BENG/ECE 499
Bioengineering Laboratory
Spring 2010

Class Time: Wednesdays, 9:30 am- 12:20 pm (additional section pending)
Location: 3905, Engineering Building, Fairfax Campus
Instructor: Joseph J. Pancrazio, PhD
Office location: 3800 Engineering Bldg
E-mail: jpancraz@gmu.edu
Telephone: 703-993-1605
Office Hours: Mon 3-5 pm, and by appointment.

Course Description: This is a one credit laboratory course designed to provide practical experience in the measurement and use of biological signals. Students will gain hands-on experience with bioinstrumentation and signal analysis techniques that are fundamental in Bioengineering. The main emphasis of the course will be on signals generated by electrically excitable tissues in the body – these tissues include the heart, brain, and skeletal muscles. Students will make use of a wireless physiologic monitor that allows bioelectrical signals to be recorded safely and for experimental subjects to move freely. Prerequisites: BIOL 213, BENG 401/402, or permission of instructor.

Course Objectives: After successfully completing this course, a student will be able to:

- Collect, analyze, and interpret common bioelectrical measurements
- Describe sources of signal artifacts that contaminate bioelectrical signal acquisition and complicate interpretation.
- Explain the origins of bioelectrical potentials.
- Apply statistical methods for characterization of bioelectrical signals and their variation.
- Design, perform, and analyze data from experiments using bioelectrical signals
- Prepare a laboratory report and present laboratory findings.
- Describe how bioelectrical signals can be used in diagnosis and control of assistive devices.

Course Organization: Students will work in groups of two or three to undertake each of the laboratory exercises. For several of the laboratory exercises, one student will serve as the bioelectrical signal source where the partner will be responsible for the data acquisition. The role of experimental subject should be shared equally.

Schedule:

<table>
<thead>
<tr>
<th>Date</th>
<th>Lab #</th>
<th>Topic</th>
<th>Format</th>
<th>Notes:</th>
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<tbody>
<tr>
<td>20-Jan</td>
<td>1</td>
<td>Course Organization &amp; Policies</td>
<td>lecture</td>
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<tr>
<td>27-Jan</td>
<td>1</td>
<td>Biopotentials &amp; Data Acquisition Basics</td>
<td>lecture &amp; laboratory</td>
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<tr>
<td>3-Feb</td>
<td>2</td>
<td>Statistics</td>
<td>lecture &amp; laboratory</td>
<td>Lab #1 report due</td>
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<td>10-Feb</td>
<td>3</td>
<td>Electrocardiography</td>
<td>lecture &amp; laboratory</td>
<td>Lab #2 report due</td>
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<td>17-Feb</td>
<td>4</td>
<td>Electroencephalography</td>
<td>lecture &amp; laboratory</td>
<td>Lab #3 report due</td>
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<td>24-Feb</td>
<td>5</td>
<td>Electromyography I</td>
<td>lecture &amp; laboratory</td>
<td>Lab #4 report due</td>
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<td>3-Mar</td>
<td></td>
<td>Mid-term/Lab Make-Up Time</td>
<td>exam/laboratory</td>
<td>Lab #5 report due, lab</td>
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<td>Date</td>
<td>Event</td>
<td>Location</td>
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<td>10-Mar</td>
<td>Spring Break</td>
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<td>notebook check</td>
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<td>17-Mar</td>
<td>Electromyography II laboratory</td>
<td>laboratory</td>
<td>lab notebooks returned</td>
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<td>24-Mar</td>
<td>Accelerometry laboratory</td>
<td>laboratory</td>
<td>Lab #6 report due</td>
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<td>31-Mar</td>
<td>Electro-ocularography laboratory</td>
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<td>Lab #7 report due</td>
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<tr>
<td>7-Apr</td>
<td>Motor Control Laboratory laboratory</td>
<td>laboratory</td>
<td>Lab #8 report due</td>
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<td>14-Apr</td>
<td>Alertness Detection Laboratory laboratory</td>
<td>laboratory</td>
<td>Lab #9 report due</td>
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<td>21-Apr</td>
<td>Independent Laboratory Work laboratory</td>
<td>laboratory</td>
<td>Lab #10 report due</td>
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<tr>
<td>28-Apr</td>
<td>Independent Laboratory Presentation</td>
<td>laboratory</td>
<td>Presentation in lieu of lab #11 report</td>
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<tr>
<td>5-May</td>
<td>Final Exam/Lab Make-Up Time exam/laboratory</td>
<td>lab notebook check</td>
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Laboratory Notebooks and Reports: While the work will be performed together, each student will be required to maintain a separate laboratory notebook (see appendix A for detail) and to submit a laboratory report for each laboratory exercise. The laboratory reports should include the following:

- Title of the laboratory exercise
- Your name, your lab partner’s name, date
- Experiment objectives (2-3 lines)
- Screen/Data captures with descriptive captions – what is being shown?
- Answers to selected review questions at the end of the laboratory exercise

Laboratory reports should be submitted in hardcopy format no later than 1 week after the laboratory exercise.

Textbook: No textbook is required for this course. Laboratory exercises will be available as PDFs on Blackboard or made available on the computers in the 3905 for download. Students are expected to read the laboratory material in preparation for conducting the laboratory exercise.

Grading Policy:
Laboratory Notebook: 20%
Laboratory Reports: 40%
Mid-term Exam: 10%
Final Exam: 20%
Class Participation & Independent Lab Presentation: 10%
Appendix A: Laboratory Notebook

For this course, you need a bound laboratory notebook, quadrille-ruled, with numbered pages similar to the one shown below. It is not necessary for there to be tear-out duplicate pages for making copies. Laboratory notebooks similar to the one shown on the right are available at the Johnson Center Student Bookstore.

Expectations:
- Ball point pen for all entries.
- Put your name, a telephone number, e-mail address, and course number on the outside front cover of the record. Put that same information on the first page inside, or on the inside front cover. If your notebook does not include a pre-labeled table of contents section, then reserve the first several pages for a table of contents by labeling the top of each page as Table of Contents and numbering each page.
- Entries in the laboratory notebook should include:
  - The title of the laboratory exercise
  - Date
  - Name of your laboratory partner
  - A brief statement of the experiment objectives (2-3 lines)
  - Results and Discussion Section:
    - Device recording parameters - data acquisition rates, filter settings, etc.
    - List of data files recorded during the laboratory exercise
    - General observations on the data, brief summary – what worked well and what did?
    - Ideas for future experiments – based on what you learned, what else could you do?
  - Update the Table of Contents with page numbers associated with the particular laboratory exercise.
- The notebook may also include lecture notes.