Course Syllabus

ELCT 301 – Electronics Laboratory

Course Coordinator: Undergraduate Program Committee

Catalog Description: Design and implementation of analog and digital electronic circuits

Credit Hours 3

Prerequisite(s) by course ELCT 201; Pre or Coreq: ELCT 371

Prerequisite by topics Electronics, Use of Oscilloscopes, Circuits, Time and Frequency Domain Analysis of Linear Systems

Required Textbook

Other Materials
• Laboratory Notebook with permanently bound pages. Circuit prototyping (plug-in) board, wire cutters, wire strippers, small screwdriver, needle nose pliers.
• Class assignments and other material posted on Blackboard

Course Outcomes:
Students are successful in this course (i.e. earn C or better) will demonstrate at least the abilities to:

• recall the basics of electronic design - these fundamentals will be essential to your success in higher-level design courses.
• functionally test and debug electronic circuits
• use SPICE to simulate electronic circuits
• analyze and experimentally characterize electric circuits in the frequency domain
• explain the relationship between the time-domain and frequency-domain behavior of analog circuits
• explain the behavior of active components under small-signal and large-signal (non-linear) operation.
• communicate effectively through written lab reports and technical memos, with emphasis on critical discussion of results

Students who demonstrate higher skills will earn higher grades.

Course Topics:
• Active components under small-signal and large-signal (non-linear) operation
• Timing and pulse circuits
• Op-amp characteristics and limitations
• Active filter design
• Wave shaping and generation
• Transistor behavior
• Audio amplifier
• Design of magnetic core inductor
• DC-DC switching power converter
• SPICE simulation of electronic circuits
• Populating a printed circuit board from a circuit schematic
Course Contribution to Program Outcomes:
ELCT 301 contributes to an achievement of:

- Outcome A – an ability to apply knowledge of mathematics, science and engineering
- Outcome B -- an ability to design and conduct experiments, as well as to analyze and interpret data
- Outcome E -- an ability to identify, formulate, and solve engineering problems
- Outcome G -- an ability to communicate effectively
- Outcome K – an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

General Course Policies

Academic Integrity
Unless otherwise stated, assignments and examination work are expected to be the sole effort of the student submitting the work. Students are expected to follow the University of South Carolina Honor Code and they should expect that every instance of a suspected violation will be reported. Students found responsible for violations of the Code will be subject to academic penalties under the Code in addition to whatever disciplinary sanctions are applied.

Accommodating Disabilities
Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services: 777-6142, TDD 777-6744, email sasds@mailbox.sc.edu, or stop by LeConte College Room 112A. All accommodations must be approved through the Office of Student Disability Services.

Diversity
When scheduling exams, I have attempted to avoid conflicts with major religious holidays. If, however, I have inadvertently scheduled an exam or major deadline that creates a conflict with your religious observances, please let me know as soon as possible so that we can make other arrangements.

Recommended Study Habits

- Prepare for the lab sessions by performing the required work and computer simulations.
- Bring thoughtful questions to class for discussion.
- Prepare for the exams in study groups.
- Take notes during class discussions and while completing reading assignments.

Deviations
Minor deviations from the syllabus are a normal part of any adaptive teaching and learning process.
Instructor’s Addendum for Fall 2015

Instructor: Dr. Enrico Santi  
Office: Swearingen 3A36  
E-mail: santi@cec.sc.edu  

Phone: 803.777.1843  
Office hours: Mon-Wed 11 AM – 12 PM  
Class Meeting Time:  
Lecture: Tue 2:50 – 4:50 PM  
Lab section 1: Mon 3:30 – 6:30 PM  
Lab section 2: Wed 3:30 – 6:30 PM  
Lab section 3: Fri 3:30 – 6:30 PM  
James Colwell (Monday Session)  
Office Hour: Mon 2:30 – 3:30pm  
Phone: 864-325-4336  
Email: colweljl@email.sc.edu  

Teaching Assistants:  
Joseph Harden (Wednesday Session)  
Office Hour: Wed 1:30 – 2:30pm  
Phone: 864-351-9788  
Email: hardenja@email.sc.edu  

Matthew Milton (Friday Session)  
Office Hour: Fri 1:30 – 2:30pm  
Email: mmilton@email.sc.edu  

Class Location: Swearingen 2A31 (lecture) and 2A36 (lab)  

Course Delivery Structure:  
Lectures/Laboratory  

Course Assessment  
Course assignments include lab reports and exams.  

