ENGN 178: Introduction to Engineering
MTuWF 9:45 - 10:45am, Parmly 302

Instructor information

Name:	Steven Woodruff, Ph.D. (he/him)
Email:	swoodruff2@wlu.edu
Office:	Howe 118
Phone:	(540) 458-8888
Office hours:	M 2-3pm; Tu 3-4pm; W 1:30-2:30pm; F 1-2pm

Teaching assistant information

Name:	Lui Blomberg
Email:	blombergl25@mail.wlu.edu

Course overview and objectives

This course introduces students to basic skills useful to engineers, the engineering design process, and the engineering profession. Students learn various topics of engineering, including engineering disciplines, the role of an engineer in the engineering design process, and engineering ethics. Skills learned in this course include programming and the preparation of engineering drawings. Programming skills are developed using flowcharting and MATLAB. Autodesk Inventor is used to create three-dimensional solid models and engineering drawings. The course culminates in a collaborative design project, allowing students to use their new skills.

The course is divided into the three themes listed below. By the end of the course, within each theme, you should be able to:

1. Computer programming with MATLAB

   - Import and produce data commonly found in engineering
   - Perform calculations on the data for analysis
   - Plot the data in ways that convey a clear message
   - Develop simple programs using loops, conditional statements, and functions
   - Troubleshoot bugs and overcome other obstacles in coding

2. Parametric modeling with Autodesk Inventor

   - Understand the different types of engineering drawings and their purposes
   - Create parts and assemblies using Inventor
   - Produce engineering drawings by hand and with Inventor

3. Engineering profession

- Understand the types of engineering fields and the responsibilities of engineers in those areas
- Effectively communicate technical information in both written and oral forms
- Recognize the impact that engineering has on society and know how engineers can solve problems to benefit communities and other stakeholders
- Understand engineering design processes to systematically solve problems

Course textbook

You are not required to purchase a textbook for this course. Listed below are resources that are relevant to the course and might be helpful to you:

- Kosky, P., Balmer, R. T., Keat, W. D., & Wise, G. (2020). *Exploring engineering: An introduction to engineering and design* (5th ed.). Academic Press. ISBN: 978-0128150733.

- Dym, C. L., Little, P., & Orwin, E. J. (2013). *Engineering Design: A Project-Based Introduction* (4th ed.). Wiley. ISBN: 978-1118324585.

- Oakes, W. C. & Leone, L. L. (2016). *Engineering Your Future: A Comprehensive Introduction to Engineering* (9th ed.). Oxford University Press. ISBN: 978-0190279264.

- Shih, R. H. (2021). *Parametric Modeling with Autodesk Inventor 2022*. SDC Publications. ISBN: 978-1-63057-422-2.

- Beyenir, S. (2011). *A Brief Introduction to Engineering Computation with MATLAB*. Open Textbook Library. https://open.umn.edu/opentextbooks/textbooks/a-brief-introduction-to-engineering-computation-with-matlab.

- Tutorials Point (2014). *MATLAB Numerical Computing*. https://www.tutorialspoint.com/matlab/matlab_tutorial.pdf.

Grading

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

Category	%
Daily comprehension checks	20%
Weekly deliverables	35%
Individual coding project	20%
Collaborative design project	25%

Your letter grade is determined using the following scheme:

Percentage Grade	Letter Grade	Meaning
90-100%	A	Superior
80-89%	B	Good
70-79%	C	Fair
60-69%	D	Marginal
<60%	F	Failure

Part of your grade depends on how well you engaged with the course material, as determined through class and office hours meetings. Thus, you will be assigned a plus or minus (e.g., B+, B, or B-) to your final grade based on the professor's impression of your growth, participation, and understanding through the semester.

Your final grade will be rounded to the nearest whole number (e.g., 89.4% $\rightarrow$ 89% or 89.5% $\rightarrow$ 90%). Your final grade must be no less than 60% to pass the course. In some circumstances, an incomplete (letter grade I) or conditional failure (letter grade E) may be assigned at the professor's discretion. Please see the Grades section in the university Academic Regulations for more information on conditional failures and incomplete grades.

