Penn State University
School of Engineering Design
EDSGN497D.001 – Interdisciplinary Capstone Design Project
Spring 2010
Syllabus revision number: 2

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Office Hours: Monday 1-2 p.m. Wed. 2-3 p.m. Thursday 10-11 a.m., and by appt.

Location:	Tuesday	11:15 – 1 p.m.	312 Hammond Bldg.
	Tuesday	1-2:15 p.m.	306 Hammond Bldg.
	Thursday	1-2:15 p.m.	306 Hammond Bldg.

Web site for general resources for Learning Factory Capstone Projects: http://www.lf.psu.edu

Complete document for all the Learning Factory Project for Sp10 is in ANGEL for this course, and at: http://www.lf.psu.edu/Instructors/PROJECTS.pdf

Course Description:
The course focuses on multidisciplinary design projects offered in conjunction with the College of Engineering's Learning Factory. Design teams of three to five senior engineering students from two or more engineering majors will work on industry-sponsored and community service-based design projects. During the semester the design team works with the project sponsor to conceptualize, design, build, and demonstrate a solution to the problem posed. This course focuses on multidisciplinary, innovative design projects for industrial partners and community service projects. Teams will apply fundamental design and analysis methods to open-ended engineering problems. Lectures and course material will also be provided by the instructor on project management, design, product manufacturing, intellectual property, engineering ethics, societal/global/contemporary/professional issues, and related topics, in addition to specific invited technical lectures relating to student projects.

Course Objectives: Upon completing this course, students will:
1. *Learn the process(es) that leads from an idea or problem to be solved to a final, functional solution.*
2. *be members of a multidisciplinary team, working with students from BIOE, CMPEN, EE, IE, and/or ME.*
3. D*emonstrate the ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy.*
4. E*xperience what it is like to work closely with a team of other professionals to complete a project.*
5. Learn *to develop a design project proposal (i.e., Statement of Work).*

6. L*earn an assortment of tools used by engineers in the process of designing a new system of component.*
7. Write *a final design report.*
8. Verbally present their final design to a company representative, their peers, and the instructor.

In addition, the course has been designed to meet the ABET engineering program objectives a-k, with particular focus on objectives a, c, d, e, f, g, h and k:
1. The ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, sustainability, and engineering standards.
2. An ability to function on multi-disciplinary teams.
3. An ability to communicate effectively in technical reports and orally.
4. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
5. Demonstrate independent learning to solve problems; appreciate continuous education (lifelong learning) and professional development.
6. State professional code of ethics, identify ethical issues, understand ethical responsibility and appreciate role of engineer in society.
7. Contemporary issues.
8. Interact with industry.

Prerequisites:
Senior level standing in BIOE, CMPEN, EE, IE, or ME; BIOE440, or EE330/350/316, or IE302/305/323/327/330/405, or ME340

Optional Text: "Product Design and Development", 3rd or 4th Editions, by Karl T. Ulrich and Steven D. Eppinger. It is strongly recommended that you purchase the textbook for use in this course and as a reference for future design projects. A copy of this textbook is on reserve in the Engineering Library.

Grading Table: Final grade will be based on the following tasks and topics:

Task / topic	**Percent – individual**	**Percent - team**
Oral Presentations (6% and 6% - individual)	12%	
Written Progress Reports (team)		08%
Assignments, including project recap (individual)	06%	
Project Proposal/Statement of Work (team)		20%
Design Specification Report/prototype (team)		15%
Final Project Report (team)		10%
Poster (team)		05%
Design Criteria Satisfaction (team)		03%
Professionalism and participation (individual)	04%	
Three Peer Evaluations (4% each- individual)	12%	
Customer [project sponsor] evaluation (team)		05%
Total	34%	66%

Course Policies:

· ***Academic Integrity:*** Students are expected to abide by the College of Engineering's Academic Integrity policy, http://www.engr.psu.edu/CurrentStudents/acadinteg.aspx. In this course, students are expected to work together with their team on most assignments including progress reports, written reports, and oral presentations. There are some assignments which are to be done individually, i.e., each student is required to submit his or her own original work. 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 behavior that is considered plagiarism is submitting a written assignment that includes text taken directly from another source and/or text that is not properly referenced. If you have any questions as to how to properly reference material taken from another source, please ask.

· ***Deadlines:*** All reports and materials are due at the start of the class period as shown in the schedule below. Late submissions will NOT be accepted.

· ***Grading Disputes:*** If a student feels that a report or homework set was graded unfairly or in error, please bring it to my attention **in writing** within one week after the graded material was handed back. Scores will not be reconsidered after this time period has elapsed.