Approximate grading scheme is as follows:  

Lab Demonstrations  
- 80% is Hardware meeting specifications and pre-lab work  
- 20% is Neatness and correct use of components  
30%  

Lab Reports  
- Average of all lab reports + lab notebook grade (counts as one lab report)  
- Technical memos count as half of a full report  
35%  

Oral, written or practical exams for projects  
There will be two exams as indicated in the class schedule  
35%  

There will be no final exam.  

WARNING!!! – Unclean work-space and misuse of equipment will result in a grade penalty assessment against the entire class of up to 10% of everyone’s semester grade.
### Class Schedule

<table>
<thead>
<tr>
<th>Project</th>
<th>Date Assigned</th>
<th>Project Completion Date(^1)</th>
<th>Report Date (Wed class)(^2)</th>
<th>Report Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Scope usage</td>
<td>Tue Aug 25</td>
<td>Fri Sept 11</td>
<td>Tue Sept 15</td>
<td>Tech memo</td>
</tr>
<tr>
<td>2. Op-Amp Characteristics (PCB)</td>
<td>Tue Sept 8</td>
<td>Fri Sept 18</td>
<td>Tue Sept 22</td>
<td>Report</td>
</tr>
<tr>
<td>3. Timing &amp; Pulse Circuits</td>
<td>Tue Sept 15</td>
<td>Fri Sept 25</td>
<td>Tue Sept 22</td>
<td>Tech memo</td>
</tr>
<tr>
<td>4. Audio Amplifier (PCB) #</td>
<td>Tue Sept 22</td>
<td>Fri Oct 9</td>
<td>Tue Oct 13</td>
<td>Report</td>
</tr>
<tr>
<td>5. Magnetics</td>
<td>Tue Oct 6</td>
<td>Fri Oct 16</td>
<td>Tue Oct 20 §</td>
<td>Tech memo</td>
</tr>
<tr>
<td>6. dc-de Converter</td>
<td>Tue Oct 13</td>
<td>Mon Oct 26</td>
<td>Tue Nov 3</td>
<td>Report(^3)</td>
</tr>
<tr>
<td>7. Signal Generator (PCB) #</td>
<td>Tue Oct 20</td>
<td>Fri Nov 6</td>
<td>Tue Nov 10</td>
<td>Report</td>
</tr>
<tr>
<td>8. Active Linear Filters (PCB)</td>
<td>Tue Nov 3</td>
<td>Fri Nov 13</td>
<td>Tue Nov 17</td>
<td>Report</td>
</tr>
<tr>
<td>9. Current Mirrors</td>
<td>Tue Nov 10</td>
<td>Fri Nov 20</td>
<td>Tue Nov 24 §</td>
<td>Tech memo(^3)</td>
</tr>
<tr>
<td>Exam 1 *</td>
<td>Tue Sept 29</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Exam 2 *</td>
<td>Tue Oct 27</td>
<td></td>
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<tr>
<td>Electric safety class + demo ballast</td>
<td>Tue Nov 17,</td>
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<tr>
<td>Lab notebook grading</td>
<td>Oct 20</td>
<td>Nov 24</td>
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<td></td>
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<tr>
<td>Final Exam *</td>
<td>No exam</td>
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</tbody>
</table>

* indicates exam  
# indicates two-session lab  
§ indicates lab notebook grading

Note 1: The deadline for lab checkoff is Friday of the project completion week for the Monday and Wednesday sessions and the following Monday for the Friday session. The Project Completion Date shown is for the Monday and Wednesday sessions. For example, for the Op-Amp lab the project completion date is Fri Sept 18 for the Monday and Wednesday sessions and Mon Sept 21 for the Friday session.

