

Biomedical Signals & Systems

BME3508 Section 24285
Class Periods: M, W, F | Period 5 (11:45 AM - 12:35 PM)
Location: NZH 0112
Academic Term: Spring 2020

Instructor:

Dr. May Mansy | mmansy@bme.ufl.edu | 352-273-5305
Student Hours: ****Survey results**** in BMS-JG289

Teaching Assistant:

Amanda Studnicki | astudnicki@ufl.edu |

Course Description

3 credit undergraduate course – This course introduces the basic theory and concepts of signals and systems from a biomedical engineering perspective. The characterization and analysis of man-made as well as random biological signals, in the time and frequency domains, is discussed and implemented using MATLAB.

Course Pre-Requisites / Co-Requisites

Pre-Requisites: MAC2313 with minimum grade of C.

Course Goal:

This course will introduce the student to the major concepts and methods for the characterization and analysis of deterministic as well as random signals in biological systems. Students will acquire tools and develop a mindset that enables them to apply signals & systems' concepts to various biomedical applications, on the microscopic and macroscopic levels.

Learning Objectives:

Students are expected to:

1. Recognize and identify components, parameters, and variables of biological systems.
2. Describe biological signals using correct terminology.
3. Characterize biological systems using correct terminology.
4. Explain and predict the functionality and performance of a biological system for a given signal.
5. Apply basic methods for the appraisal and analysis of biological signals using MATLAB.

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	Medium - Introduced

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	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks and Software

- Signal Processing for Neuroscientists by Wim van Drongelen, Academic Press, 2011.
- MATLAB with Simulink – student edition

Recommended Material

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

Course Schedule

Week#	Week of	Topic
Module 1		
1	01/06	Introduction to biological signals & systems
2	01/13	Time-domain properties
3	01/20	Time-domain operations
Module 2		
4	01/27	Introduction to the frequency domain
5	02/03	Fourier series
6	02/10	Fourier transform
7	02/17	Power Spectral Density (PSDs) and Spectrograms
8	02/24	Introduction to noise
9	03/02	** SPRING BREAK **
Module 3		
10	03/09	Continuous systems & frequency response
11	03/16	Analog filters
12	03/23	Discrete systems & sampling theorem
13	03/30	Digital systems & filters
Module 4		
14	04/06	Introduction to random variables and stochastic processes
15	04/13	Similarity measures
16	04/20	*Overflow* - Reading days
17	04/27	Final Project

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. 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 arrive on time for class. Late arrivals (beyond 10 minutes) will affect the attendance grade. Classes will start and be dismissed on time.

Class expectations:

Class format: Class will follow a classic lecture format using PowerPoint slides and occasionally the board.

In-class attitude: Class will be very interactive and rely 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](#)).

Participation: Anonymous pop-up quizzes will be conducted via Canvas to encourage participation and engagement in discussions. These in-lecture quizzes are used to monitor attendance and count towards the participation & attendance grade.

Electronics devices: Usage of electronic devices should be limited to take digital notes and to respond to the in-lecture quizzes only. Avoid distractions by social media, texts and/or talking to your neighbor.

Food/Drinks: Class runs during lunchtime. Make sure to have an early lunch or a quick snack before you arrive. Only beverages will be allowed during class.

Make-up Policy:

In-lecture quizzes: No make-up allowed.

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 (pdfs) will be uploaded to Canvas by the instructor before the class meeting. Students are strongly encouraged to read the notes before arriving to class and should take their own notes during the lecture to complement the pdf. Be reminded that the class notes are meant to illustrate complex concepts and thus may not be fully comprehensive. As such, lecture notes do not substitute the supplemental readings. Students are responsible to cover lecture notes and supplemental reading material.

Supplemental reading material: Supplemental material will be provided by the instructor and posted to Canvas (Files/Resources). All material posted to Canvas is exam and homework relevant unless otherwise noted by the instructor.

Homework: Homework will be assigned on Canvas and are always due at 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. Homework organization and tidiness counts towards the final grade. Submission integrity (correct file, extension, and format) is the responsibility of the student. Always view your submission after you submit!

Evaluation of Grades:

“You are not defined by your grade, but by your effort and morals” ~Dr. Mansy

Assignments 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. Evaluation is designed to allow for frequent low-stake assignments rather than few high-stake assignments to reduce pre-exam anxiety and stressful exam hours.

Assignment	% of Final Grade	Objective
Attendance & Participation (A&P) - Canvas submission	20%	Monitoring of class attendance & engagement Real-time evaluation of the apprehensions/comprehension of the material
Homework Sets - Canvas submission	35%	Practice newly introduced concepts. Implement new concepts in MATLAB. Solve problems that reinforcement the understanding of the theory Solve problems that extend the taught concepts
Test I (Module 1)	10%	Assess student comprehension of the theory and concepts introduced in module 1
Test II (Module 2)	10%	Assess student comprehension of the theory and concepts introduced in module 2
Test III (Module 3)	10%	Assess student comprehension of the theory and concepts introduced in module 3
Final Project	15%	Assess student comprehension of the theory and concepts introduced in modules 1-3
Total	100%	Overall class performance

Grading Policy

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
%	≥95	90-94	85-89	80-84	75-79	70-74	65-69	60-64	55-59	50-54	45-49	< 45

Percent grades will always be rounded to the next point (92.23 will become 93%). More information on UF grading policy may be found at <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Class Ethics:

- Collaboration or teamwork in Homework assignments is allowed and encouraged but each student must make individual submission of their own work.

- Plagiarism, the act of verbatim copying of text, figures and/or images (essentially anything) from the web without proper citation or paraphrasing is strictly prohibited. Turnitin will be enabled randomly and students will be notified of any detected plagiarism.
- Team-work and discussions in in-lecture quizzes are strictly prohibited.
- Remote attempts of in-lecture quizzes are also strictly prohibited. You can take in-lecture quizzes *only* if you are attending the lecture.

Any violations of the above, or attempts thereof, will be immediately reported to the Dean of Students Office for Student Conduct.

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).

Course Evaluation

Course evaluations are mandatory. 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.a.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.a.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 (implicit or explicit), 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
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, 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>

Health and Rest:

Your academic success relies on your 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 [next section](#)).

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 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

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. <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.

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