Sonoma State University  
School of Science and Technology  
Department of Engineering Science  
EE 221–Electric Circuits Laboratory, Fall 2018

Instructor Contact Information
Name: Dr. Sudhir Shrestha  
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Email: Sudhir.Shrestha@Sonoma.edu  
Office Hours: Mondays & Tuesdays, 1 – 3 PM (or by appointment)

General Course Information
Class Days/Time: Wednesdays/Thursdays 1:00-3:50 PM  
Classroom: Salazar 2005  
Credit Hours: 1.0  
Pre-requisite: EE 110, Co-requisite: EE 220

Course Description
EE 221: Electric Circuits Laboratory (1). Laboratory: 3 hours. Laboratory work on material treated in EE 220 emphasizing elementary design principles. Prerequisite: EE 110 and corequisite: EE 220

Course Format and Instructional Methods
This course will be taught using multiple instructional methods. These methods will include oral presentations, group discussion, and hands-on activities. Typically, course topics will be introduced via a short oral presentation followed by hands-on lab activities. This course will also utilize Canvas, SSU’s learning management system, where you will interact with your classmates and with the instructor. Within the course Canvas site you will access the learning materials and syllabus; discuss issues; submit assignments; participate in online group activities; and share your projects. Refer to the course calendar/schedule and assignment instructions for information on where and when to submit your work.

Course Objectives and Student Learning Outcomes
The objectives of the course are to provide the students:

- Ability to test, analyze, and debug resistive and RC circuits using breadboards, digital multimeters, oscilloscopes, and function generators.
- Ability to test and verify circuit laws through experiments and simulation tools.
- Ability to test circuits with operational amplifiers.
- Ability to conduct basic AC measurements.
- Ability to measure amplitude and frequency responses of low pass filters and draw bode plot.
Upon successful completion of this course, students will be able to:
2. Measure voltages and currents in electric circuits.
3. Conduct experiments to verify basic electric circuit laws.
4. Use simulation software to analyze circuits.
5. Test circuits with operational amplifiers.
6. Test first order circuits with steady state and transient input and draw phasor diagrams.
7. Conduct basic AC measurements.
8. Measure amplitude and frequency response of low pass filters and draw bode plot.

**Required Texts/Readings**

**Textbook**


Additional materials will be posted on Canvas.

**Other Equipment/Material Requirements/Software**

Each student is required to have the following tools and components:
1. **Digital Multimeter**
   A multimeter with following minimum requirements:
   - Measures (with 5\% accuracy): DC (0.01 mV – 50 V), AC (1 mV – 150 V), Resistance (1 \(\Omega\) – 10 M\(\Omega\)), Capacitance (1 pF – 1 mF), Continuity Test, Diode Test, Optional Features - Frequency and Transistor
   - **Has probe and clip leads**

2. **Breadboard**: A high quality breadboard from a good (well-known) manufacturer.

3. **Resistor kit**: One **beige-colored** resistor kit with values ranging from 10 \(\Omega\) to 10 M\(\Omega\) and with maximum 5\% tolerance.

4. **Capacitor kit**: A capacitor kit with values ranging from 4.7 pF to 470 \(\mu\)F.

Students should consult Engineering Resources website for parts suggestions and purchase the ones that meet above specifications.

Additional software and hardware needs will be discussed in the first class.
**Tentative Course Schedule** (Changes will be announced in the class and/or on Canvas)

<table>
<thead>
<tr>
<th>Laboratory Exercises</th>
<th>Date Wed./Thu.</th>
<th>Readings (From the text)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lab introduction and syllabus discussion</td>
<td>Aug. 22/23</td>
<td></td>
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<tr>
<td>2. Ohm’s Law</td>
<td>Aug. 29/30</td>
<td>Ch. 1: 1.1 – 1.6</td>
</tr>
<tr>
<td>3. Series and Parallel Resistors and Kirchhoff’s Laws</td>
<td>Sep. 5/6</td>
<td>Ch. 2: 2.1 – 2.7</td>
</tr>
<tr>
<td>4. Methods of Circuit Analysis</td>
<td>Sep. 12/13</td>
<td>Ch. 3: 3.1 – 3.7</td>
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<tr>
<td>5. Introduction to Circuit Simulation</td>
<td>Sep. 19/20</td>
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<tr>
<td>6. Thevenin’s &amp; Norton’s Equivalent Circuits</td>
<td>Sep. 26/27</td>
<td>Ch. 4: 4.1 – 4.6, 4.8</td>
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<tr>
<td>7. Oscilloscope and Signal/Function Generator</td>
<td>Oct. 3/4</td>
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<tr>
<td>8. Operational Amplifier</td>
<td>Oct. 10/11</td>
<td>Ch. 5: 5.1 – 5.5</td>
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<tr>
<td>9. Project Discussion</td>
<td>Oct. 17/18</td>
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<tr>
<td>10. First-Order Circuits</td>
<td>Oct. 24/25</td>
<td>Ch. 7: 7.1 – 7.6</td>
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<tr>
<td>11. Project</td>
<td>Oct. 31/Nov.1</td>
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<tr>
<td>12. Sinusoids, Phasors, and AC Power Analysis</td>
<td>Nov. 7/8</td>
<td>Ch. 9: 9.1 – 9.6</td>
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<tr>
<td>13. Frequency Response of a Low-Pass Filter</td>
<td>Nov. 14/15</td>
<td>Ch. 11, 12, &amp; 13</td>
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<tr>
<td>15. Final Lab Exam</td>
<td>Dec 5/6</td>
<td>Lab 2-8, 10, 12 &amp;13</td>
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</table>

