ENGN 250: Introduction to Engineering Design

MWF 9:30 - 11:30am, Payne Hall 201 (Lecture)
MWF 12:45 - 2:45pm, Howe Hall 208 (Lab)

Professor information

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Office hours:	MWF 11:45am - 12:45pm (or by appointment)

Course overview and objectives

This course introduces students to the principles of engineering design through first-hand experience with a design project. In this project-based course, the students gain a working understanding of computer-aided drafting, fabrication techniques, design processes, and written and verbal reporting.

By the end of the course, you should be able to:

1. Understand the design process in theory and in practice

2. Be able to clearly present your work, both orally and in writing

3. Develop skills in teamwork and project management

Course textbook

While you work on the design project, you will simultaneously learn one framework for how engineers approach design. Outside of class, you will read sections from:

Dym, C.L. & Little, P. & Orwin, E. J. (2013). *Engineering Design: A Project-Based Introduction* (4th ed.). Wiley. ISBN: 978-1-118-32458-5.

We will discuss the readings in class and apply the topics to the design project.

Grading

Grades for each assignment will be posted on Canvas. Your grade will be determined using the following distribution:

Category	
Design notebook	40%
Final presentation	20%
Final report	20%
Participation	20%

Your final grade will be rounded to the nearest whole number (e.g., 89.4% → 89% or 89.5% → 90%).

1. Design notebook

Design notebooks are documents meant to record and track progress on a design project. They are used in industry as evidence for work done, especially when a company is applying for a patent or in intellectual property litigation. You will be provided your own notebook, which you will fill out individually throughout the term. You notebook will include:

- Reading notes

- Lecture or discussion notes

- Reflection responses after lab assignments

- Design sketches

- Calculations

- Work journal entries (a narrative on what happened, what went wrong, what was successful, etc.)

- Any questions you have about the topic or project

Each page should be dedicated to a single task (i.e., don't try to fit reading notes and sketches on one page). Your notebook should exhibit evidence that you have been engaged with the class and lab assignments.

You will receive weekly feedback on your notebook to help you improve your documentation skills.

2. Final presentation

At the end of the term, the class team will present its work in an oral presentation. The presentation should highlight the process you followed while designing, fabricating, and testing your prototype. The presentation is meant to share your product and convince the audience that your decisions are justified. Technical jargon and complex details should be avoided here.

3. Final report

Your team will deliver a comprehensive final report that describes the design process you followed during the term. In this document, you will provide the details required to reproduce your design. The report should contain ample figures to support your text. This report will give you the opportunity to share your successes, set-backs, and final product.

4. Participation

You are required to participate in both class discussions and within your team. Examples of exemplary participation include:

- Asking or answering questions during discussions

- Starting an in-class dialogue with Prof. Woodruff or another classmate about a course topic

- Showing up to every meeting, both with the class and with your team

- Completing the work assigned to you on time (and actively applying the motto of "under-promise and over-deliver")

- Focusing on the work at hand and conducting yourself in a professional manner

- Contributing to leadership in your team, when needed

Your grade will depend on assessments from Prof. Woodruff along with team peer assessments submitted at the end of the term.

Late submission policy

Deliverables (there are only a few) must be submitted before the date and time they are due. If an emergency illness or situation arises, you must talk to Prof. Woodruff as soon as possible to arrange alternative plans.

Communication policy

Your success in this class depends on your ability to communicate in a timely and professional manner. Some rules to follow include:

- Any requests should be made in writing over email to ensure that there is a dated record. For requests made in conversation, send a detailed reminder over email.

- I do not expect you to answer emails outside of normal working hours, nor should you expect me to respond.

- Be direct, specific, and professional in your writing. Do not write like you would in a text message.

You are welcome to ask questions about the course, engineering in general, structural engineering, careers, graduate school, etc., and asking questions is a great way to generate rapport with Prof. Woodruff.

Collaboration policy

You will work closely with your peers this term, which will involve many exchanges of ideas and information. However, the work that you submit must be your own, unless explicitly cited. Copying (or superficially modifying) code, text, or drawings from your peers or from online resources is plagiarism. Anyone found violating this rule will receive a zero on the assignment and will be reported to the Executive Committee for an Honor Violation.

Technology/electronic devices in the classroom policy

You will use computers to help answer questions, solve problems, and generate designs. However, you will not need your computer or phone during discussions or lectures. Using an electronic device in ways irrelevant to the class will harm your participation grade.

Policy on respect and inclusion

The greatest resources engineers have are the knowledge, experience, and wisdom of the members of their team. This course will work to ensure that students from all background and perspectives are treated equitably and have the respect they deserve as engineers and human beings. This includes the chance to share your personal pronouns with the professor and/or the class (if you feel comfortable and safe to do so) or to share your concerns with the professor about other issues in private.

