BIOM 3010: Medical Measurements (Syllabus)

Aaryani Sajja

University of Memphis

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BIOM 3010: Intro to Medical Measurements Syllabus

Course Information

Class Timings and Location
Lectures : M, W @ 11:00 a– 12:25p ; ES 326
Labs : W @ 2:40 – 4:30p ; ET 301

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 or system 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
At the end of the course, students will 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
• BIOM 1720
  o Introduction to biomedical engineering is a preparatory course for upper level courses
• BIOM 2810
  o Intro to Biomechanics/Mechanics of materials has preparatory information for physiological phenomenon measured in instrumentation
• EECE 2201 or EECE 2283/2281
  o Circuits I is a prerequisite because building and analyzing circuits are performed extensively throughout the course
• PHYS 2120/2121
  o Sci/Engr Phys II/Calc is a calculus based physics course that covers principles of electricity and magnetism that are used extensively throughout the course

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
• Electrodes, Sensors & Transducers/Measurements with transducers & sensors
• Wheatstone Bridge/Wheatstone Bridge
• Operational Amplifiers/Op-Amp basic operation and properties
• Active Filters/Op-Amp Advanced operations and Filters
• Electrocardiogram/Acquiring ECG signals
• Electroencephalogram and Electromyogram/Acquiring EMG signals
• Signal Analysis in Time and Frequency Domain/Matlab Exercises
• Medical Imaging/Image processing

Textbooks, Supplementary Materials, Hardware and Software Requirements

Required Textbooks

Circuits, Signals, and Systems for Bioengineers: A MATLAB-Based Introduction


Required Resources:

• Install MATLAB:
  - Mac: https://www.memphis.edu/umtech/solutions/docs/matlab/matlab_mac.pdf
• MATLAB Training Modules: https://matlabacademy.mathworks.com/
• Use Matlab LiveScript for writing codes and submitting the solutions.

Specific Course Requirements
Review of circuits is necessary. Knowledge of Microsoft word, Adobe pdf, and scientific writing are required to compose laboratory reports.

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
• Laboratory Reports, homeworks and assignments 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 e-courseware dropbox.
• Communication between students during the exams is not allowed.

**Grading Procedure**
Homeworks, quizzes, lab reports, exams and projects will be scored and published on Canvas.

**Grading Scale**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>91-100</td>
</tr>
<tr>
<td>B</td>
<td>81-90</td>
</tr>
<tr>
<td>C</td>
<td>71-80</td>
</tr>
<tr>
<td>D</td>
<td>61-70</td>
</tr>
</tbody>
</table>

Final grade will be determined by dividing assignments into categories with the following weight toward the final grade.

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>50%</td>
</tr>
<tr>
<td>Attendance</td>
<td>10%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Mid-terms</td>
<td>25%</td>
</tr>
<tr>
<td>Final</td>
<td>25%</td>
</tr>
<tr>
<td>Laboratory</td>
<td>50%</td>
</tr>
<tr>
<td>Attendance</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>

**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.

**Punctuality**
Students are expected to read announcements and communications from the professor in order 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 in 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. Late assignments will be assigned a score of zero, unless prior documentation and permission from the instructor has been approved.
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](https://www.memphis.edu/osa/pdfs/csrr.pdf)
14. Policies may be revised or augmented as required during the term.

Guidelines for Communication

Email
- Always include a subject line.
- Remember without facial expressions some comments may be taken the wrong way. Be careful in wording your emails.
- Use standard fonts.
- Do not send large attachments without permission.
- Special formatting such as centering, audio messages, tables, html, etc. should be avoided unless necessary to complete an assignment or other communication.
- Respect the privacy of other class members.

Discussion Groups
- Review the discussion threads thoroughly before entering the discussion.
- Try to 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.

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
Your 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 or be given other instructions to follow. 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.

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.

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.

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

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