BENG 381
Circuits and Electronics Lab
Fall 2014

Class Time:  SECTION 1 (201): Tuesday, 1:30-4:15 pm  
SECTION 2 (202): Thursday, 1:30-4:15 pm  
Location:  ENGR 3505, 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: Monday 9:45-11:45 am, and by appointment

Graduate Teaching Assistant for Sections 1 & 2:  
Ms. Susheela Meyyappan  
E-mail:  smeyyapp@masonlive.gmu.edu  
Office hours location:  ENGR 3505  
Office Hours: TBD

Course Description: This is a one credit course designed to provide practical laboratory-based experience in constructing and measuring basic electronic circuits. In addition to linear circuits, transistor and digital logic circuits will be introduced. Students build circuits and measure circuit functions and relate these results to those obtained from theoretical calculations and computer based simulations. Wherever possible, relevance to biological signal acquisition and analysis will be emphasized. Prerequisite: PHYS 261 or permission of instructor; Co-requisite: BENG 380

Course Objectives: After successfully completing this course, a student will be able to:  
- Collect and analyze measurements from electronics circuits  
- Compare measured results with theoretical predictions  
- Understand limitations of conventional electronics laboratory measurement equipment and electronics components.  
- Prepare a laboratory report.

Relationship to Bioengineering Program Outcomes: It is expected that this course will help students achieve the following outcomes:

a) an ability to apply knowledge of mathematics (including differential equations and statistics), science (including biology and physiology), and engineering to solve problems at the interface of engineering and the life sciences  
   - students will have acquired necessary knowledge, such as differential equations, statistics, physics, computational techniques, cellular biology and integrative physiology, that would allow them to address problems at the interface of engineering and the life sciences  
   - students can apply an appropriate combination of mathematical, scientific and engineering techniques to solve a problem at the interface of engineering and the life sciences  
   - students apply engineering judgment to evaluate answers
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability, and sustainability

- students understand design requirements and consider relevant constraints
- students use appropriate engineering and computational tools in their design
- students evaluate their design objectively

e) an ability to identify, formulate, and solve engineering problems, addressing issues associated with the interface of engineering and the life sciences.

- students can identify and formulate engineering problems that are at the interface of living and non-living systems
- students can use engineering approaches to solve problems in the life sciences

Course Organization: Students will work individually or in groups of two to undertake each of the laboratory exercises. Laboratory topics are coordinated with the lecture course BENG 380.

Schedule:

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<th>Section 2 (Thurs)</th>
<th>Lab #</th>
<th>Topic</th>
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<td>26-Aug</td>
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<td>Course Organization &amp; Policies</td>
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<tr>
<td>2-Sep</td>
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<td>Introduction to Electronics Laboratory</td>
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<td>9-Sep</td>
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<td>Ohm’s Law and Loading</td>
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<td>16-Sep</td>
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<td>Mesh Analysis</td>
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<td>23-Sep</td>
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<td>30-Sep</td>
<td>2-Oct</td>
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<td>Forced Sinusoid</td>
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<td>7-Oct</td>
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<td>Transient Response 1st Order Circuits</td>
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<td>21-Oct</td>
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<td>Introduction to Op-Amps</td>
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<td>Electrocardiography Laboratory</td>
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<td>Electrocardiography (continued)</td>
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<td>Bipolar Junction Transistors</td>
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<td>18-Nov</td>
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<td>25-Nov</td>
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<td>Digital Logic</td>
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<td>2-Dec</td>
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<td>*Reading Day – option Section 1 and 2 students to take Final Exam at time TBD</td>
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<td>8-Dec</td>
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<td>15</td>
<td>Section 2 Regularly Scheduled Final Exam Lab Practical: 1:30-4:15 pm</td>
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<tr>
<td>11-Dec</td>
<td>13-Dec</td>
<td>16</td>
<td>Section 1 Regularly Scheduled Final Exam Lab Practical: 1:30-4:15 pm</td>
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*Final Exams- Because the Final Exam is a laboratory practical, we will need to schedule an open 3 hr window for a subset of students. This will likely be during one of the Reading Days, either Dec 8 or Dec 9.
**Laboratory Reports:** No more than 2 people in a lab group, unless previously approved. A single laboratory report will be submitted and graded for each group. All group members are expected to contribute to the report. The laboratory reports should include the following:

- Course number (BENG 381), title of the laboratory exercise
- Your name, date laboratory performed, date of laboratory report submission
- Laboratory objectives (2-3 lines)
- Theory: predictions of circuit behavior based on theoretical considerations, as appropriate.
- Results: table and/or graph of results - label table columns or axes of each curve with units, oscilloscope display (sketch by hand is adequate, or digital image capture), and discuss briefly in a few sentences what was observed.
- Discussion: answer any questions posed in the laboratory exercise, interpret the results, compare theoretical and experimental results, as appropriate, and explain sources of error or variations (resolution of measurement devices). Percent deviation = (observed-actual)/actual *100%
- Contributions: brief paragraph on who wrote/prepared which sections of the report

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 and manuals will be available as PDFs on MyMason (Blackboard) or made available in the classroom. Students are expected to read the laboratory material in preparation for conducting the laboratory exercise.

**Hardware:** Each student is expected to purchase a lab kit from the Bioengineering “store”. Please see Ms. McGowan in the Bioengineering office during regular office hours.

**Grading Policy:** The primary metric for this course is laboratory reports. Students can help one another during data collection but each student must demonstrate he/she is capable of collecting data on his/her own. Copying of data or laboratory report text from another lab group is not permitted. A **hands-on final exam will test each individual student’s ability to work with the prototyping board, introduce signals, measure outputs, and present data.** While the laboratory session runs for nearly 3 hrs, it is important that each student arrive on time. There will often be introductory information provided at the beginning of class and it will not be repeated. Grades will be determined according to the following distribution:

Laboratory Reports: 60%
Final Exam: 30%
Timely Class Attendance Participation: 10%

**Mason Email Accounts:** Students must use their MasonLIVE email account to receive important University information, including messages related to this class. See [http://masonlive.gmu.edu](http://masonlive.gmu.edu) for more information.
Classroom Etiquette: No food or drinks should be consumed during the laboratory. Cell/smart phones must be put into silent mode and no texting is permitted in the laboratory during the exercise or especially during any lectures. If you have an emergency need to answer a call please quietly leave the room BEFORE answering the call.

Office of Disability Services: If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu