ME 310 Instrumentation: SPRING 2025

LECTURE

A1: MW 10:10 – 11:55 AM, PHO 210
Prof Caleb Farny (farny@bu.edu), 110 Cummington Mall, Rm 207
Office hours: Tuesdays & Wednesdays 2-3 pm

A2: MW 12:20 – 2:05 PM, PHO 117
Prof Brian Walsh (bwalsh@bu.edu), 110 Cummington Mall, Rm 319
Office hours: Mondays 9-11am

LAB

Rm 113A, 110 Cummington Mall

Mon (C5) 2:30 – 6:15 pm	Tues (C7) 11:30 am – 3:15 pm
Tues (C1) 5:30 – 9:15 pm	Weds (C6) 2:30 – 6:15 pm
Thurs (C2) 5:30 – 9:15 pm	Fri (C3) 8 – 11:45 am
Fri (C4) 2:30 – 6:15 pm	

GSTs

Sarah Loshinsky (sloshin@bu.edu)	(Weds & Fri afternoon lab sections)
Pranav Sultania (pranav19@bu.edu)	(Tues morning & Fri morning)
Dingcheng Sun (dcsun@bu.edu)	(Monday & Weds)
Hao Zang (hzn1848@bu.edu)	(Tues evening & Fri afternoon)
Kelsey Crawford (kmc372@bu.edu)	(Tues evening & Thurs)
Viraat Hooda (viraatsh@bu.edu)	(Monday & Weds)
Leonardo Zamora Yanez (zamora@bu.edu)	(Monday & Fri morning)
Xiaohang Xie (xhxie@bu.edu)	(Tues morning & Thurs evening)
Yukkta Selam (yukktas@bu.edu)	(Tues evening & Fri afternoon)
Amani Campbell (amanic@bu.edu)	(Thursday)

Course description

Designing, assembling, and operating experiments involving mechanical measurements; analyzing experimental data. Safety considerations in the laboratory. Wind tunnel testing. Mechanical and electrical transducers for flow, pressure, temperature, velocity, strain, and force. Electric circuits for static and dynamic analog signal conditioning. Computer use for digital data acquisition and analysis; instrument control. Introduction to frequency domain analysis. Professional standards for documenting experiments and preparing reports, including formal uncertainty analysis involving elementary statistics. Discussion of commercial instrument development. Interpretation of experimental results. Includes lab and design project.

Course Learning Outcomes

As an outcome of completing this course, students will successfully:
i. Design and implement experimental solutions to engineering problems, including static and dynamic mechanical, electrical and thermal measurements, and justify the tradeoffs between cost, performance and complexity of measurement schemes.
ii. Analyze the uncertainty of experimental results, including identification of sources & types of uncertainty, combination & propagation of uncertainties.

iii. **Hub unit: Writing Intensive**. Demonstrate proficiency in technical writing and documentation of experimental work through use of standardized lab reporting policies and requirements.
iv. Demonstrate the operating principles and justify the uses of transducers, output devices, and signal conditioning elements of measurement systems for flow, pressure, temperature, velocity, strain, and force.
v. Apply the concepts of signals and systems and their interaction in both static and dynamic measurements, including mathematical modeling of such systems' static and time-dependent behavior.
vi. Demonstrate knowledge of the theory and practical application of analog-digital conversion in the context of data acquisition and MATLAB and LabVIEW interface data acquisition control software.
vii. Work efficiently in individual and team settings by performing labs and projects in both self-organized and instructor-organized groups.
viii. Present experimental design and results in an oral presentation.

Hub Learning Outcome: Writing Intensive (course outcome iii)

Text: Figliola and Beasley, *Theory and Design for Mechanical Measurements,* Wiley. ISBN: 9780470547410. **(**Any edition after the 4th edition is likely cheaper and is also acceptable)
Optional Text: Taylor, *An Introduction to Error Analysis*, 2nd edition, Univ. Sci. Bks., 1997.

Website/Digital materials

Blackboard (learn.bu.edu): All course material will be hosted on Blackboard. Please check the course Blackboard site to review your grades and submit digital copies of your lab reports.

Gradescope: We will use Gradescope *solely* for the purpose of submitting the video questions and homework assignments.

Grading	10%	Video questions, Class & Lab performance
	20%	Design Project
	15%	Homework Sets
	20%	Labs and Lab Reports
	35%	Exams (both midterms)

Nominally, the mean of the overall score across the class will set the dividing line between a B and a B-. Failure to engage with the design project or failure to submit the majority of the lab reports will result in an automatic failure of the course, regardless of your other grades.

Lab: You should have a bound notebook or well-organized digital file for your in-lab notes and data. Read through ME310 Lab Guide document (posted separately) for details on lab policy and report expectations.

Class

ME310 is a "flipped class" to a certain extent; some lectures will involve a discussion of new concepts while others will focus on group-based measurement challenges. In order to prepare for these challenges, it is required that you watch the course videos, and have submitted the corresponding worksheet questions PRIOR to coming to class. Participation with your group on

the in-class measurement challenges will be part of your grade. Further information in "Videos" below.

