

ENGR160 Fundamentals of Engineering Spring 2017

Course Info / Syllabus

Engineering practice integrates knowledge from physics, computer science, mathematics, and other scientific disciplines to create objects and systems that serve human needs. This project-based course introduces some of the big ideas of engineering:

- The engineering design process and rapid prototyping
- Feedback and control
- Modeling and simulation

as well as professional skills that will be useful for any discipline, and engineering tools including Solidworks, MATLAB, Arduino microcontrollers, and laser cutting. The class offers good preparation for those students interested in taking additional engineering courses at Olin College or MIT.

Course Learning Objectives

1. Use the engineering design process to develop functional physical prototypes
 - 1.1. Ensure design requirements are satisfied
 - 1.2. Generate, evaluate, and select design concepts
 - 1.3. Create CAD models
 - 1.4. Build prototypes using the laser cutter and/or common workshop tools
 - 1.5. Test and evaluate prototype performance
2. Use digital electronics for feedback and control; use numerical computing for modeling and simulation
 - 2.1. Create sketches in a programming environment to execute commands that fulfill the stated objective
 - 2.2. Use a microcontroller to receive data from sensors and control actuators
 - 2.3. Apply bang-bang and proportional control and explain and demonstrate the applicability, features, and limitations of these control algorithms
 - 2.4. Create basic models and simulations of physical systems
3. Demonstrate effective professional interpersonal skills in the following areas:
 - 3.1. Teamwork
 - 3.2. Informal and formal presentations and design reviews
 - 3.3. Communication with customers
 - 3.4. Documentation of work and reflection of outcomes
 - 3.5. Showing up

Prerequisite: PHYS107 or by permission of instructor.

Course website: <<http://blogs.wellesley.edu/engr16001sp17/>>. Bookmark this page and use it regularly for assignments and lecture notes.

Course Staff

Amy Banzaert, Ph.D.

Director and Lecturer of Engineering Studies

Office: SCI L001

Email (preferred): abanzaert@wellesley.edu; Cell (emergency): 857-488-8969

Office hours: TBA by 1/31/17, go to <http://whenisgood.net/engr-160> to help find a good time for all.

The best way to reach me outside of office hours is email; you can expect a response within one business day (this includes appointment requests). I welcome meeting with you during office hours and by appointment/drop-in to help you with the class, offer advice about engineering, and similar topics. My door is typically closed, but that's only because the Science Library is nearby and noisy. My blinds will be closed if I would prefer not to be disturbed; otherwise, knock and enter.

Larry Knowles, machinist

lknowles@wellesley.edu

Hours: 7:30-4:30, Tuesday, Wednesday, & Friday

Course Policies

Attendance and Responsibility

Class attendance is required, due to the hands-on nature of the class. If you must miss a class, inform Amy and your lab partner(s) as early as possible so that we can plan appropriately and provide you with makeup materials (an email during class is better than nothing). Your grade will suffer if you are tardy or absent regularly. You are expected to come to class on time and should also check the course website and your email frequently as part of your responsibilities for the class.

If the course schedule and due dates cause you difficulty in observing any religious holiday, please talk to Amy about making alternate arrangements well in advance.

All course work is covered by the Wellesley College honor code "As a Wellesley College student, I will act with honesty, integrity, and respect."

Safety

In this class, you will learn how to use pieces of equipment (e.g. laser cutter, drill press, thermal press, soldering iron, 3D printer, hand tools) that are potentially

dangerous to you and your classmates if not used properly. Many are also expensive to repair if you break them. You are not allowed to use these pieces of equipment without direct supervision by an instructor or TA unless you have been explicitly certified to use them by an instructor.

You should come to class dressed appropriately for hands-on work: avoid wearing loose clothing or dangling jewelry; pull back long hair into a ponytail or bun; and wear comfortable clothing and closed-toe shoes.

You must acquire safety glasses by the second day of class, and bring them to all course meetings and whenever you work in the lab. Be sure to label them with your name. There are many pairs of safety glasses available from past classes that you can "adopt." Alternatively, you can purchase a new pair from the campus bookstore. Make sure to choose a pair that fits your face (and fits over your glasses, if appropriate). Glasses-wearers can also choose to wear whole face shields, found in lab.

Diversity & Inclusion

All enrolled students are welcome in my classroom. I expect and embrace different ways of thinking, living, being, working, and learning. If you have questions or concerns, please speak up in class or let me know individually.

<http://www.wellesley.edu/about/diversityandinclusion/about>

Disabilities

Students with disabilities who are taking this course and who need disability-related accommodations should talk to Amy Banzaert to make appropriate arrangements. These students are also encouraged to work with Jim Wice, the Director of Disability Services. Jim's office is located in the Pforzheimer Learning & Teaching Center on the third floor of Clapp Library. If you have a physical disability or a learning disability, Jim is the person to see to arrange for accommodations. If your learning disability is undocumented or if you are uncertain as to whether you have an actual disability, Jim can arrange for you to be tested. <http://www.wellesley.edu/disability>

Workload

According to Wellesley's policies, a 1-credit course should require 10-11 hours of your time per week. We'll be in class 5 hours per week, leaving 5-6 hours of outside work for assignments, problem sets, reading, making headway on projects, etc. If you're spending noticeably more or less time than this on this class, please let Amy know.

Grading

This is a project-based course. During the semester you will be asked to work on a series of projects, each of which has a set of “deliverables” that you must submit. For example, the deliverables for a project might include physical artifacts, SolidWorks files, MATLAB programs, and entries in your individual design blog posting. Projects will vary in length. Some might take a day to complete, others several weeks. The relative grading weight assigned to each project will be in rough proportion to the length. Class attendance and participation will also be a component of your course grade. Standards-based grading, based on the course objective, will be used; more information on this approach will be provided as the course progresses.

