Biomedical Instrumentation Laboratory

BME4503L Sections 01AG, 15C0, 2446
Class Periods: T, W, R | Period 3-5 (09:35 AM – 12:35 PM)
Location: NSC 407
Academic Term: Fall 2025

Instructor:
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Book a Meeting with Me | Request A Letter of Recommendation

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Syllabus Policy:
It is your responsibility to read and adhere to the instructions, guidelines, and schedules outlined in this syllabus, as well as to check the Canvas site regularly for updates or announcements about any changes. Failing to review the syllabus or announcements will not be accepted as a valid excuse for missing assignments or deadlines.

Course Description
1 credit lab course – The laboratory will introduce the student to the basic building blocks of biomedical instrumentation using simplified electric and electronic circuits that allow the acquisition, measurement, and conditioning of physiological signals. Students will acquire a foundational knowledge of amplifiers and the instrumental role they play in biomedical devices by designing, building, and characterizing different circuit configurations on a breadboard and using the circuit simulation software KiCad. Students will explore the basic principles of sensors while constructing clinically relevant circuits like a temperature transducer, a Flexion detector, and an alarm system. They will also learn about the limitations and safety considerations pertinent to medical devices. This laboratory course complements BME 4503 Biomedical Instrumentation (lecture) and provides hands-on experience of the topics discussed in the lecture via circuit construction and simulation.

Course Pre-requisites
MAC2313, MAP2302, PHY2049, BME3508, and EEL3003 or EEL3111C with min grades of C. ***Now is a good time to review the material of those courses!***

***Course Co-requisites*:**
BME 4503
BME3508

Course Objectives
- Identify, design, and construct simplified building blocks of a biomedical instrumentation system.
- Simulate and characterize the functionality and performance of a given circuit design using LTSpice or KiCad.
- Troubleshoot the interconnected blocks (subsystems) of a larger pipeline (system).
- Acquire measurements and interpret data from physiological systems.
- Appraise and evaluate the practical limitations of physiological measurements.

- Write a technical lab report in the form of a Technical Summary.

Materials and Supply Fees
$26.25

Professional Component (ABET):
This course covers 1 credit of engineering topics

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks
No textbook is required.

Required Software
- KiCad. KiCad is a free one-stop shop for circuit schematic creation, simulation, and PCB design. It is compatible with both PC and Mac and has a user-friendly GUI on both platforms. We will use KiCad v 9.0, and you can download it from Canvas. Please download KiCad from Canvas, and NOT the official KiCad website.
- MATLAB - student edition
- Arduino IDE

Required technology:
- A Windows-compatible USB drive is required to capture results from the oscilloscope.
- A laptop, tablet, or iPad is needed to view the lab instructions and take notes.
- A laptop or desktop for circuit simulation, MATLAB and Arduino programming, and PCB design. See UF-HWCOE Computer Requirements for more information.

Recommended Materials

- Medical Instrumentation Application and Design - John G. Webster, 4th edition
  ISBN-13: 978-0471676003 ISBN-10: 0471676004

***Tentative** Course Schedule: subject to change*

Wk#	Wk of	Lab	Topic	Pre-Lab		Post-Lab
				Read	Assg.	Assg.
1	08/25		pL0 in class			
2	09/01*	L0	Intro to circuit measurements + safety	L0	---	L0Q + Tech Summary
MODULE 1 - Operational Amplifiers						
3	09/08	L1	Op-Amps: INV. and Diff. amps	pL1, L1	pL1Q	L1Q + Tech Summary
4	09/15	L2	Op-Amps: Active Filters	pL2, L2	pL2Q	L2Q + Tech Summary
5	09/22		~ Reflection Week~			
MODULE 2 - Basics of Bio-Sensors						
6	09/29	L3	Sensors: Wheatstone bridge + Thermistor	pL3, L3	pL3Q	L3Q+ Tech Summary
7	10/06		~ Reflection Week~			
8	10/13*	L4	Sensors: Flex sensor + Potentiometer	pL4, L4	pL4Q	L4Q + Tech Summary
9	10/20		~ Reflection Week~			
MODULE 3 – Cardiac Detector & Project						
10	10/27	L5	ECG detector	pL5, L5	pL5Q	L5Q+ Tech Summary
11	11/03		~ Reflection Week~			
12	11/10		Build Your Own Design (BYOD) Planning			
13	11/17	L6	BYOD			Video + Tech Summary
14	11/24*		*Thanksgiving break* - No Lab			
15	12/01*		*Reading Days* - No Lab			