The course instructors are aware of and in agreement with Boston University's Policy on Religious Observance, whereby absences for any religious beliefs are understood and missed assignments on such occasions will be given a chance to be made up. Students are required to notify their instructor at least a week in advance for such occasions, particularly if an accommodation must be made.

Videos

The course has 5 content modules that have an accompanying set of videos that we have created for you to watch. There are 2 – 4 videos per module; each ranges from 9 – 14 minutes, depending on the complexity of the topic. Most videos contain embedded questions. You are responsible for writing these questions down and answering them. These make up your "worksheet questions" and are due to *Gradescope* on the day of the corresponding active learning exercise.

Homework

Homework assignments should be submitted via Gradescope by 11 pm on the dates listed on the course schedule. LATE HOMEWORK WILL NOT BE ACCEPTED unless circumstances merit the exception.

Exams

Two in-class exams will be held. Make-up exams will only be given in extreme situations.

Design Project

You will design and implement a complete transduction system to measure the frequency-dependent displacement of a damped mass on a spring. This will occupy roughly the final 4 weeks of laboratory meetings.

Collaboration

A. *Homework and video questions*: Do it individually. However, you are encouraged to consult with classmates on general concepts.

B. *Lab reports*: Also to be done individually. All pre-labs are also to be done individually. This policy extends to **ALL** components (text, figures, tables, etc) of the document. **Do NOT share digital files other than whatever raw data needs to be shared within your group.** For some experiments, there will only be one copy of your raw data/results, which you must copy later for inclusion in your own reports. Your lab report should be a stand-alone document, and therefore you may not 'reference' any section in one of your lab partners' reports. However, you are encouraged to consult with your lab partners to discuss findings and results.

Take this guidance **very seriously but PLEASE feel free to come talk to us if you're unsure about boundary lines!**

C. *Design project*: This is a group project, and we expect to see some division of labor here; there will be 1 report per group, so each group member nominally receives the same grade. Despite the division of labor each member of the group must understand the other member's contributions.

Use of generative AI in ME310

Technical writing combines the analysis-driven know-how that you've gained from your engineering education with the important ability to express your knowledge in a clear and concise way to your client, boss, or colleagues. The ability to communicate technical information in such a way is a critical and highly sought-after skill in the world of engineering; pay scale often correlates with the ability to write technical reports. Analyzing data into results, often expressed via plots and tables, and being able to *explain* the trends that appear in those results and *why* we should care about your explanation is to your benefit if you want the greater world to pay attention to your engineering goals.

Our deep-seated belief is that being able to express your knowledge of a technical investigation in your own words, independent of assistance by generative AI, is a superior way to learn how to produce a technical report. However, GenAI has presented itself as a much faster way to write, and tools such as ChatGPT offer fantastic resources for generating technical reports. Many examples of hilarious failures from GenAI text exist. Your submitted reports are expected to be your work and will be graded as such.

It is my experience that ChatGPT cannot fully understand the nuances of an experiment such that it can incorporate the procedure and equipment you used, experimental conditions that lead to a particular set of results, and then be able to *explain* those results in your Discussion section. Use of GenAI in ME310 is permitted but you are expected to understand that your work is representative of your knowledge of the report's goals.

Our guidance is that you may take advantage of time-saving tools such as GenAI software **so long as** you:

a) Understand what this tool has written, in support of your goal (i.e. the technical report that you've been asked to write)
b) Can identify **and** correctly edit any mistakes the tool has made (these tools are based on existing internet resources that may be incorrect and/or incorrectly assembled)
c) Can learn from what the tool has written for you, in support of the ME310 course goals

Academic Conduct Statement

Cheating on homework, quizzes, exams, project reports, or any form of assignment, may be a form of plagiarism and is an infringement of every code of engineering ethics. Plagiarism is a serious academic offense and should not be taken lightly. Understanding your ethical responsibilities is an integral part of becoming a professional. A copy of the Code of Ethics of engineers, promulgated by the Accreditation Board for Engineering and Technology (ABET) and the National Society of Professional Engineers, can be found on the main course web site.

Recall that when you enrolled at Boston University, you agreed to an Academic Honesty Pledge. The Academic Conduct Code details your responsibilities as well as the results of code violations, and is posted at: *https://www.bu.edu/academics/policies/academic-conduct-code/*

Accommodations for students with documented disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic

accommodations must submit appropriate medical documentation and comply with the established policies and procedures.

We will make every effort to accommodate such requests but (a) please notify us at the beginning of the semester if you've received approved accommodations in previous semesters (even if you haven't received your documentation for this semester yet) and (b) our policy is that we need at **least one week's** notification prior to each exam so we can make the necessary arrangements. Exam sessions should be scheduled through the University Testing Center; please schedule these **two weeks** in advance of the scheduled exam dates published in the course schedule.

Software Access

We **highly** recommend the use of MATLAB or python tools for analysis and plotting for ME310, and will require it for some of the homework analysis. You can download Matlab to your personal computer: http://www.bu.edu/tech/services/cccs/desktop/distribution/mathsci/matlab/