ENGR 130: Foundations of Engineering & Programming
Fall 2023
Case Western Reserve University

Instructors

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TAs + Meeting Time and Locations

Lecture: T 2:30 - 3:45 pm, Millis Schmitt Lecture Hall

Section	Labs	Instructor	In-Lab TAs	Grader
110	MW 3:20 - 4:35	Kurt Rhoads	Maddy Dietrich (mgd56) Elijah Shew (ets51) Nathaniel Smith (ncs82)	Abigail Burianek (arb264)
113	TR 8:30 - 9:45	Kathy Harper	Ipsa Bijumalla (ixb135) Will Cassano (wmc31) Michelle Du (mxd682)	Maria Tuepker (mct72)
111	TR 10:00 - 11:15	Kathy Harper	Andrew Baierl (amb456) Rucha Batchu (rpb89) Arnav Manu (akm174)	Brian Nguyen (nbn10)
112	TR 1:00 - 2:15	Kurt Rhoads	Grace Despres (gwd25) Octavio Guzman (bog4) Danny Saliba (das339)	Joey Ahmed (ana98)
114	TR 4:00 - 5:15	James Schmidt	Pranav Balabhadra (pxb408) Valentina Nova (vxn106) Ryan Perez (rcp77)	Abe Nidhiry (amn84)

SI: Angel Ramirez (axr987)

Course Description

Students will learn the fundamentals of engineering analysis and computer programming using a hands-on, project-based approach. During each module, students will collaborate to apply engineering skills, such as data analysis or prototyping, in addition to programming, to design a device. MATLAB will be the primary coding language. Projects incorporate skills from various engineering disciplines. In addition, students will learn about the engineering profession and the engineering design process. A laptop computer capable of running MATLAB is required for this course.

Course Goals

Students will learn:

- to analyze data in the context of engineering problems
- to program using MATLAB
- to work effectively in teams
- to prototype, using basic CAD, 3D printing, etc.
- about different engineering disciplines and practices

Quantitative Reasoning

This course satisfies the Quantitative Reasoning skill in the General Education Requirements because students will use computer programming and data analysis to solve engineering problems in each module. In addition, students will use mathematics and statistics in multiple modules and computer programming assignments.

Course Structure

This course consists of one 75-minute lecture and two 75-minute laboratory sessions each week. The lecture will be used to introduce engineering concepts and for learning and practicing MATLAB programming. We also have guest lecturers every week to teach students about the different engineering disciplines and career paths. In the lab, students apply their engineering and MATLAB skills to complete assignments in teams of four.

Required Equipment

Personal laptop computers are required for lectures and labs. If you do not have a laptop, please inform the instructor right away to discuss accommodations.

Grading Basis

The final score will be computed from the following components:

Lecture Preparation	10%
Lecture Formative Quizzes	3%
Homework	12%
Laboratory	35%
Midterm Exam	15%
Final Exam	25%

Letter grades will be assigned according to the following scale: A – 90-100%, B – 80-89%, C – 70-79%, D – 60-69%, F – Below 60%.

Lecture Preparation: You are required to complete a preparatory assignment and take a short quiz before each lecture. The preparatory assignment will usually consist of watching a video or reading a textbook passage.

Lab Reports: Each team will submit weekly lab reports. These will include 1) the team's MATLAB code as written and implemented during the labs and 2) typed answers to reflection questions. All members of the team are responsible for the content and quality of the submitted document, including loss of credit for incorrect and/or late file uploads. You will work with several different teams during the course, and there are

two categories of assignments related to your teamwork: team contracts and peer reviews. Each time you begin working with a new team, you will establish guidelines for how you will work together and put those into a team contract. The peer reviews at the end of each module are for you to reflect on your contributions to the team, for teammates to provide and receive feedback, and to assess individual contributions to the team assignments. The peer reviews, in tandem with instructor observations, will be used to adjust individual lab report grades when necessary.

Late lab reports will be assessed a 10% penalty for up to 24 hours late and a 20% penalty for up to 48 hours late. No late lab reports will be accepted after 48 hours without prior approval.

Lab Attendance: Engineering is not a spectator sport, so the hands-on experiences in the lab are essential. Any student is going to miss a lab session, for any reason, should notify their team and instructor in advance. In the case of an emergency, the notification should happen as soon as possible. After the missed lab period, the student must communicate with their lab team to determine what work was done in their absence and then attend an open lab session to complete the work that was missed. A TA will document that the work has been completed. If the work is not made up before the lab report is submitted, that individual's lab report grade for the week will be reduced by 50% per absence. Extreme or habitual tardiness may be counted as an absence.

Lecture Attendance: Please note that while attendance will not be taken during lecture, students are still responsible for the material addressed in lecture, including the guest lectures and any course announcements that occur there.

