>Peer Evaluation 10%</td>
<td>Concept Proposal + Presentation 15%</td>
</tr>
<tr>
<td>Participation 10%</td>
<td>Progress Memo + Alpha Prototype 10%</td>
</tr>
<tr>
<td>Quizzes 10%</td>
<td>Beta Prototype + Final Report + Pitch 25%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final Average</th>
<th>&gt; 93.0</th>
<th>90.0-92.99</th>
<th>87.0-89.99</th>
<th>83.0-86.99</th>
<th>80.0-82.99</th>
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<tbody>
<tr>
<td>Letter Grade</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final Average</th>
<th>77.0-79.99</th>
<th>73.0-76.99</th>
<th>65-72.99</th>
<th>&lt; 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Grade</td>
<td>C+</td>
<td>C</td>
<td>D</td>
<td>F</td>
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* All team members will normally receive the same grade if, in the judgment of the instructor, all members participated equally. However, at the discretion of the instructor, separate grades may be given.

Note: We will not curve grades in this course. It is possible for everyone in the class to receive an A (or an F). Your performance depends on how well you perform, not on how everyone in the class does. It is therefore in your best interests to help your classmates, while acting within the bounds of the university’s academic integrity policy. Education research has shown that helping others also increases your own learning.

Re-Grading Policy: If you believe that an error was made in grading of any assignment, report, memo or quiz, you must write a short, clear justification of your claim and attach it to the original assignment in question, and put in the instructor’s office with additional notice via email (“ME340” must be in the subject line). The statute of limitations for submitting such claims is one week after that assignment is returned. Note that the entire assignment will be examined and re-graded, not just the item in question, in order to ensure consistency and fairness.

Use of Cell Phones and Electronic Communication Devices: As a professional courtesy to your classmates, the TAs, and the instructor, please limit the use of cell phones in class and during lab sessions, except when asked. Students are encouraged to use social media to share and exchange pictures and events in class and lab sessions using #me340.

Work Load: Consistent with University policies for 3 credit hours, this course requires 8-10 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 most of the activities are team-based.

Learning Factory Machining Training: All students are required to attend a machining training session at the Learning Factory. An online signup form will be used for scheduling (details will be provided in lab). Begin by completing the online safety quiz: https://www.lf.psu.edu/makerspace/index.aspx. Print out the form and bring it to your scheduled training. You must wear long pants, closed-toe shoes, and bring your own safety glasses to the training session.

Students with Special Needs: Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at 814-863-1807 (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at http://equity.psu.edu/ods/. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (see the PSU guidelines at: http://equity.psu.edu/ods/guidelines/documentation-guidelines). If the documentation supports the need for academic adjustments, then ODS will provide a letter identifying appropriate academic adjustments. Please share this letter and discuss the adjustments with your instructor as early in the course as possible. You must contact ODS and request academic adjustment letters at the beginning of each semester.