CEE 1618
Design for the Environment

Course Description

Global population growth, resource scarcity, a changing climate, and an increasingly stressed water supply and agricultural system are significant environmental challenges we face today. The prominence of these challenges has led to increased awareness and demand for more sustainable approaches to engineering design and policy strategies.

Design for the Environment will begin with an introduction to sustainability, design frameworks, the design process and its role of innovation. Additional topics in the first half of the course include systems thinking, frameworks to quantify and evaluate the sustainability of identified alternatives, and assessment of toxicity and risk. The second half of the course will introduce students to designing appropriate technologies within the context of the developing world as well as a series of current sustainability case studies (e.g., water, energy, agriculture and nanotechnology).

Design will be incorporated throughout the course as a way for students to apply what they are learning in class to the development of an innovative solution to a defined 'real-world' sustainability challenge. Equally important to the engagement in hands-on active learning experience is the opportunity for students to work effectively in a group, and practice written and oral presentation skills.

Course Outcomes

Design for the Environment is a course that is designed for students to develop a working knowledge of sustainable engineering that is immediately applied to a design project. A mix of lectures, in-class activities, out-of-class assignments, group work, and hands-on prototyping offer students a diverse learning experience. Upon completion of this course, students should be able to:

1. Define sustainable engineering and apply it to their future career as an engineer.
2. Collaborate effectively with people from diverse backgrounds to solve a problem.
3. Tackle a structured sustainable design innovation exercise, from concept to prototype.
4. Implement current design frameworks for sustainable design and articulate the pros and cons of each.
5. Assess sustainable attributes of products and processes rigorously and quantitatively using multiple criteria, including toxicity and risk analysis, resource (energy, water, and material) intensities, flows and efficiencies, and end of life options.

General Information

Logistics Tuesday & Thursday 6:00 – 7:15 pm
232 David Lawrence Hall

(We will occasionally meet in other rooms - dates noted in the syllabus)

Professor Dr. Leanne M. Gilbertson
202 Benedum Hall
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Required Text There is no required text for this course. Readings have been compiled from multiple sources and will be made available through the online CourseWeb system.

Course Expectations and Academic Integrity

Performance Assessment: The homework assignments, project reports, in-class exercises, midterm, and term project are used to assess student progress and learning.

Assignments, readings and project deliverables are mandatory. They are instrumental in helping you grasp fundamental concepts and in exposing you to techniques and skills for applying these principles to real-life situations.

- *Homework assignments* should be done in several sittings; you cannot expect to be successful doing homework quickly the night before it is due. Each student is required to submit an original assignment. However, working together in small groups (2-3) is acceptable as long it is a mutual learning experience for all involved. Direct copying of a peer's assignment is unacceptable, as is splitting up an assignment and exchanging solutions later. If you get stuck and cannot solve a given problem after putting in a reasonable effort, it is completely acceptable for another student who has solved the problem to teach you how to solve it; it is not acceptable to offer or accept a completed solution as a guide. I reserve the right to change this policy if I believe it is being abused.
- *Reading assignments* should be completed before class; they will be discussed in class and supplement the lecture material.
- You are required to submit five *project deliverables* throughout the semester. Specific information and requirements for each will be provided prior to the due date and expectations posted on the course website. One report will be submitted per group.

In-class exercises are designed to offer you the opportunity to collaborate with and learn from your diverse group of classmates while working towards a shared and structured objective. Participation and respect are paramount to the success of these activities.

The *midterm examination* will be completed during class as outlined in the syllabus. It is not collaborative and will be completed independently. Cheating and dishonesty are not tolerated in any form.

You will complete a *term project* on a topic related to this course that incorporates and demonstrates mastery of key concepts through their application to a real-world sustainability design challenge. Specific requirements and expectations for the project will be outlined and distributed in a separate handout.

Grading Scheme

Assignments	20%
Class Participation/Group Innovation Exercises	20%
Midterm Examination	20%
Project Deliverables	10%
Term Project	30%

Laptops, Computers, Tablets and Cell Phones

Occasionally you will be asked to use your electronic devices for in-class or group activities. At all other times, students *should not use their cell phones* during class, unless it is an emergency. Browsing the internet, playing games, and texting friends during class is disrespectful to the instructor and distracts your classmates. Please discuss with Dr. Gilbertson if you wish to use your laptop or tablet for taking notes.

Standards for Written Work

- Engineers demonstrate their standard of professionalism primarily through the quality of written work; I expect you to do the same. Sloppy work, no matter how technically correct, is unprofessional and potentially dangerous, as it may be misinterpreted. You will suffer significant point reductions for sloppy work.
- I expect your homework submissions to be neat, thorough and logically organized. When you perform engineering calculations, you must explain your work such that an uninformed reader can follow precisely how and why you performed each step. Practicing engineers must maintain very high standards in the quality of their calculations because engineering calculations are *always* checked independently, by other engineers, as part of the design review process.
- Engineers communicate with drawings, tables and graphs. You must learn to supplement your engineering calculations with clear, concise sketches and graphs. Use this course as an opportunity to start developing this skill.