Homework: There will be weekly MATLAB programming assignments, as indicated on the course schedule. No credit will be given for late homework without prior approval or documentation. The one lowest homework score will be dropped and excluded from grade calculations.

Lecture Formative Quizzes: During every lecture, students will complete a low-stakes formative quiz designed to assess their own learning of the course material. These will be collected at the end of class. The problems will be graded for completion only, not for correct answers. The two lowest scores will be dropped and excluded from grade calculations.

Midterm Exam: The midterm exam will assess MATLAB programming and lab concepts covered up to that point. The lab questions will address topics such as the underlying concepts of the labs, how the lab equipment is manipulated, and how to analyze data taken during the labs.

Final Exam: The final exam will assess MATLAB programming and lab concepts covered throughout the whole semester.

Lab Safety

These rules are to minimize the possibility of accidents or injuries:

- Eye protection and lab coats will be required for some lab activities (see course schedule)
- Know location of first aid kit
- Be careful with sharp corners
- Report ALL injuries to the instructor
- No food or drink in the lab

Textbook

MATLAB – A Practical Introduction to Programming and Problem Solving, 5th Edition (2019), by Stormy Attaway. Publisher: Elsevier.

The ebook version of this textbook is available at no cost through Kelvin Smith Library. You must be on the Case network or VPN to access the PDF. Search for the book in the KSL catalog; choose "Online Access - Connect to resource (CWRU only)". https://case.edu/library/
In addition, you may find useful documentation by typing "help" in the command line or from the https://www.mathworks.com/ website. MathWorks is the company that develops and commercializes MATLAB. Their website also offers tutorials for end-users and students.

Canvas

We will use Canvas (canvas.case.edu) extensively throughout this course. All of the course materials, important dates, and assignments will be posted on Canvas. Please note that Canvas begins marking assignments late at the due time, not in the minute following it. If Canvas marks the assignment late, it is late.

Academic Integrity Policy

All students in this course are expected to adhere to University standards of academic integrity. Cheating, plagiarism, misrepresentation, and other forms of academic dishonesty will not be tolerated. This includes, but is not limited to, consulting with another person during an exam, turning in written work that was prepared by someone other than you, making minor modifications to the work of someone else and turning it in as your own, or engaging in misrepresentation in seeking a postponement, excused absence, or extension. Students may not seek the assistance of Generative AI Tools like ChatGPT. Use of a Generative AI Tool to complete an assignment constitutes academic dishonesty. Ignorance will not be accepted as an excuse for any form of academic dishonesty. If you are not sure whether something you plan to submit would be considered either cheating or plagiarism, it is your responsibility to ask for clarification. For complete information, please go to https://students.case.edu/community/conduct/aiboard/policy.html.

Disability Resources

Disability Resources is committed to assisting all CWRU students with disabilities by creating opportunities to take full advantage of the University's educational, academic, and residential programs. For further information, please go to https://students.case.edu/academic/disability/.

Commitment to a Diverse and Inclusive Learning Environment

CWRU and the Case School of Engineering support an inclusive learning environment where diversity and individual differences are understood, respected, appreciated, and recognized as a source of strength. All students are welcome, regardless of race, ethnicity, culture, language, political view, religious belief, gender, gender identity, sexual orientation, learning and physical ability, age, veteran's status, citizenship, social or economic class, and the other diverse identities that we each bring to class. We respect the value of every member of the class, and all are encouraged to share their unique perspectives as individuals, not as representatives of any category. All are expected to engage respectfully and with dignity for others.

Everyone has the right to be addressed by their chosen, correctly pronounced, name and pronouns. Class rosters do not always contain this information, so you are encouraged to indicate your preferences, which will be respected at all times in this class. Mistakes in addressing one another may happen; we ask all to be open to correction and learning. We will not tolerate repeated comments which disrespect others. If at any point

during the term you would like to be addressed differently, please tell your instructor. If you ever experience non-inclusive behavior from your instructor, a teaching assistant, or one of your classmates, please let Dr. Rhoads, Dr. Harper, or Mr. Schmidt know so we can create a more inclusive environment. Thank you.

