

# BIOSIGNALS AND SYSTEMS

BME 3508 Section 034G

**Class Periods:** MWF Period 8 (3:00 – 3:50 PM)

**Location:** BLK 0315

**Academic Term:** Fall 2016

## **Instructor:**

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BMS J283, 3-6877

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

## **Course Description**

3 Credits. Basic theory and techniques of biosignals and systems. Topics include sampling, noise in biological signals, signal averaging of noisy biological signals, Fourier analysis and filtering.

## **Course Pre-Requisites**

MAC 2313 with minimum grade of C.

## **Course Objectives**

Upon completion of the course, students should be able to:

- Understand how signals arise in the body, and explain the physiological function of these signals at a systems level. [a,k]
- Quantify the frequency content of bioelectrical signals using Fourier and Z transforms, and separate frequencies associated with physiological function from those associated with noise. [a,k]
- Determine and apply the appropriate methods and techniques to study transient and steady-state responses after determining the nature of the signals and systems. [a,k]
- Design appropriate filters for biosignals, and determine their outputs. [a,c,k]
- Determine the conditions for and study the stability of systems and convergence of signals. [a,k]

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

The table below is an example. Actual outcomes will vary by program. Below is applicable only to MSE.

Outcome	Coverage*
a. Apply knowledge	High
B1. Conduct experiments	
B2. Statistical design of experiments	
c. Design	Medium
d. Function on teams	
e. Solve programs	
f. Professional and ethical responsibility	
g. Communicate	
H1. Economic impact	
H2. Global, societal, and environmental impact	
i. Lifelong learning	
j. Contemporary issues	
k. Techniques, skills, and tools for degree program	High

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

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

- MATLAB, MathWorks, Cambridge, MA

### ***Recommended Materials***

- Signals and Systems in Biomedical Engineering, Suresh R. Devasahayam, E-book, available at UF Libraries
- Biomedical Signals and Systems, Joseph H. Tranquillo, E-book, available at UF Libraries
- Signals and Systems Analysis in Biomedical Engineering, Robert B. Northrop, E-book, available at UF Libraries
- Signals and Systems for Bioengineers, John Semmlow, 2<sup>nd</sup> Edition, Elsevier

### ***Course Schedule***

Week 1:	Linear Algebra
Week 2:	Signals, Measurements, Properties of Signals, Signal Comparison
Week 3:	Linear Systems, Convolution
Week 4:	The Impulse Response
Week 5:	Sampling, Aliasing and Quantization
Week 6:	MIDTERM I -The Fourier Transform
Week 7:	The Fourier Transform
Week 8:	Frequency Response
Week 9:	Spectral Filtering
Week 10:	Spatial Filtering
Week 11:	MIDTERM II - Laplace Transform
Week 12:	Z-Transform
Week 13:	Causality and Stability
Week 14:	Feedback Systems and Control
Week 15:	Review Examples

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

Attendance is mandatory but not monitored. Class notes will not be provided to 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. 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. There will be no make-up for the final exam.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets	100 each	25%
Midterm Exam I	100	20%
Midterm Exam II	100	20%
Final Exam	100	35%

### ***Grading Policy***

Course grades will be curved.

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

### ***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 feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

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

#### ***Health and Wellness***

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

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**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 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>.