**Course Requirements & Grading Policy:**

*Refer to Canvas course site for further details.*

Pre-Lab Assignments---------10%
Pre & Post-Lab Discussions--10%
Lab Reports -------------------40%
Project -----------------------20%
Final Lab Exam ---------------20%

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 93.0%</td>
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<tr>
<td>A-</td>
<td>≥ 90.0%</td>
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<tr>
<td>B+</td>
<td>≥ 87.0%</td>
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<tr>
<td>B</td>
<td>≥ 83.0%</td>
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<tr>
<td>B-</td>
<td>≥ 80.0%</td>
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<tr>
<td>C+</td>
<td>≥ 77.0%</td>
</tr>
<tr>
<td>C</td>
<td>≥ 73.0%</td>
</tr>
<tr>
<td>C-</td>
<td>≥ 70.0%</td>
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<tr>
<td>D+</td>
<td>≥ 67.0%</td>
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<tr>
<td>D</td>
<td>≥ 60.0%</td>
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<tr>
<td>F</td>
<td>&lt; 60.0%</td>
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</table>
Classroom Protocol
Refer to Canvas course site for further details.

Canvas
Canvas is SSU's Learning Management System (LMS). Canvas is the place where you will find the course syllabus, read posted announcements in the news forum, participate in online class discussions with classmates, submit your assignments online and view the materials for this course. To access the Canvas course site use your SSU Seawolf ID and password to log into SSU's Online Services Portal https://login.sonoma.edu. Click on the Canvas link. You can also access it from https://canvas.sonoma.edu. When you get to the Canvas site home, click on the “Courses” menu located on the left navigation. Click on the link for this course (classes are listed by course name and number, click on “All Courses” if this course does not appear on the list). Note: The Login link is also conveniently located at the top of the Sonoma State University homepage http://www.sonoma.edu and many other university pages.

Canvas Help and Student Computing Resources

Canvas and General IT Help Desk
Contact the IT Help Desk at http://www.sonoma.edu/it/helpdesk/ if you need assistance with Canvas or other information about computing and information technology at SSU. Three ways to contact the IT Help Desk are:
- Call: 707-664-4357
- Email: helpdesk@sonoma.edu
- Visit Location: Schulz 1000

Plugins
Download Plugins at http://www.sonoma.edu/about/plugins.html lists plugins that may be needed to access some content on or linked from SSU websites and Canvas.

General Student Computing
Review the information posted at Student Computing at http://www.sonoma.edu/it/students. There you will find computer use guidelines and a list of available computer labs.

Library Research Guides and Subject Librarians
The University Library can help you find information and conduct research. You can make an appointment with a subject librarian, get help online, or drop by the library during open Research Help hours: http://library.sonoma.edu/about/hours/detailed.
(Insert the URL address for the Research Guides at http://libguides.sonoma.edu/ provided by your subject librarian, contact information for the Subject Librarians at http://library.sonoma.edu/research/subjectlibrarians/, and any applicable Information for distance learners at http://library.sonoma.edu/services/distancelearners/.)

University Policies
There are important University policies that you should be aware of, such as the add/drop policy; cheating and plagiarism policy, grade appeal procedures; accommodations for students with
disabilities and the diversity vision statement. See Important Policies and Procedures for
Students http://www.sonoma.edu/uaffairs/policies/studentinfo.shtml.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drops,
academic renewal, etc. How to Add a Class http://www.sonoma.edu/registration/addclasses.html
has step-by-step instructions. Registration Information
http://www.sonoma.edu/registration/regannounce.html lists important deadlines and penalties for
adding and dropping classes.