Note 2: Lab reports are due on Blackboard at midnight the day before the next lab session. For example, for the Op-Amp lab the lab report is due on Sun Sept 20 for the Mon session, on Tue Sept 22 for the Wed session and on Thursday Sept 24 for the Friday session.

Note 3: There is a problem with Fall Break on Oct 22-23. The Friday class will be unable to complete the DC-DC converter lab. The Friday students will skip the DC-DC converter lab, but lab 9 Current Mirrors will be a full lab report for those students rather than a tech memo.

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### Instructor Policies

**Preparation/Homework**

You are required to prepare for most projects in a certain way prior to coming to the lab (pre-lab). Carefully read the project description in the lab exercise and perform the preparatory steps before coming to the lab. In particular the pre-lab will frequently include computer simulation of the circuit under investigation using Spice. All simulations have to be performed using Spice. Simulations with other software (such as Multisim) will not be accepted. The TA will check your notebook during lab for any required calculations, computer output, etc. If the pre-lab is not satisfactory, the TA may require you...
to do it over and repeat the lab exercise. He may also take points off your lab demonstration grade. If you are having trouble with a pre-lab, consult your TA before it is due. An honest effort may keep you from doing extra work! If you show up for a lab without having done the pre-lab, the TA will take 30% off your lab demonstration grade.

Check-off and Lab Demonstration Grade
When you have completed the lab exercise and the circuit is working to your satisfaction, schedule time with your TA to get “checked-off.” This means you must demonstrate to the TA that the circuit works and you have met the specifications. At check-off the TA will inspect your notebook as well as witness your demonstration. Timely completion of the assigned project is part of your grade. Ideally you should complete the lab and be checked off during your lab session. The TA and instructor will judge how well you met the challenge and how well you kept your notes, and grade you accordingly. You will be assigned a grade for the lab demonstration. That grade will appear on the graded lab report for that lab. The check-off deadline is the Friday of the project completion week for the Monday and Wednesday sessions and the following Monday for the Friday session. After that there will be a 10% grade penalty per working day.

Laboratory Notebook
We require you to keep a complete laboratory notebook to document the projects, measurements, and calculations that you make. A notebook shall be a book with pages permanently bound into it and commonly sold as a Laboratory Notebook. Spiral bound books and tablets are not acceptable. Pages printed with graph paper are desirable since you will make many drawings of measured waveforms. Set aside the first page of the notebook as an index, adding project titles and page numbers as the semester progresses. All entries shall be in INK, and they shall be in chronological order -- do not leave blank pages. Paste in computer output (graphs, computer programs, etc) wherever appropriate. Do not leave loose inserts in your notebook. Sign and date each day’s entry. Essentially, everything you do during this course should be documented in the notebook. An instructor or TA should be able to completely reproduce any of your project results by referring to your notebook. Your lab notebook will be graded twice: at the midpoint of the semester and at the end of the semester as indicated in the lab schedule above. Your notebook should contain a thorough record of each project that you do, including:

**Preparation** - Prepare for the lab as outlined in the exercise found on this webpage. Include in your pre-lab preparations a brief notebook entry setting forth the main purpose of the lab as you understand it, any questions that you have about the assigned reading, and your expectations of the lab project. Pre-lab work can include material from the lab write-up or from handouts or both.

**Lab Work** - Record in the notebook details of the equipment setup, circuit construction, measurement results, any observations made during the exercise, and all calculations and analyses called for in the instructions.

**Additional Entries** - Make additional entries at any other time that it seems appropriate -- for instance, as you analyze data while you prepare a report. Also after each lab session, make a brief entry summarizing what you learned that day and noting any material that is still unclear.