***** = a day or more of that week is a holiday; **pLx** = pre-Lab x; **Lx** = Lab x; **pLxQ** = pre-Lab x Quiz; **LxQ** = Lab x Quiz

Attendance Policy:

The biomedical instrumentation laboratory is a BME core course that offers unique hands-on training that helps you develop a skillset essential for your junior and senior design projects in the short run and your BME career in the long run. *Therefore, attendance of all labs is **mandatory** and will be tracked by the participation assignment.*

Punctuality: Lab will start promptly at 9:35am. Students are expected to arrive on time (9:30am). Unexcused late arrivals of 10 minutes or more will **cost 1 token** for every 10 minutes, up to 30 minutes. Late arrivals, after 30 minutes, are not permitted into the lab. Excused late arrivals must be consistent with university policy.

Absence and Make-up Policy:

1. Requirements for class attendance are consistent with university policies. Click here to read the university attendance policies: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/
2. Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. You are responsible for making up the labs you missed due to your absence during the following week.
3. Health-related excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation. Students are responsible for making up the material or activities covered in their absence. After due warning, the instructor has the right to prohibit further attendance and subsequently assign a failing grade for excessive absences. More information can be found in the undergraduate catalog.

4. Students are excused from class or other scheduled academic activity to observe a religious holiday of their faith upon prior notification of their instructor.
5. Students will be permitted a reasonable amount of time to make up the material or activities covered in their absence and will not be penalized because of the religious observances. I will do my best to keep religious holidays in mind while scheduling major academic events. Please notify me if you think I have overlooked a religious holiday. No documentation is required to prove the religious observance.
6. **Unexcused absences (no-shows) will void the participation of the corresponding lab until it is made up.**
7. You can make up only **two** labs throughout the semester. Lab make-ups are allowed only during the following week of said lab.

Lab Attire Policy

To comply with UF Environmental Health & Safety (EH&S) regulations, students must wear closed-toe shoes and long pants or a long skirt that fully covers the legs. These requirements are **mandatory** for all in-person lab sessions. Students who arrive without proper attire will not be allowed to participate in lab activities for safety reasons and will be asked to leave the lab space.

Class expectations:

Class format: This is a 100% **in-person** lab. Class will start with a brief PowerPoint presentation to introduce the lab topic. Then, students will split into groups of two to perform the lab. The students will take notes, collect data/results (images from the oscilloscope or numerical data) during the lab period, and leave when they have completed the lab.

In-class attitude:
Class is highly interactive and relies heavily on your participation. So, bring your best self to class to ensure a great learning experience. Keep up with the pace, and always ask questions. If you feel like you are falling behind, raise your hand and notify the instructor immediately. Having a bad day in general, drop me a Canvas note (see Health and Rest section).

Electronic devices: The usage of electronic devices should be limited to taking digital notes and viewing the lab instructions document. Avoid distractions from social media, texts, and/or chats.

Food/Drinks: Food and drinks are **not allowed** inside the lab.

Communication Policy:

Communication is a cornerstone of the success of the students' learning experience. Hence, to ensure a message doesn't get lost and receive a timely response, all correspondence to/from the instructor and TA should be made via Canvas messages and UF email. All important dates, announcements, and tips will be posted on Canvas. Students are fully responsible for every piece of information on Canvas and must check it regularly for updates (turn the notifications ON).

Class Material:

Pre-Lab document: The pre-lab document will be uploaded to Canvas one week prior to the lab. The pre-lab provides essential background information that complements the lecture material (BME4503) and helps you prepare for the pre-lab quiz. You must read the pre-lab document thoroughly and be familiar with the lecture topics before attempting the pre-lab quiz.

Pre-Lab quiz: The prelab quiz must be completed **individually** on Canvas before you arrive at the lab to ensure you are prepared for the lab and have a good idea of what it entails.

Lab intro: Each lab will start with a brief (10-15min) PowerPoint presentation to ensure we are well prepared for the lab and to announce any critical considerations regarding the lab.

Lab instructions (Lab doc): The instructions document for every lab will be uploaded to Canvas a week before the actual lab (along with the pre-lab). The lab doc will lay out the steps you need to perform in the lab. It will also include design, troubleshooting, and analysis questions (Qs) that will help prepare you for the lab quiz and lab report. You are strongly advised to read the lab doc before arriving at the lab.

Lab Reflections: At the end of each lab, you'll complete a brief reflection in the Class Notebook (OneNote). The reflection captures a key insight, one remaining question, a metacognitive observation, and a self-evaluation of your understanding and engagement. These reflections support your learning and help the teaching team identify where support is needed. Reflections are submitted **individually.** A Lab reflection template will be provided on Canvas and will be marked weekly using specification-based grading.

