2023

BIOM 3010: Medical Measurements (Syllabus)

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University of Memphis

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BIOM 3010: Medical Measurements

Course Information

4 credit hours: 2 hours lecture and 2 hours lab per week

Class meeting: M,W 12:40a - 2:05p  ET238
Lab meeting: Th 2:40p - 4:35p  ET301

Instructor
• Carl Herickhoff, PhD, ET 321E; Email: Carl.Herickhoff@memphis.edu
  o Office Hours: by appointment (I’m happy to meet & help; email me)

Teaching Assistant
• Ezzuddin "Ezz" Abuhussein; Email: bhssein2@memphis.edu

Course Description
This course provides a comprehensive introductory to circuit analysis, signal processing, and instrumentation to condition signals for biomedical applications. The course covers the physical principles which govern the measurement of a biological variable using sensors and transducers and describes the operation of common biomedical instrumentation. The course provides a framework for students to understand, investigate, and further develop instrumentation for medical applications.

Course Goals
After completion of the course, students should be able to:
• Discuss the physical principles which govern the measurement of a biological variable
• Discuss principles of instrumentation in biomedical applications
• Construct circuits to acquire/process biomedical signals and perform signal processing to extract physiological information
• Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Prerequisites and Corequisites
• BIOM1720, EECE 2201/2203 or EECE 2281/2283, PHYS 2120
Course Topics
The following is the sequence of course topics. Note that core modules for lecture are followed by relevant laboratory topics. Students should complete lecture modules prior to moving to laboratory modules or the next module in the sequence.

Lecture/Lab
- Review of Circuits/Series, Parallel, and Combination Circuits
- Biosignals and Noise/DC, AC, and RLC circuits
- Wheatstone Bridge/Wheatstone Bridge
- Operational Amplifiers/Op-Amp basic operation and properties
- Active Filters/Op-Amp Advanced operations and Filters
- Electrodes, Sensors & Transducers/Measurements with transducers & sensors
- Electrocardiogram/Acquiring ECG signals
- Electroencephalogram and Electromyogram/Acquiring EMG signals
- Medical Imaging/Image processing

Important Announcements due to COVID

- **COVID-19 Safety Protocols - Masks and Social Distancing**
  The UofM follows the latest national (CDC), state and local guidelines and directives for our campus; the latest guidelines can be found at: [https://www.memphis.edu/coronavirusupdates/guidelines/](https://www.memphis.edu/coronavirusupdates/guidelines/). Major points are: Masks are strongly recommended to be worn by all persons while indoors and in places where maintaining appropriate social distancing is not possible; All students, faculty and staff are strongly encouraged to receive the COVID-19 vaccine; Do not come to campus if you are experiencing symptoms, are in isolation or quarantine due to positive test results or exposure, pending test results, or have reason to believe you have come in contact with the virus; Daily symptom monitoring and self-reporting of positive test results are required.

- **Notification Requirements & Student Health**
  Students who test positive for COVID-19 or come in close contact with a positive individual must email Dr. Herickhoff and the Dean of Students (deanofstudents@memphis.edu) so the student can be guided through University protocols and be provided any available resources. Students may contact Student Health Services at studenthealth@memphis.edu or 901.443.1397 or 901.443.6438 with questions or concerns about coronavirus symptoms.
Textbooks, Supplementary Materials, Hardware and Software Requirements

Required Textbooks/Resources


- MATLAB Training: https://matlabacademy.mathworks.com/
- Use Matlab LiveScript (freely accessible via UM account) for writing codes and submitting the solutions.