Daily Schedule ENGR 130 FALL 2023

Week	Day	Class	Topic	Due*
Week 1	M-T, 8/28-29	Module 0, Lab 1	Introductions, teamwork, algorithms	
	T, 8/29	Lecture 1	Additional course introduction, academic integrity, metacognition	Lecture Prep 1
	W-R, 8/30-31	Module 0, Lab 2	Intro to design, MATLAB scripts, variables, and math	HW 1
	F, 9/1			
Week 2	**M-T, 9/4-5**	**No lab due to**	**Labor Day holiday on Monday**	
	T, 9/5	Lecture 2	Input, output GUEST TOPIC: Aerospace Engineering	Lecture Prep 2
	W-R, 9/6-7	Module 1, Lab 1	Vectors, matrices	HW 2
	F, 9/8			
Week 3	M-T, 9/11-12	Module 1, Lab 2	Repetition	
	T, 9/12	Lecture 3	Logical operators and selection GUEST TOPIC: Environmental Engineering	Lecture Prep 3
	W-R, 9/13-14	Module 1, Lab 3	Arduinos	HW 3
	F, 9/15			
Week 4	M-T, 9/18-19	Module 2, Lab 1	Turbidity, breadboarding	Module Report 1
	T, 9/19	Lecture 4	Graphing, data fitting GUEST TOPIC:	Lecture Prep 4
	W-R, 9/20-21	Module 2, Lab 2	Collecting data with the Arduino	HW 4, Team Contract 1
	F, 9/22			
Week 5	M-T, 9/25-26	Module 2, Lab 3	Calibration, filter design **	Module Report 2_1
	T, 9/26	Lecture 5	Logical indexing, file input and output GUEST TOPIC: Materials Science	Lecture Prep 5
	W-R, 9/27-28	Module 2, Lab 4	Filter design and testing **	HW 5
	F, 9/29			

Week 6	M-T, 10/2-3	Module 3, Lab 1	Oscilloscopes	Module Report 2_2
	T, 10/3	Lecture 6	Debugging, midterm exam topics GUEST TOPIC:	Lecture Prep 6
	W-R, 10/4-5	Module 3, Lab 2	Piezoelectrics and signal analysis	HW 6, Team Contract 2
	F, 10/6			CATME - Module 2
Week 7	M-T, 10/9-10	Module 3, Lab 3	Detecting knocks	Module Report 3_1
	T, 10/10	**Lecture 7**	**Midterm Exam**	
	W-R, 10/11-12	Module 3, Lab 4	Knock sensor demonstrations	HW 7
	F, 10/13			
Week 8	M-T, 10/16-17	Module 4, Lab 1	Euler's method	Module Report 3_2
	T, 10/17	Lecture 8	Functions I GUEST TOPIC: Mechanical Engineering	Lecture Prep 8
	W-R, 10/18-19	Module 4, Lab 2	Wheg research	HW 8
	F 10/20			CATME - Module 3
FALL BREAK 10/23 - 10/24. No classes, open lab, or office hours				
Week 9	W-R, 10/25-26	Module 4, Lab 3	SolidWorks and wheg design	Module Report 4_1
	F, 10/27			
Week 10	M-T, 10/30-31	Module 5, Lab 1	Sinusoidal decomposition, Fourier analysis	Module Report 4_2
	T, 10/31	Lecture 9	Functions II GUEST TOPIC: Biomedical Engineering	Lecture Prep 9
	W-R, 11/1-2	Module 5, Lab 2	More with sinusoids and FFTs	HW 9
	F, 11/3			CATME - Module 4
Week 11	M-T, 11/6-7	Module 5, Lab 3	Processing biomedical signals	Module Report 5_1
	T, 11/7	Lecture 10	Random numbers GUEST TOPIC:	Lecture Prep 10
	W-R, 11/8-9	Module 5, Lab 4	Creating unique signals	Team Contract 3, HW 10
	F, 11/10			
Week 12	M-T, 11/13-14	Module 6, Lab 1	Control systems	Module Report 5_2

	T, 11/14	Lecture 11	Debugging GUEST TOPIC: Systems Engineering	Lecture Prep 11
	W-R, 11/15-16	Module 6, Lab 2	Manual control	HW 11
	F, 11/17			CATME - Module 5
Week 13	M-T, 11/20-21	Module 4, Lab 4		Module Report 6_1
	T, 11/21	Lecture 12	File input and output with complex files GUEST TOPIC:	Lecture Prep 12
	W, 11/22	**NO LAB**		HW 12
THANKSGIVING BREAK 11/23 - 11/24. No classes, open lab, or office hours				
Week 14	M-T, 11/27-28	Module 6, Lab 3	PID control and tuning I	
	T, 11/28	Lecture 13	String and character data GUEST TOPIC:	Lecture Prep 13
	W-R, 11/29-30	Module 6, Lab 4	PID control and tuning II	HW 13
	F, 12/1			
Week 15	**M-T, 12/4-5**	**Module 4, Lab 5**	**Whegs competition**	Module Report 6_2
	T, 12/5	Lecture 14	Applications, final exam topics GUEST TOPIC:	Lecture Prep 14
	W-R, 12/6-7	Module 7	Reflection	HW 14, CATME - Module 6
	F, 12/8			Reflection, Module Report 4_3

FINAL EXAM Tuesday December 19th, 3:30 PM

*Lab reports, lecture preparation, homework assignments, and team contracts are due at noon, on the dates indicated above. CATMEs are due at midnight.

** On the 2 dates indicated, students must bring lab coats and protective eyewear