· ***Attendance:*** Attendance is expected at the start of each class. As a professional courtesy, please inform the instructor prior to any anticipated legitimate absences. Two absences without a reasonable excuse is one fractional letter grade reduction, and so on. Job interview absences must be previously cleared with all team members and the instructor. Absence from oral presentations and/or when intensive teamwork is necessary is not permitted, so plan accordingly. Also see the Faculty Senate Policy on Class Attendance (42-27), http://www.senate.psu.edu/policies/42-00.html#42-27.

· ***Cell Phones:*** Turn cell phones off upon entering the classroom.

Additional Course Requirements and Information:

· **Project Notebook:** One team member is responsible for organizing and maintaining a project notebook throughout the semester. This can be an E-Notebook using Angel, Google Groups, or Microsoft Office OneNote® or a thin permanently bound working journal (a.k.a. design logbook, record book, notebook). The notebook must include drawings, concepts, ideas, information pertaining to the project, and anything discussed regarding the project with dates & initials of those present. The journal is a working document; so it must be legible and dated. This will be reviewed each Tuesday during the staff meetings.

· **Progress Reports:** Each team must submit a weekly progress/status report (includes "Gantt with milestones" to both the project sponsor (via FAX or email) and to the instructor via ANGEL. A summary of the team's progress and a weekly "Things-To-Do (TTD)" list with finish dates and responsibility must be included and will be discussed each Tuesday during the staff meetings. This is usually a bulleted list or spreadsheet and is about one page in length. It describes the team's accomplishments and what is planned in the immediate future. Bring a paper copy for the instructor to review on Tuesdays. Be honest about who was in attendance and your assessment of the team's progress, and be aware that minor delays in the beginning cause major problems at the end.

· **Labor Division:** After the teams have formed, members will prepare a document showing division of labor and ground rules. This will be documented in your notebook. Effective teamwork is essential in this class.

· **Literature/Patent Search:** This provides you with background information and a summary of what has been previously done on the topic. The engineering library is a good place to start the literature survey, while the patent search can be quickly done in the patent room in Davey Lab or the various free online sites that access USPTO, http://www.libraries.psu.edu/psul/researchguides/matbytype/patents.html. I would suggest you first use the tutorial online at prior to your effort, http://www.libraries.psu.edu/instruction/business/Patents/index.html; this tutorial will expedite your searches. They have paper copies and discs in the library covering patents for the last century. Note that finding patents prior to 1976 will involve a bit more work than later patents. Please do not think that simply searching various web sites is sufficient.

· **Resources:** The Learning Factory and the basement of Reber have machine shops for construction. Testing and storage in (Engr Unit C, Room 101, Door Combo: 523). Ensure you are certified (see Learning Factory (LF)) to operate equipment prior to starting. Specialized training in machining and welding is available, see http://www.lf.psu.edu/lf/train.htm . Do not miss out on this wonderful opportunity even if your project does not require machining. PCs at the LF & ME computer studio have Microsoft Project for Gantt Charts. Solidworks® for solid modeling and shop drawings can also be accessed in 315 Hammond Sunday through Thursday evenings from 7:00PM-11:00PM. Note for planning purposes in Hammond: a TA will be available for assistance, but be mindful that the room is partially vacant the first two thirds of the semester but is generally full the last one third.

· **Project Proposal/Statement of Work (SOW) Report:** This report more of a selling document than a technical document. It should include an executive summary, problem statement, literature review/patent searches, project objectives, preliminary design concepts with 3 or more alternatives, budget estimates, Gantt charts, citations etc. See Angel for a template and details. You will be graded on the Title Page, Table of Contents, Executive Summary, Problem Statement, Technical Approach, Project Management, Deliverables, Budget, Communication with Sponsor, Resumes, and References. The SOW, DSR, and Final Report will also have a paragraph addressing how environmental and ethical standards were followed from the start of the project. First or third person is acceptable for the reports; however, avoid beginning paragraphs or sections with the first person (Not "We varied fluid flow rates to test the design," but "To test the design, we varied fluid flow rates").

· **Design Specifications Report (DSR):** This report should include executive summary, problem statement, quantitative design specifications, justification with concept selection matrix, engineering drawings, analysis, manufacturing process plan, evaluative test procedures, remaining work to do, updated Gantt chart, budget report, references, and appendix. See Angel site for template and details.