Hardware and Software Requirements

The minimum requirements can be found at: https://www.memphis.edu/uofmglobal/services/technology/requirements.php

Assessment and Grading

Testing Procedures

- Homeworks, assignments and projects should be submitted to appropriate dropbox, noting deadlines will not be extended.
- In-class quizzes involving solving problems by hand and/or Matlab and uploading to Canvas dropbox.
- Exams may be given closed-book or open-book; students should be prepared.
- Communication between students during the quizzes/exams is not allowed.
**Grading Procedure**
Homeworks, quizzes, exams and projects will be scored and published on Canvas; components of each student’s final score will be weighted:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>50%</td>
</tr>
<tr>
<td>Attendance, Participation, Hmwk/Notebook, Behav’s</td>
<td>15%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm Exams</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
<tr>
<td>Laboratory</td>
<td>50%</td>
</tr>
<tr>
<td>Attendance, Behav’s</td>
<td>20%</td>
</tr>
<tr>
<td>Lab Reports</td>
<td>50%</td>
</tr>
<tr>
<td>Lab Exam/Project</td>
<td>30%</td>
</tr>
</tbody>
</table>

*Honors students will be graded on a separate rubric that requires significantly advanced understanding as demonstrated in the assigned homework, quizzes, mid-term & final exams and project reports.  
*Note on Behaviors: students will be generally assessed by the instructor and TA (and to some degree, their teammates and fellow students in the course) based on the following elements:

- **Active Engagement** (contribution in class & with team—assessment aided via CATME) and **Curiosity** (inquiring/seeking/exploring what’s not yet understood)
- **Diligence** (consistent, thorough, complete in one’s preparation & execution) and **Connections** (integrate info from multiple sources, assess & manage risk)
- **Creating Value** (identify opportunities, persist through & learn from failure) and **Doing YOUR Best** (striving for excellence, not just doing the bare minimum)

**Grading Scale**
- 91-100---A
- 81-90---B
- 71-80---C
- 61-70---D

**Class Participation**
Students must participate in all interactive aspects of the course. Students must check the course content and updates on Canvas frequently for announcements. Students must actively participate in threaded discussion events.
Projects:
Students will be assigned into teams of 4-5 students/each; each team must develop and then test a relevant hypothesis involving biosignals by building a prototype instrument (sensor(s) & circuitry) and designing and conducting an experiment to record, process, analyze, and interpret quantitative biosignal data. Initial team project proposals (~1/2 page) must be submitted by October 5, and final reports & notebooks are due December 6—when each team will give a 10-min oral presentation and lab demonstration of their project.

Punctuality
Students are expected to read announcements and communications from the professor to make progress through the course and turn in assignments in a timely manner.

Course Ground Rules
1. Students must use the assigned university e-mail address rather than a personal e-mail address.
2. Students are expected to learn how to navigate Canvas, and keep abreast of course announcements.
3. Students are responsible for all material, whether covered in class or as part of an assignment.
4. No late assignments (homework, reports) will be accepted. Without prior documentation approved and permission from the instructor, late assignments will be assigned a score of zero.
5. Except when collaboration and teamwork is specifically encouraged or required, any work submitted for a grade must be your own original work. Working together on homework is certainly acceptable and encourage, but each person must work through the problem individually. Do not simply copy someone else’s solution. Do not electronically share your assignment files with classmates.
6. You are expected to participate actively in discussion.
7. Students are expected to communicate with other students on teams for laboratory assignments
8. Absences from exams require prior documentation and approval from the instructor. Student is responsible for scheduling makeup exams.
9. You are responsible for determining the availability of computing resources used in the class and for scheduling work accordingly.
10. Students must always observe course netiquette.
11. You must fully comply with all university guidelines and applicable laws regarding the use of computing facilities and software that may be provided for this course.

12. Students should address technical problems immediately.

13. Academic dishonesty of any form will not be tolerated. See the “Code of Student Rights & Responsibilities” for further details. 
   https://www.memphis.edu/osa/pdfs/csrr.pdf

14. Policies may be revised or augmented as required during the term.

Guidelines for Communication

Email
- Use standard fonts; always include a subject line.
- Remember without facial expressions some comments may be taken the wrong way. Be careful in wording your emails. Use of emoticons might be helpful in some cases.
- Do not send large attachments without permission.
- The first student to email the instructor to set up an office hour by appointment will give a one-point bump in their class participation score for the term.
- Special formatting (centering, audio messages, tables, html) should be avoided unless necessary to complete an assignment.
- Respect the privacy of other class members.