Grades are non-negotiable. I make every effort to be fair and proportionate with grading. If you feel strongly that a re-evaluation of the work is warranted after thoughtful reflection, I will review the work again but a change is unlikely.

This grading table is representative; however, I reserve the right to shift the correlation between numerical and letter grades up or down, as needed, to fairly represent overall student performance.

93%+	A	meet with conspicuous excellence every demand that can fairly be made by the course
90-92%	A-	
87-89%	B+	
83-86%	B	add to the minimum of satisfactory attainment excellence in not all, but some of the following: organization, accuracy, originality, understanding, insight
80-82%	B-	
77-79%	C+	
73-76%	C	attained a satisfactory familiarity with the content of a course and who have demonstrated ability to use this knowledge in a satisfactory manner
70-72%	C-	
60-69%	D	passing
<60%	F	failure

Extensions

Please do not ask me for an extension on any assignment.

Late work will be subject to the following penalties: assignments will be penalized 5% for each day that passes beyond the due date.

Collaboration Policy

Generally, you will work on projects in pairs or groups. You are strongly encouraged to change partners for each new project.

Although you are working with a partner it is essential that you each maintain your own documentation. There will be certain deliverables for each project that can be submitted jointly and others that need to be submitted individually. Details will be specified with each project assignment.

It is NOT acceptable to review design blog documentation from past semesters in order to help you complete your work.

Design Blogs and Submitting Assignments

Students will individually use the course blog at <http://blogs.wellesley.edu/engr16001sp17/> to document their journeys through the course. An individual's postings should contain the following:

- assignment-by- assignment documentation of all projects, including text, drawings, code, images, and videos
- other thoughts/observations/sketches inspired by the hands-on activities, reading, etc.
- (optional) posts on any topic of your choosing

Documentation is a major component of your grade. You should consider the blog postings to be an e-portfolio of your work, which may prove quite valuable to demonstrate your capabilities to prospective employers. Because comments are public, I will not typically provide comments on your blog but through assignment feedback. I will review your blog postings regularly, however.

Course schedule

- *Due to the project-based nature of this class and the challenges associated with expensive machinery, it is highly probable and predictable that some schedule shifting will occur. Check the course website for revisions.*
- *All assignments due at 10 am (other than demos and in-class activities, which should be ready at 1:30 pm sharp for the start of class unless otherwise specified)*
- *Items in bold are deliverables that past students have reported were more time-consuming than average ... your mileage may vary*

Theme	D	Date	Class	Assignment Due
design & mechanism basics: bottle opener, windlass, Lego racer	T	24-Jan	Welcome	
	R	26-Jan		Schedule Office Hours
	F	27-Jan	Safety, Laser Cutting	Hello Blog Post
	T	31-Jan	Fastening & Attaching	Cantilever PSET Blog Commenting
	F	3-Feb	Bottle Opener Demos, Windlass work	Demo Bottle Opener
	T	7-Feb	Windlass work	Bottle Opener Blog Post Blog Commenting Strong Joints Blog Post
	F	10-Feb	Mechanisms, Windlass Work	Mechanisms
	T	14-Feb	Gears & Motors	Blog Commenting
	F	17-Feb	Lego racer work	Demo Windlass
	T	21-Feb	Monday schedule	Windlass Blog Post Blog Commenting
	feedback & control: Arduinos, Sciborgs, Sensors & Actuators	F	24-Feb	Demo Lego Racer, Arduino Intro
T		28-Feb	Sensors & Actuators	Lego Racer Blog Post Blog Commenting
F		3-Mar	SciBorgs	Arduino Introduction Blog Post
T		7-Mar	Feedback & Control	Real-World Feedback & Control Systems Reading & Blog Post Blog Commenting
F		10-Mar	Feedback & Control work	Feedback & Control 1 Blog Post
T		14-Mar	Feedback & Control work	Blog Commenting

final project intro	F	17-Mar	CSC Visit (& start MATLAB if time)	Final Project Readings & Blog Post
				Feedback & Control 2 Blog Post
MATLAB & thermal systems	T	21-Mar	MATLAB	Reflection on CSC trip
				3D Printing
				Blog Commenting
	F	24-Mar	Thermal Systems 1	MATLAB intro Blog Post
	T	28-Mar	Spring break!	
	F	31-Mar		
T	4-Apr	Initial Final Project Pitch, Thermal Systems 2	Final Project Initial Pitch (due in class)	
			Blog Commenting	
final project	F	7-Apr	Develop project idea	Thermal Systems Blog Post
	T	11-Apr	Detailed Proposal	Blog Commenting
				Final Project Detailed Proposal (due in class)
				Final Project Update Blog Post
	F	14-Apr	Begin Prototype	Reflecton on Feedback Blog Post
	T	18-Apr	Continue to build prototype	Final Project Update Blog Post
				Blog Commenting
	F	21-Apr	CSC Pilot Day	Final Project Pilot Day (due in class)
	T	25-Apr	Refine/rebuild prototype	Final Project Update Blog Post
				Blog Commenting
	F	28-Apr	In-class exhibition & refinement, poster draft	Final Project In-Class Exhibition & Poster Draft (due in class)
	M	1-May		Final Project Poster
	T	2-May	Public Exhibition	Public Exhibition (due in class)
W	10-May		Final Project Blog Post	