Lateness and Absence

Late homework assignments will not be accepted. Similarly, make-up exams will not be given unless PRIOR coordination is made with the professor or there is an official note from a physician explicitly stating why attending the scheduled test was impossible.

Discrimination

I am dedicated to establishing an inclusive learning environment that values all students' experiences. Therefore, disrespectful and demeaning statements, attitudes, and behaviors based on age, ability, color/ethnicity/race, gender identity/expression, immigration status, marital/parental status, military/veteran's status, national origin, political affiliation, religious/spiritual beliefs, sex, sexual orientation, or socioeconomic status will not be tolerated.

School of Engineering Statement on Students with Disabilities

If you have a disability for which you are, or maybe, requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 216 William Pitt Union, (412) 648-7890 / (412) 383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Schedule

Class Meeting	Topic(s) Covered	Readings Due*	Assignments Due	Group Project Deliverables Due
8/29/17	Introduction to Design Thinking: Empathize	An Introduction to Design Thinking: Process Guide (d.school)		
8/31/17	Introduction to Design Thinking: Define and Ideate			
9/5/17	Introduction to Design Thinking: Prototype and Test BEH B06 Orientation (**Class will meet in B06**)		Assignment 1	
9/7/17	Wrap Up Design Thinking			
9/12/17	Design Frameworks Introduce group projects and expectations		Assignment 2	
9/14/17	Biomimicry: Part I Group project team introduction			
9/19/17	Biomimicry: Part II			
9/21/17	Toxicity and Risk: Part I	*Suggested Reading:* Environmental Engineering Ch 6: Environmental Risk (by Mihelcic and Zimmerman)	Assignment 3	
9/26/17	Toxicity and Risk: Part II			
9/28/17	Product life cycle / Systems thinking / Life Cycle Assessment	Paper Versus Polystyrene: A Complex Choice (Hocking) *Suggested Reading:* Ch 1: Life Cycle and Systems Thinking (by Mathews, et al.)	Assignment 4	
10/3/17	Identifying criteria / Multicriteria decision analysis			
10/5/17	Durability, waste management, and end-of-life / Design for disassembly		Assignment 5	
10/10/17	***No Class*** ***Monday Classes Meet***			Problem/Design statement + Gantt Chart (email)
10/12/17	Disassembly Exercise (**Class will meet in G34**)		Assignment 6	
10/17/17	Design for the developing world/Appropriate technologies Part I	Appropriate Technology – A Comprehensive Approach for Water and Sanitation in the Developing World (Murphy, et al.)		
10/19/17	Design for the developing world/Appropriate technologies Part II			
10/24/17	**MIDTERM EXAM**			
10/26/17	Prototyping work day **(Class will meet in BEH B06)**			Alternatives Generation + Gantt Chart

10/31/17	One-on-One meetings with Dr. Gilbertson in your project groups (**Meetings will be in BEH 202**)	Discuss progress, answer questions, get feedback	Come prepared to use your time wisely!	
11/2/17	Case Study: Water	Global Freshwater Resources (Gleick), Global Hydrological Cycles and World Water Resources (Oki and Kanae)		Evaluation Criteria + Gantt Chart
11/7/17	**Group project interim presentations** 5 min presentations to the class, feedback from classmates			
11/9/17	Case Study: Energy	Ch. 6: Case Studies (Allen and Shonnard)		
11/14/17	Case Study: Agriculture	*Watch:* The Big Waste: Why Do We Throw Away So Much Food?		
11/16/17	Case Study: Nanotechnology, Final presentation expectations	Toward Green Nano (Eckelman, et al), *Watch:* A Brief history of nanotechnology (aka Advanced Materials)		
11/21/17	Prototyping work day **(Class will meet in BEH B06)**			Alternatives Assessment + Gantt Chart
11/23/17	***No Class, Thanksgiving Recess***			
11/28/17	*Focus Group with Dr. Clark*			
11/30/17	Practice Final Presentations (4 groups, 10 min 'pitch', 5 min Q&A)			
12/5/17	Practice Final Presentations (4 groups, 10 min 'pitch', 5 min Q&A)			
12/7/17	Self and Group Evaluations, Project wrap up			
Exam Week	Final group project presentations			1 page leave-behind

* Assigned readings should be completed before class.
** The midterm will be administered during class on the day indicated.

Video Links

Biomimicry	https://youtu.be/sf4oW8OtaPY
The Big Waste	http://e360.yale.edu/feature/the_big_waste_why_do_we_throw_away_so_much_food/2874/
A Brief history of nanotechnology (aka Advanced Materials)	https://youtu.be/wMLvodIVYNI