

# **BIOMEDICAL INSTRUMENTATION**

BME 5500 Section 3A21

***Class Periods:*** MWF Period 7 (1:55 – 2:45 PM)

***Location:*** NEB 202

***Academic Term:*** Fall 2019

## ***Instructor:***

Aysegul Gunduz

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BMS J283, 3-6877

Office Hours: W 4:00-5:00 PM

## ***Supervised Teaching Student:***

Bryan Gatto

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Office Hours: TBA

## ***Course Description***

3 Credits.

Engineering and medical aspects of measuring and processing signals from living systems. Discusses biomedical transducers for measuring movement, biopotentials, pressure, flow, concentrations, and temperature; and treatment devices like ventilators and infusion pumps. Whenever possible, devices actually used in clinical practice are used in class.

## ***Course Pre-Requisites***

Basic knowledge of physics and calculus, consent of instructor.

## ***Course Objectives***

Upon completion of the course, students will gain understanding of:

- Sensor principles, rationales, and designs
- Design principles as they apply to measurements on the human body
- Instrumentation regulation and safety considerations

## ***Required Textbooks and Software***

- Webster, John G. Medical Instrumentation: Application And Design, 4<sup>th</sup> Edition, John Wiley & Sons.
- Arduino Software (Open Source)

## Course Schedule

Week	Reading	Topic
1	Basic concepts of medical instrumentation (Ch. 1)	Terminology and objectives, operational amplifiers
2	Amplifiers & signal processing (Ch. 3)	(non)inverting amp, follower circuit, differential amp, summing amp, rectifiers
3	Amplifiers & signal processing (Ch. 3)	instrumentation amp, comparators, integrator, differentiator
4	Basic sensors and principles (Ch. 2)	Thermistors, thermocouples, strain gauges, resistive sensors
5	Amplifiers & signal processing (Ch. 3)	Intro to spectral analysis, filters (lowpass, highpass)
6	Amplifiers & signal processing (Ch. 3)	Filters (bandpass, bandstop)
MIDTERM I		
7	The origins biopotentials (Ch. 4)	EKG, EOG, EMG, ENG, EEG
8	Biopotential electrodes (Ch. 5)	(Non)Polarizable electrodes, electrode circuit models
10	Biopotential amplifiers (Ch. 6)	EKG amplifiers, differential gain, general interference
10	Biopotential amplifiers (Ch. 6)	Common-mode rejection ratio, common-mode gain
11	Biopotential amplifiers (Ch. 6)	Interference mitigating circuits/designs/approaches
MIDTERM II		
12	Blood pressure, flow, volume and sound; and their measurement (Ch. 7/8)	Pulse ox, ultrasound, stethoscope design, physiological signals, PPD
13	Electrical safety (Ch. 14)	Safety codes and standards
FINAL PROJECT		

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Attendance is mandatory but not monitored. Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. Class notes will not be provided to unexcused absent students. Priority will be given to students with good attendance history at office hours. Computers, tablets, and cell phones have to be put away during class.

10 points will be taken off from an assignment grade for every day the submission is late.

There will be only be one make-up for missed midterms. If you miss two midterms, you will receive a zero for one of the exams.

## Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets	Weighed based on number of questions	25%
Midterm Exam I	100	30%
Midterm Exam II	100	30%
Final Project	100	15%

## Grading Policy

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
≥92	90-91	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	< 60

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

## Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

## 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.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/>.

## 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 Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. 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
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.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>

### ***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:** <http://www.counseling.ufl.edu/cwc>, 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](#), 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/>.

#### *Academic Resources*

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

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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