· **Oral Presentations:** Will be judged by the instructor (1/2) and by the students (1/2) on preparation, visual aids, stage presence, and overall effectiveness. Each individual presentation will be about 3 minutes for SOW and 4 minutes for the Final Report with the team's total presentation about 20-25 minutes including class discussion and reflection. Time allotted may vary depending upon groupings and number of groups.

· **Final Report:** This report should include information from the DSR along with updated solid models, updated shop drawings, photographs of prototype(s), test results plus, final economic results,

construction details, manufacturing considerations and improvements, conclusions and recommendations. See Angel site for template and details.

· **Self Assessment:** Your end product or process will be evaluated on how effectively it satisfied all of the customer needs and design criteria. Additionally, your work should demonstrate an appreciation of any possible global and societal, safety or sustainability implications. You will be asked to rate your team on a scale of 1 to 10 in the appendix of the Final Report on these topics. An accompanying paragraph is necessary for justification.

· **Professionalism:** You should conduct yourself with high professional standards and have ethical and positive social interactions with the sponsor, team members, LF personnel and instructor. Hence, being a team player, acceptance of responsibility, and respect for others will be graded. Each absence at any out-of-class team meeting or a LF training class will be a loss of a third the professionalism grade as noted on the grading table. This multiplier will be used for your individual professionalism score in conjunction with your sponsor judged team professionalism.

· **Poster Presentation:** There will be one poster presentation at the project showcase at the end of the semester. Use the Engineering Copy Center in the Engineering Units Building and let them know which you are enrolled in EDSGN497D. Ensure that the text is large and uncluttered. The title, figures, text, names, and conclusions should be able to be read by someone standing 4 ft. away. Dark backgrounds are not recommended. The best two posters and prototypes in our section will be voted upon by the students.

· **Project Recap:** This is a one-page executive summary of the project that provides an overview, list of objectives, and a summary of the approach and project outcomes. One or two pictures should also be included to highlight the prototype, test results, etc. from your project. A template will be provided on Angel. If you signed an IP form confidentiality may be an issue, so the sponsor should approve the Project Recap as a courtesy.

· **Safety:** Start the Learning Factory training class within the first month of the semester, preferably as soon as possible, unless certification from previous ME340 course is verified. *Be advised that things always take longer than expected especially if testing or machining is involved; so, please do not rush a job and cause an accident. Also never believe the results of computer simulation unless some other verification method is employed such as experimentation or back-of-the-envelope calculation.*

· **Reimbursement:** The total budget, including travel expenses, is $1000 per project with a $50/vendor/day limit. Anything over $50 requires Pam Shawver to place the order. It is mandatory to have the original receipts initialed by the instructor prior to submission for reimbursement. Purchase requests should include: your name, local address, email address, team name, and sponsor name. It is highly recommended that you work with Pam Shawver or Erin Peterson in 314 Leonhard Building to use the Penn State purchasing card, as it is the fastest method and least amount of paperwork for you and them. Petty cash of up to $50 can be attained weekly. If you have multiple petty cash receipts that total more than $75 for a given week, your reimbursement will be issued via check and take about two weeks to process. Meals, taxi in State College, and clothing will not be reimbursed. Postage will not be reimbursed; Pam will mail things for you. Telephone calls should be made from the conference room in 312 Leonhard Building (see Pam to reserve it) or the Learning Factory. If you call from your residence, the bills are reimbursable if you have the original phone bill.

Instructor's and Student's Roles:
The instructor is there to assist you in locating information and act as a coach or consultant on technical issues, but will not tell you which option to use in your final design. The design problems specified by your sponsor are just the tip of the iceberg. It is your responsibility to further define the problem by discussing it with your sponsor. **Excellent student teamwork and communication are essential in this class**!

Deliverables to the Learning Factory Office (314 Leonhard Bldg.):
These requirements must be met before final funds are reimbursed.
a) Deliverables agreement signed by students and sponsor by Feb. 26, 2010.
b) Copy of final report (DOC and PDF versions) for the LF files and future student reference (in addition to the copies for your sponsor and instructor), due Monday May 3, 2010. Submit to Pam Shawver in 314 Leonhard Bldg.
c) A one-page Project Recap (DOC & PDF) that includes 1-2 photos from the project, due Monday May 3, 2010.
d) Final poster (for future display) ; mandatory size: 32"x40" foam board, portrait oriented in both PPT and PDF formats. Posters from previous semesters are on display on the 2nd floor of Reber and the 3rd floor of Leonhard Building. Posters will be used at the Design Showcase on April 29, 2010.