Written Reports
This course stresses good writing because the ability to communicate well is essential for success as an engineer. If you have difficulty, consult the writing center. Written reports are due at the beginning of your lab section following the week in which the lab exercise was performed unless otherwise instructed. The maximum grade available on a report will decrease by 10% for each day it is late. Every effort will be made to return graded reports during the next scheduled lab meeting.
The standard document preparation software in this department is Microsoft Word. However, you are allowed to use any software and any computer that you choose as long as the quality of the report does not suffer. The format(s) used are based on the IEEE standard and are the same formats taught in ELCT 201. We expect professional quality reports and memoranda for every assignment. Lab reports will be graded for content according to the lab report rubric available on the class web page.

**Technical Content** – is concerned with the correctness of your measurements, project outcomes, analysis of data, and interpretations and conclusions drawn from your analysis of the data. Be thorough and complete all requirements specified in lab notebook.

**Format/Presentation** – This is a qualitative assessment of the report. Has the writer used the recommended format (this includes graphs charts and tables)? Is the report readable? Can it be understood without additional information?

**Appropriate use of computer tools** - Reflects your ability to incorporate features other than words into your report. Sixty percent of the available credit for each skill will be awarded for a rudimentary application of the skill. One hundred percent credit will be awarded when the skill results in a polished application. When applicable you should simulate the circuits you are building in the lab and compare experimental and simulation results, attempting to explain discrepancies.

You may be asked to edit and resubmit a lab report. This will help you understand what constitutes a good lab report. Failure to resubmit will result in zero points for that lab report. You are required to turn in both a hardcopy and an electronic copy of your report. The electronic submission will be done using Blackboard. You are encouraged to annotate using a pen your lab report hardcopy, for example to point out salient features of scope waveforms.

**Late lab reports**
Lab report submission time is determined by the electronic submission on Blackboard. Lab reports are due at midnight the day before the next lab session. There is a 10% grade penalty per day for late reports.

**Quizzes** – There will be quizzes at the beginning of every lab session as part of pre-lab checkoff. The grade of these quizzes will be part of the pre-lab checkoff grade.

**Attendance Policy**
Recitation attendance is mandatory. A sign-up sheet will be circulated at each recitation session. A student missing n recitation sessions will have a grade penalty according to the formula 2\*n*(n-1). Notice from the Table below that missing one class does not incur a penalty, missing three classes will incur a one-letter grade penalty, missing four classes will incur a two-letter grade penalty, and missing five classes will cause the student to fail the class. If you have a legitimate reason for missing a class, please notify both the instructor and your TA prior to class time.

<table>
<thead>
<tr>
<th>N</th>
<th>Grade penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
Plagiarism (Cheating) Policy

In this class a policy of zero tolerance towards cheating will be followed. Instances of cheating will be reported following standard University procedures. Even though two people may work on an exercise together, they must produce their own results and write individual laboratory reports. BE SURE that you write your own report. Multiple copies of the same report, or similar reports with only minor changes, are not permitted. This type of casual cheating is easily detectable by Blackboard and will result in disciplinary action.

WARNING: Protect your computer account so your classmates cannot copy your files! Do not attempt to use copies of reports from past semesters! Do not let other students see or borrow your reports! We routinely check for these things.

Housekeeping Policy

Before you leave, sweep debris from the table top into a trash can, and take with you your test leads and instrument probes. Report any damaged parts or equipment so that they can be repaired or replaced before the next student needs them. While you are working, don't let other people into the lab. If they have the authority to enter they will have the entry code or a key. Keep your lab area clean!

Expectations for Classroom Behavior

Please be respectful of each other, the instructor, and any guest presenters while in class. We are all here to learn! Any disrespectful or disruptive behavior may result in your referral to the Office of Student Judicial Programs.

Midterm and Final Exams

Makeup exams will be allowed only with pre-approval of the instructor or with an acceptable, documented reason. Acceptable reasons for makeup exams include severe illness, family emergencies or other unavoidable events including dangerous weather conditions and car accidents. Exam format for makeup exams may be different than the original exam.

Expectations of the Instructor

I understand that students expect me to facilitate their learning, to answer their questions appropriately, to be fair and objective in grading, to provide timely and useful feedback on assignments, to maintain adequate office hours, and to treat them as I would like to be treated in their place.