Your responsibility as a student is to uphold the values of diversity, equity, and inclusion by being respectful and welcoming to other students and your instructors. You are encouraged to start brave conversations with your peers and instructors when you see actions or hear statements that harm members of your community.

Remember, if an idea creates a strong emotional response in you, be sure to first ask yourself why that might be before reacting. You will either learn something new about yourself and others or strengthen your own argument against what was said. Practicing this emotional intelligence skill will benefit you professionally and intellectually.

Policy on religious holidays

You may receive an excused absence from class during a religious holiday that is important to you. However, you must inform Prof. Woodruff of your absence within the first week of class. Furthermore, you should talk with Prof. Woodruff and your peers to catch up on the class and get notes after your absence.

Policy on student mental health and wellbeing

An engineering curriculum, on top of other aspects of life, is stressful. If you feel overwhelmed, please, seek help from friends, family, Prof. Woodruff, or professionals. Washington and Lee University is committed to advancing the mental health and wellbeing of its students. Mental health services are available to you at no cost. For help, contact the University Counseling Center (website here) or your class dean. Additionally, feel free to reach out to Prof. Woodruff if you have any questions or concerns about this class or anything else.

Policy for students requiring accommodation

It may be frustrating or frightening to seek accommodation in classes. However, know that accommodations exist to help you meet your potential – they do not give unfair advantages to people with disabilities. It is recommended that you request accommodations through the university (instructions here) to receive documentation of your accommodation needs that you may share with the professor. Know that you have the right to choose whether or not to disclose your accommodation needs to the professor, but to receive accommodations in class, you must inform the professor as early as possible. You are encouraged to meet with Prof. Woodruff to discuss your needs if you believe they will affect your experience in the class.

Land and labor acknowledgment

Engineering involves more than just solving math and science problems on paper. In this class, you will develop solutions to other people's problems, and it is essential that you understand the impact that technology and development can have on people adjacent to those problems.

In that vein, acknowledge that Washington and Lee University sits on land historically occupied by members of the Monacan and Yésah-descended nations. Further acknowledge that the land you occupy, like almost all property in the United States, stands on lands obtained, generally in unconscionable ways, from indigenous people. The resources you benefit from as a member of the university were originally gained through exploitation of others. Knowing where you live and work does not change the past, but a thorough understanding of the ongoing consequences of this past can empower you and the community in the work to create a future that supports human flourishing and justice for all individuals. For more information about indigenous land occupation, visit https://native-land.ca/.

Also acknowledge that you cannot separate the history of Washington and Lee University and the surrounding community from the history of slavery in the United States. Acknowledge the legacy of slavery in this area and the blood, sweat, and tears of enslaved people that soak the earth beneath your feet in Lexington, Virginia. This legacy persists today as you and the community continue to work towards racial equity and justice.

Course schedule (subject to change)

Wk	Mtg	Date	Discussion Topic	Activity	Lab	Reading
1	1	M 4/24	Course introduction	Icebreaker	Getting to know the Miura-ori pattern	
	2	W 4/26	Definitions of design	Client meeting	Designing and cutting origami panels	Ch. 1-2 (36)
	3	F 4/28	Understanding the client's goals	Objective trees; pairwise comparison charts	Signal processing with an Arduino circuit	Ch. 3-5 (32)
			Notebook check #1 due on Friday, 4/28 at 11:59pm			
2	4	M 5/1	Establishing functions; team dynamics	Function-means tree; performance specs	Forming teams	Ch. 6; 15 (29)
	5	W 5/3	Design alternatives	Morphological charts	Final design choices	Ch. 7-8 (21)
	6	F 5/5	Project management	Work breakdown structure; calendar	Team meetings	Ch. 16 (17)
			Notebook check #2 due on Friday, 5/5 at 11:59pm			
3	7	M 5/8	Proofs of concept and prototypes	Final day for ordering parts and materials	Team meetings	Ch. 10 (10)
	8	W 5/10	Engineering drawings	Drawings, algorithms, schematics	Team meetings	Ch. 9 (13)
	9	F 5/12	Documenting a design project	Final report outline	Team meetings	Ch. 11 (16)
			Notebook check #3 due on Friday, 5/12 at 11:59pm			
4	10	M 5/15	Ethical issues in design	Ethical case study	Team meetings	Ch. 17 (13)
	11	W 5/17	Economics and sustainability	Team meetings	Team meetings	Ch. 13-14 (21)
	12	F 5/19	Final presentation	Work on final report	Work on final report	
			Notebook check #4 due on Friday, 5/19 at 11:59pm			
			Final report and team peer assessment due on Sunday, 5/21 at 11:59pm			