Lab quiz: The lab quiz is a Canvas assignment you must complete **individually** after every lab. The lab quiz ensures you have a solid understanding of the concepts and theories of the lab.

Lab Reports: Lab reports are submitted **as a group** and cover one lab. The report follows a technical summary format and will be marked weekly using specification-based grading. The report template will be released on Canvas and in the Class Notebook (OneNote) at the beginning of each module.

Class Notebook:
We will use the shared OneNote Class Notebook in Canvas for all lab-related documentation in BME4503L. This notebook will serve as your central workspace for Lab Notes, Lab Reflections, and Technical Summaries. Each student will have a private section accessible only to you and the teaching team. This will be your live record of progress and learning throughout the semester. You are expected to keep your OneNote section updated after each lab. The submissions must still be exported as PDF and submitted to Canvas, where feedback will be provided. Use OneNote as a digital notebook to sketch circuits, paste images, insert screenshots, and organize your work as you go. If you're unfamiliar with OneNote, don't worry, we'll walk you through it during the first lab.

Evaluation of Grades:

"You are not defined by your grade, but by your effort and morals" ~Dr. Mansy
Assignments are pedagogical tools that evaluate and assess the learning objectives listed above. This *happens* to result in a grade. As such, asking questions and seeking help early on can significantly improve the outcome. Evaluation is designed to allow for frequent, low-stakes assignments rather than a few high-stakes assignments, thereby reducing test-induced anxiety and stress.

Assignment	%	Objective	Submission	Grading
6x Pre-lab Quizzes	25%	• Prepare and practice the theoretical concepts of the lab. • Identify gaps in understanding of the lecture material.	Individual on Canvas	Percentage
6x Lab Quizzes	30%	Evaluate students' ability to • Explain and apply core design concepts. • Modify the original design by adjusting key parameters. • Analyze how design changes impact circuit performance and system	Individual on Canvas	Percentage

7x Lab Reports (Technical Summary)	30%	• Write a technical summary for each lab • Communicate circuit design	Group in OneNote Canvas	Specifications
7x Reflections (6x Lab Reflections + 1x Lab Portfolio)	15%	• Monitor weekly attendance and engagement	Individual in OneNote & Canvas	Specifications
Total	**100%**			

Grading Policy

Percentage Grading: Prelab quizzes & lab quizzes will be graded according to UF's percentage grading policy.

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
%	≥94.5	90.0 - 94.4	86.7 - 89.9	83.4 - 86.6	80.0 - 83.3	76.7 - 79.9	73.4 - 76.6	70.0 - 73.3	66.7 - 69.	63.4 - 66.6	60.0 - 63.3	0 - 59.9

More information on UF grading policy may be found at https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Specifications-Based Grading: Technical Summaries and Lab Reflections will be graded using a hybrid grading model that combines elements of Specifications Grading and Standards-Based Assessment to promote clarity, mastery, and fairness. This approach shifts the focus from collecting points to learning as it emphasizes growth and accountability, encouraging students to take ownership of their learning journey.

SRI Marking Scale

Technical Summary assignments will be evaluated using the following marks:

- **S – Satisfactory:** The work meets all specified criteria for content, clarity, completeness, and professionalism.
- **R – Redo/Revise:** The submission is mostly complete but does not meet one or more expectations. If an assignment receives a Revise (R) mark, you have 1 week from the date feedback is provided to submit your revision. Each revision will require **1 token**. Revisions are expected to be thoughtful and substantive. Quick, superficial edits may be returned without further re-evaluation and revisions. Unrevised work will be considered Incomplete (I). Revisions on the very first assignment are free!
- **I – Insufficient:** The work is missing many required components or was not submitted. An incomplete may have been revised with **2 tokens**.

Complete / Incomplete Marking Scale

The Lab Reflections and Portfolio will be evaluated using the following marks:

- **C - Complete**: The submission meets all major criteria, demonstrates meaningful effort and engagement, and follows the required format.
- **I - Incomplete/Revise:** The submission is missing key components, lacks sufficient depth, or does not follow the expectations. An "Incomplete" may be revised and resubmitted within 1 week of receiving feedback. Each revision will require **2 tokens**. Revisions are expected to be thoughtful and substantive. Quick, superficial edits may be returned without further re-evaluation and revisions. Revisions on the very first assignment are free! [Does not apply to the Lab Portfolio]

This system encourages you to focus on doing the work well, not just "getting it done."