Intellectual Property (IP) Concerns
In order to protect their competitive positions, some sponsors may require each team member to sign a confidentiality agreement (see www.lf.psu.edu/lf/confid2.doc) as a condition for working on their project. These projects tend to be on the cutting edge of technology. By signing this document, you are obliged to protect the confidentiality of information provided by the sponsor. If you have any problem with this condition, you must pick another project.

Sponsors may also require that they retain exclusive ownership rights to any IP that id developed during the course of this project. Projects in this category require students to assign their IP rights to the sponsor using the form found at: http://guru.psu.edu/plocoes/RAG13.html. If you have any problem with this condition, you must pick on of the projects that have no IP restrictions.

Course Schedule and Assignments

(Note: Items on schedule are subject to change)

Week	Date	Topic	Deliverables
1	Tue 1/12	Meet and greet; course and Learning Factory overview. Project Preference Form and student questionnaire, notebook http://www.lf.psu.edu/Instructors/PROJECTS.pdf	By end of class, questionnaire completed.
	Thurs 1/14 1:00 – 3:00 p.m. *No regular class meeting.*	**Project Kickoff Luncheon** Meet project sponsors in the HUB/Ballroom. BUSINESS CASUAL DRESS REQUIRED. **FREE LUNCH!!**	Read project descriptions; meet project sponsors at Kickoff. Submit project preference form before 3 p.m.

2	Tue 1/19	Team Organization – Team Rules, etc. Tips for success. SOW layout. Problem formulation / planning / customer needs. *Brainstorming techniques (1)* *Customer needs assessment (1)* Preparation for site visit: objectives? Negotiate & define Tuesday Staff Meeting times.	Complete the IP Agreement Form for your project, if applicable.
	Thurs 1/21	Consultation with Sponsor.	Contact sponsor; arrange/take site visit.
3	Tue 1/26	Staff Meetings – Project concept generation / Selection *Project management (1)* When is/was your sponsor site visit / video conference?	Weekly Status Report 1
	Thurs 1/28	*Working on multidisciplinary teams (1)* Effective Written Communication – R. Alley	
4	Tue 2/2	Staff Meetings	Weekly Status Report 2
	Thurs 2/4	*Intellectual property, patents, and copyrights (1)*	**Deliverables Agreement to Pam Shawver**
5	Tue 2/9	Staff Meetings	Weekly Status Report 3
	Thurs 2/11	*Product design and development (1)*	**Submit Draft SOW to instructor**
6	Tue 2/16	SOW Team Presentations	Weekly Status Report **SOW Presentations**
	Thurs 2/18	*Rapid prototyping techniques (1)* *Manufacturing and fabrication techniques (1)*	**Submit SOW to sponsor**
7	Tue 2/23	Staff Meetings	Weekly Status Report 5
	Thurs 2/25	*Codes and standards (1)*	
8	Tue 3/2	Staff Meetings	Weekly Status Report 6
	Thurs 3/4	*Engineering ethics (1) – but also across semester* Design Specification Report (DSR) Workshop	Peer Evaluation #1
	Tue 3/9	No Class – Spring Break	
	Thurs 3/11	No Class – Spring Break	
9	Tue 3/16	Staff Meetings	Weekly Status Report 7
	Thurs 3/18	*Societal/contemporary/professional issues (1)*	**Submit Draft DSR to instructor**
10	Tue 3/23	Staff Meetings	Weekly Status Report 8
	Thurs 3/25	*Invited Speaker*	**Submit DSR to Sponsor**
11	Tue 3/30	Staff Meetings	Weekly Status Report 9
	Thurs 4/1	*Working in a global economy (1)* Presentation of first prototype	**First prototype due**
12	Tue 4/6	Staff Meetings	Weekly Status Report 10
	Thurs 4/8	*Career paths and advancement opportunities (1)* *Consultations*	
13	Tue 4/13	Staff Meetings	Weekly Status Report 11
	Thurs 4/15	Consultations	

14	Tue 4/20	Staff Meetings	Weekly Status Report 12
	Thurs 4/22	Final Report Workshop	SRTE, Peer Evaluation #2
15	Tue 4/27	Final Project Presentations	**Final Presentations**
	Thurs 4/29	***Project Design Showcase*** @ BJC Annex Gym 11-noon Set-up / 1-3 p.m. Judging ***Industry Partners Dinner*** Penn Stater Hotel 6-8 p.m. with awards	Poster and prototype on display at the Showcase **FREE DINNER!!**
16	Mon 5/3	Final Report Due	Final Report, Project recap, poster file on CD