Discussion Groups
- Review the discussion threads thoroughly before entering the discussion.
- Maintain threads by using the "Reply" button rather starting a new topic.
- Do not make insulting or inflammatory statements to other members of the discussion group. Be respectful of others' ideas.
- Be patient and read the comments of other group members thoroughly before entering your remarks.
- Be cooperative with group leaders in completing assigned tasks.
- Be positive and constructive in group discussions.
- Respond in a thoughtful and timely manner.

Library, Tutoring, and Other Resources
- The myMemphis Portal system, eCampus Student tab provides access to University library.
- The tutoring link in the course navigation bar provides access to free online tutoring through UpSwing tutoring.
Plagiarism and Integrity
Plagiarism, cheating, and other forms of academic dishonesty are prohibited. Students guilty of academic misconduct, either directly or indirectly, through participation or assistance, are immediately responsible to notify the instructor of the class in addition to other possible disciplinary sanctions which may be imposed through the regular institutional disciplinary procedures. Expectations for academic integrity and student conduct are described in detail on the website of the Office of Student Accountability. Please read in particular, the section about "Academic Misconduct".

Turnitin.com
Written work may be submitted to Turnitin.com, or a similar electronic detection method, for an evaluation of the originality of your ideas and proper use and attribution of sources. As part of this process, you may be required to submit electronic as well as hard copies of your written work. By taking this course, you agree that all assignments may undergo this review process and that the assignment may be included as a source document in Turnitin.com’s restricted access database solely for the purpose of detecting plagiarism in such documents. Any assignment not submitted according to the procedures given by the instructor may be penalized or may not be accepted at all.

Students with Disabilities
Qualified students with disabilities will be provided reasonable and necessary academic accommodations if determined eligible by disability services staff at the University of Memphis. Prior to granting disability accommodations in this course, the instructor must receive written verification of a student's eligibility for specific accommodations from the disability services staff. It is the student's responsibility to initiate contact with Disability Resources for Students (DRS) and to follow the established procedures for having the accommodation notice sent to the instructor.

Sexual Misconduct and Domestic Violence Policy
This policy specifically addresses sexual misconduct which includes dating violence, domestic violence, sexual assault, and stalking. The policy establishes procedures for responding to Title IX-related allegations of sexual misconduct. Complaints can be reported to the Office for
Institutional Equity (OIE). You may contact OIE by phone at 901.678.2713 or by email at oie@memphis.edu. Complaints can be submitted online at File a Complaint. OIE’s office is located at 156 Administration Building.

Non-Discrimination and Anti-Harassment Policy
University policy prohibiting discrimination and harassment based on protected characteristics and classes. Complaints of discrimination and harassment can be reported to the Office for Institutional Equity (OIE). You may contact OIE by phone at 901.678.2713 or by email at oie@memphis.edu. The full text of the policy can be found at GE2030-Non-Discrimination and Antiharassment.

Technology Requirements
The following is a list of the minimum requirements to use our learning management system. Some courses will have more advanced requirements.

- Access to a reliable, high-speed Internet connection (DSL or Cable).
- Test your device to ensure it is compatible with our LMS (Learning Management System) using the System Check Wizard.
- Open PDF files using the free downloadable PDF software.
- Access Flash-based content with Adobe Flash Player (free).
- Use Microsoft Office for document creation (available for students via http://umapps.memphis.edu/)
- Play media content with Real Player (free), QuickTime (free), or Windows Media Player (free).

Technical Support
Call the Helpdesk: 901-678-8888
Online Helpdesk

Syllabus & Schedule Changes
The instructor reserves the right to make changes as necessary to this syllabus and schedule. If changes are made during the term of the course, the instructor will immediately notify students both by individual email communication and posting both notification and nature of change(s) on Canvas.