1. Daily comprehension checks

Prior to each class, you will be required to read documents or watch videos available on Canvas. These resources will show you the concepts and skills that you will need to practice and develop in class for the day. To ensure that you are prepared for class, you will be required to complete daily comprehension checks at least three hours before class starts. You will have access to the online resources while completing the checks, but it is recommended that you take notes on the materials to help you learn the content.

2. Weekly deliverables

Each week, you will use the skills and content learned from Canvas to complete engineering projects in a variety of fields. You will have Monday, Tuesday, and Wednesday to work on the project(s) of the week in class. After these workshops, you should have some document(s) or file(s) to hand in for credit. Each deliverable will be due at 11:59pm on Friday, unless otherwise indicated.

3. Individual coding project

Midway through the semester, you will be assigned a coding project to complete individually. This project will test your coding abilities and employ skills necessary to the engineering profession, such as technical communication and critical thinking.

4. Collaborative design project

At the end of the semester, you will be assigned a design project to complete in pairs or groups. This project will test your coding and drawing abilities and employ skills necessary to the engineering profession, such as verbal communication and following a design procedure.

Late submission policy

Assignments submitted within twelve hours after the deadline will incur a 5% reduction in the final grade. Assignments submitted after twelve hours, but before twenty-four hours after the deadline will incur a 10% reduction in the final grade. For every additional twenty-four hours the assignment is submitted after the deadline, the final grade will incur an additional 10% until the final grade is zero (at most, at ten days late).

For example, if an assignment is due at 11:59pm on Friday, and the assignment was completed perfectly (100% grade), the final grade would be as follows:

Time submitted	Hours late	Final grade
before Friday, 11:59pm	≤ 0	100%
before Saturday, 11:59am	> 0 and ≤ 12	95%
before Saturday, 11:59pm	> 24 and ≤ 48	90%
before Sunday, 11:59pm	> 48 and ≤ 72	80%
before Monday, 11:59pm	> 72 and ≤ 96	70%
$\vdots$	$\vdots$	$\vdots$

If you experience an emergency (e.g., hospitalization, death in the family) that prevents you from submitting your assignments on time, please email the professor as soon as possible explaining your situation and request for an extension.

Additionally, if you are overwhelmed with work from other classes, a job, or other external obligations, you may email the professor **at least twelve hours before** the deadline explaining your circumstances and requesting an extension (you will not receive an extension if you ask for one within twelve hours before or anytime after the deadline, excluding an emergency).

The goal is to keep you on track as a student and to be fair to your classmates, while understanding that emergencies and external obligations might prevent you from completing your work. Note that the professor reserves the right to grant or deny requests for extensions, and excessive requests will result in a conversation about your obligations to this class and your learning.

Class participation

Succeeding in this class will require you to actively engage with the content through self-study, practice, and course engagement. As such, participation is essential to your learning

and will play into your final grade for this class. Participation will be assessed for each class meeting based on the content for the day. The areas where you could be assessed include:

- Attendance/punctuality

- Class or group discussions

- Attention/focus (e.g., inappropriately using your phone or laptop during class)

If you must miss class because of a religious holiday, illness, or an emergency (e.g., hospitalization, death in the family), please email the professor as soon as possible explaining your situation. Additionally, do not come to class if you feel ill. Contact the Student Health Center for access to testing and treatment.

Communication policy

Your success in this class (and any other) depends on your ability to communicate with your professor in a timely and professional manner. By setting some ground rules, you can achieve this goal. These rules include:

- Any requests should be made in writing (email works best) to ensure that there is a record (for requests made in conversations, send a note over email).

- Try to send emails during normal work hours (Monday-Friday, 9am-5pm). Responses to emails sent outside of this period may be delayed.

- In the subject line of your emails, include "ENGN 178" to ensure that the email is caught by the filter.

- Be courteous and professional in your writing (try not to write like you do 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 the professor.