Conversion from Specifications-Based Grading to Percentage:

Assignments graded using specifications-based criteria (e.g., Satisfactory/Complete) will be converted to a percentage score to align with Canvas gradebook requirements at the end of every month. The conversion will follow this formula:

$$\left(\frac{Number\ of\ Satisfactory\ or\ Complete\ marks\ received}{Total\ number\ of\ assignments}\right) \text{ x } 100$$

Token System Policy:

Each student begins the semester with **5 tokens**, which can be used across both BME 4503L and BME 4503. Tokens offer flexibility while encouraging responsibility and planning. You may use tokens as follows:

- **1 token** – to revise and resubmit an assignment with an R mark
- **2 tokens** – to revise and resubmit an assignment with an I mark
- **1–2 tokens** – to excuse a late submission (see Late Submission Policy for details)

Tokens are non-transferable and cannot be shared between students. Use them wisely! Use your tokens strategically, as they are a limited but flexible resource intended to support your learning. Carefully review the feedback you receive and revise your work thoughtfully within the designated timeframe to demonstrate mastery. If you anticipate any challenges in meeting deadlines or assignment expectations, communicate with the instructor early, as effective planning and timely communication are essential skills for your career.

Late Submission Policy

- **Delays < 1 day (grace window):** Accepted without penalty if accompanied by a brief written reflection (approximately 200 words) explaining what caused the delay, and what might help you stay on track in future submissions. The reason for the delay must be meaningful. For example, "I forgot; it won't happen again" won't suffice and will **cost 1 token**.
- **Delays > 1 day:** Excused for **1 token**, unless a UF-approved excuse is provided. Without a token or valid excuse, the assignment will receive a maximum of **80% credit**.
- **Delays > 2 days:** Excused for **2 tokens**, unless a UF-approved excuse is provided. Without a token or valid excuse, the assignment will receive a maximum of **50% credit**.

Bonus Tokens

You may earn **1 bonus token** during the semester if you do any of the following

- Complete a Design Exercise with a Satisfactory mark**.**
- Receive a 100% (on first attempt) or S (with no prior revisions) on half of the assignments in a given assignment group. It is the student's responsibility to notify the teaching team.

Class Ethics:

- You are encouraged to leverage AI tools to enhance your understanding of the class material and topics, but copy-pasting AI-generated output is prohibited; this is plagiarism. All student submissions will be checked for AI usage.
- Plagiarism, the act of verbatim copying of text, figures, and/or images (essentially anything) from the web or from Canvas resources without proper citation or paraphrasing, is strictly prohibited. Plagiarism is a common infraction to the UF Honor Code. If you are confused as to what constitutes plagiarism, see here: https://guides.uflib.ufl.edu/c.php?g=147797&p=967443 . Also, note that copying solutions for any assignment, regardless of the source (e.g., other students, pirated website solutions), will be treated as plagiarism. Turnitin will be enabled randomly, and students will be notified of any detected plagiarism. Own your choices, produce your own work, and take pride in it!

Any violations of the above, or attempts thereof, will be immediately reported to the Dean of Students as a UF Student Honor Code violation

Students Requiring Accommodations

No one is perfect, and we all have something we struggle with. If you are aware of a particular difficulty, please do the following:

1. Register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation.
2. Email mmansy@bme.ufl.edu your accommodation letter, along with any additional information and set up an appointment to discuss your needs with the instructor.
3. Register for the tests through the DRC to ensure testing accommodations are met.

***** This should be done as early as possible in the semester *****

Should you, however, feel the need for accommodation at any other point in the semester, please do not hesitate to contact the instructor immediately. This can manifest in various forms, so inform the instructor of any sudden changes you experience regarding the class (see Communication Policy).

Resolving Technical Issues:

Feel free to share any technical issues in the dedicated FAQs discussion board on Canvas. For more complex technical issues, please visit the helpdesk website or call *352-392-4357.*

Course Evaluation

I'm personally committed to improving your learning experience. I, therefore, value and appreciate all forms of constructive feedback (positive and negative) at ANY time during the semester. Help me help you! Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Health and Rest:

Your academic success relies on your combined physical, mental, and emotional health. Take care of your health by dedicating at least (bare minimum) 1 hour per week to exercise and 6-8 hours per day to sleep. Please speak to the instructor if you feel drained or exhausted or reach out to the many resources available on campus (see Resources section).

UF Student Success:

For improving study skills to connecting with a peer tutor, peer mentor, success coach, academic advisor, and wellness resources, go to *http://studentsuccess.ufl.edu*

To support consistent and accessible communication of university-wide student resources, please follow this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu