Course supervisor: James J. Carroll, 164 CAMP, x-7726, jcarroll@clarkson.edu, Hours: M,W 1:45-4:15pm. 
Course TA: Peter Johnson, 199 CAMP, x-4404, johnsopa@clarkson.edu, Hours: M,W 10am-noon, Th 1-2pm. 
Lecture period: Tuesday, 1:00-1:50 pm, 163 CAMP. 
Lab sections: Tuesday or Thursday 8am-noon, 195 CAMP. 
Software: LabVIEW 8.5.1 Student Edition 
see: http://www.academicsuperstore.com/products/National+Instruments/LabVIEW/899951 
Text: None. 
Notebook: Each student must purchase a bound, quad-ruled lab notebook, e.g., from the Scientific Notebook Company (Model: O64P) available from the Clarkson bookstore or http://www.snco.com/o64p.htm. This notebook will be used to record all experimental data taken and results observed during the course of the semester and will be periodically collected for grading purposes. All students must legibly write their names on the inside font cover of their lab notebooks. Unsigned lab notebooks will not be considered for grading purposes. 

Course Outline:

EE311: Electrical Engineering Laboratory II (WI) R-1, L-4, C-3. Prerequisites: EE 211 and EE 221.

This laboratory course provides students with a series of experiments based on material in required sophomore and junior level courses. The experiments are designed to emphasize model identification, validation and use. The course includes one or more design projects that include team oriented design, development, testing, and documentation components.

Tentative Schedule

<table>
<thead>
<tr>
<th>Week of</th>
<th>Lecture</th>
<th>Lab</th>
<th>Relationship to course learning objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/25</td>
<td>Timer circuits</td>
<td>None</td>
<td>3</td>
</tr>
<tr>
<td>9/1</td>
<td>Phase lock loops</td>
<td>Timer circuits</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>9/8</td>
<td>Salen-key filter design</td>
<td>Phase lock loops</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>9/15</td>
<td>MOSFET amplifiers</td>
<td>Salen-key filter design</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>9/22</td>
<td>Single-phase transformers</td>
<td>MOSFET amplifiers</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>9/29 (Fall brk.)</td>
<td>Break - no lecture</td>
<td>Make-up lab</td>
<td></td>
</tr>
<tr>
<td>10/6</td>
<td>DFT theory</td>
<td>Single-phase transformers</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>10/13</td>
<td>Intro. to LabVIEW</td>
<td>DFT project: harmonic components</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>10/20</td>
<td>Intro. to robotics</td>
<td>DFT project: aliasing, windowing, bit noise</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>10/27</td>
<td>Robotics project specifications</td>
<td>Robotics project</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>11/3</td>
<td>LabVIEW for robotics</td>
<td>Robotics project</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>11/10</td>
<td>LabVIEW for robotics</td>
<td>Robotics project</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>11/17</td>
<td>Engineering Ethics</td>
<td>Robotics project</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>11/24 (Thanks. brk.)</td>
<td>Inventions and Patents</td>
<td>Break - no lab</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>12/1 (Dead week)</td>
<td>None</td>
<td>Oral report/ project demonstrations</td>
<td>1,2,3,4</td>
</tr>
<tr>
<td>12/8 (Finals week)</td>
<td>None</td>
<td>Written reports due- noon Dec. 8.</td>
<td>2,3,4</td>
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</tbody>
</table>
Course Learning Objectives:

Students will:
1. Engage in a set of experiments that draw from a variety of topics across the discipline.
2. Gain experience in team-based design by participating in the design, implementation, testing, and demonstration of one or more open-ended design projects.
3. Develop an understanding of device modeling, model development, and model validation.
4. Refine their laboratory technique and ability to write technical laboratory reports.

Course content: Engineering Science 25%, Engineering Design, 75%

Relationship to course objectives:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Relationship to program outcomes</th>
<th>Program outcomes description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment- Timer circuits</td>
<td>1,2,3,5</td>
<td>1. Master essential topics in required courses.</td>
</tr>
<tr>
<td>Experiment- Phase lock loops</td>
<td>1,2,3,5</td>
<td>2. Use state of the art software/tools.</td>
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<tr>
<td>Experiment- Filter design</td>
<td>1,2,3,5</td>
<td>3. Develop teamwork and communication skills.</td>
</tr>
<tr>
<td>Experiment- Single phase transformer</td>
<td>1,3,5</td>
<td>4. Design engineering systems to meet desired specifications.</td>
</tr>
<tr>
<td>Experiment- MOSFET amplifiers</td>
<td>1,2,3,5</td>
<td>5. Close student/faculty interaction, extracurricular and community involvement.</td>
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<tr>
<td>Project- Sampling/DFT</td>
<td>1,2,3,4,5</td>
<td></td>
</tr>
<tr>
<td>Project- Robotics</td>
<td>1,2,3,4,5</td>
<td></td>
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Course Organization:

EE 311 is organized into three parts. The first section consists of a set of five stand-alone laboratory experiments. The second section consists of the development, testing, and demonstration of a virtual Fourier transform (DFT) instrument using LabVIEW. The third section involves solving a robotics challenge using LabVIEW.

The course grading will be as follows:
- Stand alone experiments: 50% total, 10% each (20% pre-lab, 80% report)
- Sampling/DFT project: 15% (20% pre-lab, 80% report)
- Robotics project: 25% (13% pre-lab, 54% written report, 33% oral report)
- Lab notebook: 10%

Experiment/project grades will be based on pre-lab reports, lab notebooks, lab reports, and laboratory performance. Bonus credit may be awarded for lecture attendance. Each lab team will typically consist of two or three partners. Lab partners will be randomly assigned for the first five lab experiments. The lab team assignments will be posted on the class web site. Students are responsible for contacting their assigned lab partners and creating a schedule for completing their assigned lab work. Students are free to choose their lab partners for the final two lab projects.

Stand-alone Experiments:

For each of the five stand-alone experiments, a pre-lab report will be due in the lab at 4pm on the Monday prior to the start of your assigned lab section, e.g., the Timer circuits pre-lab is due in 195 CAMP by 4pm on 9/1/08. This pre-lab report must be completed and approved by the TA (Peter Johnson) prior to performing the experiment. Graded pre-lab reports will be available by the beginning of your assigned lab period. The pre-lab report will consist of two sections: (1) answers to pre-lab questions and (2) a description of the lab procedures and expected results. It is expected that you will use information from the textbook, class lectures and website in addition to outside sources, such as the library or Internet, in order to complete the pre-lab assignments. The pre-lab reports may also include appropriate materials to streamline the lab work and to enable efficient writing of the lab report, e.g., figures, etc. See http://www.clarkson.edu/class/ee311/Grounding&EMI/ for a sample pre-lab report.

Once your pre-lab report has been approved, your lab team will complete an equipment requisition list and check out the required equipment from the instrument room. The lab procedure will be followed to complete the necessary work and all relevant data recorded in each student’s lab notebook. All lab-related calculations should be recorded in each student’s lab notebook as data is gathered and these calculations compared with expected results. Your lab notebooks should be signed and dated by the class instructor or TA prior to leaving the lab as verification of your participation in the lab.
Following the completion of your laboratory work, a final report must be prepared and submitted by the group, i.e., one report per lab group, in the lab by 4pm on the Monday following your lab. Your laboratory reports should consist of the following sections:

Overview
Introduction
Theory and expected results
Laboratory procedure, results, and commentary
Comparison of expected and actual results
Summary

In most cases, the report will be more readable when theory, procedure, and results sections are repeated for each major component of the experiment. See the class website for a sample lab report. Each lab reporting component, i.e., pre-lab and lab report, will have a principle author and secondary authors that are explicitly designated on the report cover. All lab team members will print and sign their names on the report cover to indicate their approval of the report contents. Lab reports submitted without signatures will not be considered for grading purposes.

Each lab experiment will be discussed in lecture before the lab is performed. Following the lecture, you will prepare a pre-lab report, based on lab handouts and the lecture. Additionally, a laboratory procedure section must be included which describes the work to be done and expected results. The procedure must include schematic diagrams and wiring and/or pin diagrams as appropriate. Handouts will be available on the class website, to aid in preparation of the report. It is acceptable to “cut and past” and/or scan diagrams from the handouts to aid in your report generation. A report consisting solely of a group of cut and past diagrams, however, is not acceptable.

Following the completion of a laboratory experiment, the lab team members will work together to prepare and submit a formal lab report. General report guidelines are contained in the EE211 lab manual and the GE Advance Courses Guide to Report Writing, which are posted on the class website. For example, all figures in your reports should be numbered and the references to these figures are required in the report body, e.g., “The differential amplifier circuit shown in Figure 2 was built and tested.”

Laboratory Preparation:

Laboratory work will be based on handouts discussed in the laboratory lectures and available from the class website. Adequate preparation is essential for the successful completion of the required work within the allotted time. An understanding of the theoretical basis for the work is also, of course, essential. This understanding will be obtained through the lab lectures, previous/current courses, and/or your class textbook and outside references. Your lab notebook and reports should contain sufficient detail for you to be able to refresh your memory on the details of the principals involved, or allow someone else in the class to reproduce your results. The laboratory procedure section should include any circuit diagrams, integrated circuit pin diagrams, and connection diagrams that are needed. The procedure section should also include steps to be taken in the construction and testing of any circuits involved, and a record of data collected. The lab handouts typically include a section labeled “PROCEDURE”. It is not suitable to simply repeat this information in your lab notebook and reports. For example, the handout might show a schematic diagram of a circuit to be tested. In your pre-lab, a similar schematic should be shown which includes the location and connection of voltmeters, oscilloscope channels, etc. In many cases it will be desirable to develop wiring diagrams showing the physical layout of circuits to the extent possible.

Laboratory Performance:

The laboratory procedures are to be conducted in a safe and professional manner. Each lab team member must neatly record all relevant lab setups, measurements, and calculations in their lab notebooks. During the first five experiments, all lab notebooks must be signed and dated by the instructor or a TA prior to students leaving lab for the day. Every effort should be made to complete as much work as possible during the assigned lab period, including data analysis and report preparation.

During the design projects, the course structure will move to an open lab arrangement where work is not necessarily confined to the assigned lab period. Your class section will have priority access to lab resources during its assigned lab period (you should take advantage of this whenever possible). During times when the lab is open, i.e., there is no scheduled lab section using the EE 311 benches, the benches will be available on a first come, first serve basis. During times when other lab classes are having scheduled labs, there may be no available lab space.
**Laboratory Documentation:**

The primary documentation for EE 311 are the pre-lab and post lab reports. As the course progresses make copies of your reports, as necessary, so that each student has a complete record of their reports in a three ring, or similar, binder. Each student must keep a lab notebook that is neat and up to date. The lab notebook must be available for your use and available for inspection by the instructor during any lab procedure. All lab notebooks will be collected and reviewed at the end of the semester along with the final project reports. All reports must include initial raw datasets taken from the lab notebook for the experiments involved. The written reports on your experiments and design projects will be joint reports with your lab partners. In most cases, these reports will have primary and secondary authors. Indicate which partner is the primary and secondary author on the cover page of your report. All team members must print and sign their names on the cover page of the report for the report to be considered for grading. Your signature is your way of showing that you have participated in generating the report and agree with its contents.

**Laboratory Equipment:**

The standard bench equipment forms the majority of the equipment you will be using in the course. In addition to this equipment, certain experiments will involve items signed out from the instrument room for the lab period. These items will be noted in the lab descriptions available on the class website. In some cases, lab equipment may be shared across lab sections or within a section.

During the design projects, a proto-board will be signed out to your team that you will keep for the remainder of the project work. This board and the components you are using are the responsibility of you and your lab partners. Lockers are available in lab for storing this equipment, but you will need to provide your own padlock. **Your work in the course will not be considered complete until these items have been returned to the instrument room.**

It is expected that you will not be “experts” on all aspects of all of the equipment you will be using. When this is the case, it is your responsibility to verify the details in question through exploration in the library, on the Internet, reading the device documentation (available through the instrument room) or discussion with your peers, the class TA or the class instructor.

**Laboratory Safety Manual:**

The laboratory safety manual is available on the class website. The manual contains safety and performance information for the course. All students are expected to be familiar with this manual and adhere to its guidelines.

**Academic Integrity (taken from the Clarkson Regulations):**

“Clarkson values personal integrity. Matriculation at Clarkson carries with it the obligation that a student will not claim as his or her own, the work of another, or any work that has not been honestly performed, will not take any examination by improper means, and will not aid and abet another in any dishonesty...Violations of the Code of Ethics are regarded as most serious offenses and render the offenders liable to severe disciplinary action. Alleged violations of the Code of Ethics are dealt with according to the section on the Academic Integrity Committee.”