

# Biomedical Instrumentation

BME4503 Section 01AF  
**Class Periods:** M, W, F | Period 2 (8:30AM – 9:20AM)  
**Location:** CSE E121  
**Academic Term:** Fall 2021

## **Instructor:**

Dr. Aysegul Gunduz | [agunduz@ufl.edu](mailto:agunduz@ufl.edu) | Please send emails through Canvas for fastest response.  
Student Hours (100% Online): Tuesdays and Thursdays 03:00-3:50PM <https://ufl.zoom.us/j/9429475359>

## **Supervised Teaching Student:**

Carlos Cruz | [cruzcarlos@ufl.edu](mailto:cruzcarlos@ufl.edu)  
Student Hours: TBD

## **Course Description**

3 credit course – Covers engineering and medical bases of application, measurement and processing of signals to and from living systems. Biomedical transducers for measurements of movement, biopotentials, pressure, flow, concentration and temperature are discussed.

## **Course Pre-Requisites / Co-Requisites**

MAC 2313, MAP 2302, PHY 2049, and EEL 3003 with minimum grades of C. Pre-req waiver requests need to be sent to Associate Chair of Undergraduate Studies, Dr. Lee Murfee ([WMurfee@bme.ufl.edu](mailto:WMurfee@bme.ufl.edu)).

## **Course Goal:**

This course will introduce the student to the bases of biomedical instrumentation and the acquisition of physiological signals. Students will gain a fundamental understanding of amplifiers and the various roles they play in all biomedical measurement devices.

## **Learning Objectives:**

Upon completion of the course, students are expected to:

- Identify the design blocks of a biomedical instrument/measuring device
- Analyze the functionality and performance of the used amplifier
- Characterize sensors
- Describe instrumentation regulation and safety considerations

**Materials and Supply Fees:** None

## **Relation to Program Outcomes (ABET):**

ABET Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High - Reinforced
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	

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, environmental, 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	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High - Introduced
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

### **Required Textbooks and Software**

- Webster, John G. Medical Instrumentation: Application and Design, 4<sup>th</sup> Edition, John Wiley & Sons.

### **Recommended Material**

Resources and supplemental reading will be provided by the instructor on Canvas (Files/Resources).

### **Course Schedule**

<b>Week#</b>	<b>Topic</b>
<b>Module 1</b>	
1	Basics of medical instrumentation & circuits primer (Ch.1)
2	Operational amplifiers I – basic configurations (Ch.3) Buffer, Inverting amp, Summing amp
3	Operational amplifiers I – basic configurations (Ch.3) Summing amp, Non-inverting amp
4	Operational amplifiers II – Differential amp (Ch.3)
5	Frequency Representations, Passive filters (Ch.3)
6	Active filters (Ch.3)
<b>Module 2</b>	
7-8	Basic sensors (Ch. 2)
9	Biopotential electrodes (Ch.5)
10-11	EKG & the cardiac vector (Ch.6)
<b>Module 3</b>	
11	Instrumentation amplifier (Ch.3)
12	Common mode rejection ratio and gain (Ch.6)
12-13	Interference mitigation I (Ch.6)
14	Safety codes (Ch. 14)



### **Attendance Policy:**

Attendance: Attendance of all lectures is mandatory and the responsibility of the student. According to University policy, students must attend 75% of the lectures to qualify for a passing grade.

Absence: Excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation (<https://www.eng.ufl.edu/wp-content/uploads/sites/5/2014/06/UF-COLLEGE-OF-ENGINEERING-EXCUSED-ABSENCE-REQUEST.pdf>).

Students are responsible to make 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 (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

Punctuality: Students are expected to show up on time for class. Classes will start on time.

### **Discussions:**

*Canvas discussions are highly encouraged for class material, and assignments. I will create discussion threads for every question I receive so that everyone benefits. These discussions also point out topics that might need a revisit (further examples) in class.*

### **Class expectations:**

Class format: Class will follow a classic lecture format using a tablet to replace the board and occasionally PowerPoint slides. Class notes will be provided after each lecture.

### **Make-up Policy:**

Exams: Makeup is allowed for only **one** exam and **under the following conditions:** 1) The student has informed the instructor of the absence at least 24hrs before the exam. 2) the student has provided adequate documentation for the excused absence (see [Absence section](#)). 3) the make-up exam must be conducted within one week of the original exam date.

### **Communication Policy:**

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

### **Class Material:**

Lectures: Lecture notes will be uploaded to Canvas after the lecture.

Homework: Homework will be assigned on Canvas and are always due midnight. Get an early start on your homework to avoid late submission. Late Homework, within 24 hours of the deadline, will be allowed 80% of the maximum grade. Homework received 24 hours past the deadline will not receive a grade.

### **Evaluation of Grades:**

Assignments and exams are educational tools to 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.

Assignment	% of Final Grade	Objective
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Homework Sets - Canvas submission	35.3%	Practice newly introduced concepts. Solve problems that reinforcement the understanding of the theory Solve problems that extend the taught concepts
Attendance & Participation (A&P) – Canvas submission	20%	Monitoring of class attendance & engagement
Exam I (Module 1)	14.9%	Assess student comprehension of the theory and concepts introduced in module 1
Exam II (Module 2)	14.9%	Assess student comprehension of the theory and concepts introduced in module 2
Exam III (Module 3)	14.9%	Assess student comprehension of the theory and concepts introduced in module 3
Total	100%	Overall class performance

### **Grading Policy**

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
%	≥95	94-90	89-87	86-83	82-80	79-77	76-73	72-70	69-67	66-63	62-60	< 60

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

### **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/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation.
2. Email [agunduz@bme.ufl.edu](mailto:agunduz@bme.ufl.edu) your accommodation letter, along with any additional information and set up an appointment to discuss your needs with the instructor.

**\*\*\* 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).

### **Course Evaluation**

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.ua.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.ua.ufl.edu/public-results/>.

### **In-Class Recording**

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Online Course Recording***

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are

agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

### ***Campus Resources:***

#### Health and Wellness

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](mailto:title-ix@ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

##### **COVID-19**

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email [covid@shcc.ufl.edu](mailto:covid@shcc.ufl.edu)) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

#### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.