Campus Policy on Disability Access for Students

If you are a student with a disability, and think you may need academic accommodations, please
contact Disability Services for Students (DSS), located in Salazar Hall, Room 1049, Voice: (707)
664-2677, TTY/TDD: (707) 664-2958, as early as possible in order to avoid a delay in receiving
accommodation services. Use of DSS services, including testing accommodations, requires prior
authorization by DSS. See SSU’s policy on Disability Access for Students

Emergency Evacuation (Optional/suggested statement)

If you are a student with a disability and you think you may require assistance evacuating a
building in the event of a disaster, you should inform your instructor about the type of assistance
you may require. You and your instructor should discuss your specific needs and the type of
precautions that should be made in advance of such an event (i.e. assigning a buddy to guide you
down the stairway). We encourage you to take advantage of these preventative measures as soon
as possible and contact the Disability Services for Students office if other classroom
accommodations are needed.

Academic Integrity

Students should be familiar with the University’s Cheating and Plagiarism policy
http://www.sonoma.edu/UAffairs/policies/cheating_plagiarism.htm. Your own commitment to
learning, as evidenced by your enrollment at Sonoma State University and the University’s
policy, require you to be honest in all your academic course work. Instances of academic
dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of
another as your own, or the use of another person’s ideas without giving proper credit) will result
in a failing grade and sanctions by the University. For this class, all assignments are to be
completed by the individual student unless otherwise specified.

Additional Resources

SSU Writing Center

The SSU Writing Center, located at Schulz 1103, helps SSU students become better writers and
produce better written documents. The knowledgeable and friendly tutors can help you with a
wide array of concerns, from generating good ideas and organizing papers more clearly to
learning citation formats and using semi-colons correctly. Visit the
http://web.sonoma.edu/writingcenter/ for more information on how to schedule time with a tutor.
Counseling and Psychological Services (CAPS)
CAPS is a unit of the division of Student Affairs of Sonoma State University. CAPS offers confidential counseling to students experiencing personal problems that interfere with their academic progress, career or well being. The CAPS website http://www.sonoma.edu/counselingctr provides information only. If you would like to talk with someone or make an appointment, please call (707) 664-2153 between 8 a.m. - 4:30 p.m., Monday-Friday.
ABET Requirements:

Course Learning Objectives (CLOs):
In this course students will:
A. Test, analyze, and debug resistive and RC circuits using breadboards, digital multimeters, oscilloscopes, and function generators.
B. Test and verify circuit laws through experiments and simulation tools.
C. Test circuits with operational amplifiers.
D. Conduct basic AC measurements.
E. Measure amplitude and frequency response of low pass filters and draw bode plot.

<table>
<thead>
<tr>
<th>Course Learning Objectives (CLOs)</th>
<th>Objectives</th>
<th>Assessment Method</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-E</td>
<td>1-3</td>
<td></td>
<td></td>
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</table>

Course Outcomes (COs):
At the conclusion of this course, students will be able to do the following:
2. Measure voltages and currents in electric circuits.
3. Conduct experiments to verify basic electric circuit laws.
4. Use simulation software to analyze circuits.
5. Test circuits with operational amplifiers.
6. Test first order circuits with steady state and transient input and draw phasor diagrams.
7. Conduct basic AC measurements.
8. Measure amplitude and frequency response of low pass filters and draw bode plot.

<table>
<thead>
<tr>
<th>Student Learning Outcomes vs. Course Learning Objectives:</th>
</tr>
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<tbody>
<tr>
<td>(Support Level (0-5) 0=No support, 1=lowest support, 5=highest support)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ABET Student Outcomes</th>
<th>Course Learning Objectives</th>
<th>Level of Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) an ability to apply knowledge of mathematics, science, and engineering</td>
<td></td>
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<tr>
<td>(b) an ability to design and conduct experiments, as well as to analyze and interpret data</td>
<td>A-E</td>
<td>4</td>
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<tr>
<td>(c) an ability to design a system, component, or process to meet desired needs</td>
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<td>(d) an ability to function on multi-disciplinary teams</td>
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<tr>
<td>(e) an ability to identify, formulate, and solve engineering problems</td>
<td>A-E</td>
<td>3</td>
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<tr>
<td>(f) an understanding of professional and ethical responsibility</td>
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<td>(g) an ability to communicate effectively</td>
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<td>(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context</td>
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<td>(i) a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>(j) a knowledge of contemporary issues</td>
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<tr>
<td>(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice</td>
<td>A-E</td>
<td>4</td>
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**Assessment Methods:**

Assessment of the student learning
1. In-class discussion of concepts
2. Lab reports
3. Lab demos and presentations

Course quality Assessment
1. Student survey of the course
2. Peer instructors feedback