Collaboration policy

You are encouraged to talk with your peers and use the myriad resources available to you online to overcome obstacles you might face in this course. However, the work that you submit must be your own, unless indicated otherwise. 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. You will never learn to code or generate engineering drawings unless you practice – a lot. Do not rob yourself of the opportunity to learn by stealing the work of others.

Technology/electronic devices policy

You will be using computers throughout the semester to solve engineering problems. You are welcome to use the computers in the classroom, or you may bring your personal laptop to class. During class meetings, you will have time to work on problems and ask for help from the professor, the TA, or your peers. It is not recommended that you use your cell phone or computer in ways irrelevant to the class during meeting times. Doing so will harm your grade and will require you to finish assignments outside of class. Please speak with the professor if there is a pressing issue requiring you to use your phone in class.

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 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, the professor, 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 to your class dean. Your dean is either Jason Rodocker (jrodocker@wlu.edu) for first-year students or Kyle McCoil (kmccoil@wlu.edu) for second-year students. Additionally, feel free to reach out to the professor if you have any questions or concerns about this class or anything else.

Policy for students requiring accommodation

There can be a frustration and fear that comes with seeking 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. You are encouraged to meet with the professor to discuss your needs if you believe they will affect your experience in the class.

Land and labor acknowledgment

Engineering is more than just solving math and science problems to develop new technology. 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	Day	Date	Topic
0	0	F	09/08	Course introduction
1	1	M	09/12	Excel: Data and calculations
	2	Tu	09/13	Excel: Line and scatter plots
	3	W	09/14	Excel: Functions and trend lines
	4	F	09/16	Engineering and personal values
2	5	M	09/19	MATLAB: Basics
	6	Tu	09/20	MATLAB: Arrays
	7	W	09/21	MATLAB: Cells, structures, and tables
	8	F	09/23	Engineering presentation skills
3	9	M	09/26	Plot types, uses, and pitfalls
	10	Tu	09/27	MATLAB: Line, scatter, and distribution plots
	11	W	09/28	MATLAB: 2D plots
	12	F	09/30	Formal and scientific writing
4	13	M	10/03	MATLAB: Loops
	14	Tu	10/04	MATLAB: Conditional statements
	15	W	10/05	MATLAB: Functions and function handles
	16	F	10/07	Engineering careers research
5	17	M	10/10	Engineering careers presentations
	18	Tu	10/11	Project work day
	19	W	10/12	Project work day
	–	F	10/14	**Fall reading day (no classes)**
6	20	M	10/17	Freehand sketching
	21	Tu	10/18	Pictorial sketching
	22	W	10/19	Orthographic sketching
	23	F	10/21	Engineering ethics

Wk	Mtg	Day	Date	Topic
7	24	M	10/24	Inventor: Creating a simple part
	25	Tu	10/25	Inventor: Creating a part with design intent
	26	W	10/26	Inventor: Revolves and patterns
	27	F	10/28	Community impact of engineering
8	28	M	10/31	Inventor: Part materials and analysis
	29	Tu	11/01	Inventor: Assemblies
	30	W	11/02	Inventor: Stress analysis
	31	F	11/04	Design process: Problem definition
9	32	M	11/07	Inventor: Orthographic drawings and dimensioning
	–	Tu	11/08	**Election Day (no class for ENGN 178)**
	33	W	11/09	Inventor: Exploded and auxiliary views
	34	F	11/11	Design process: Generating alternatives
10	35	M	11/14	Introduction to the collaborative design project
	36	Tu	11/15	Applying the design process
	37	W	11/16	Applying the design process
	38	F	11/18	Design process: Evaluation and selection
Thanksgiving holiday 11/21-25 (no classes)				
11	39	M	11/28	Prototype development and testing
	40	Tu	11/29	Prototype development and testing
	41	W	11/30	Prototype development and testing
	42	F	12/02	Prototype development and testing
12	43	M	12/05	Project work day
	44	Tu	12/06	Project work day
	45	W	12/07	Oral design defense
	46	F	12/09	Oral design defense
Collaborative design project reports due 12/16				