EE 110
Introduction to Engineering Laboratory
Department of Engineering Science

Instructor Contact Information
Name: Dr. Saeid Rahimi
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Email: rahimi at Sonoma.edu
Office Hours: MW 3:00 PM – 4:00 PM or by appointment

General Course Information
Class Days/Time: M 4-6:50 PM
Classroom: Salazar 2003
Credit Hours: 1.0
Pre-requisite: Must be eligible to enroll in MATH 45 or MATH 161. Instructor’s consent is required for co-enrollment in EE 112.

Course Description
EE 110: Introduction to Engineering Laboratory (1). Laboratory: 3 hours. This course is designed to introduce principles of engineering to the students and expose them to the electronics and computer lab environment. The students are given opportunity to design and build some simple analog and digital circuits and make measurements using various types of lab equipment.

Course Format and Instructional Methods
This course utilizes instruction and laboratory materials developed by Dr. Saeid Rahimi. This course will be taught using multiple instructional methods including 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 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 course materials; 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
Upon successful completion of this course, students will be able to:
1. Apply basic electric circuit concepts to understand the behavior of simple electric and electronic circuits.
2. Assemble electric circuits using a breadboard, resistors, capacitors, diodes, and transistors.
3. Measure the values of resistors and capacitors using laboratory instrument.
4. Construct DC and AC circuits energized by bench power supplies and function generators.
5. Measure voltages using standard laboratory instruments, including multimeters and oscilloscopes.
6. Assemble and test basic input/output microcontroller circuits.
7. Design and construct a microcontroller circuit.
8. Work collaboratively in a team.
9. Demonstrate an understanding of professional and ethical responsibility.

Required Texts/Readings
Textbook: No textbook
Laboratory Instructions: and information is provided in Canvas. Syllabus/course material is also uploaded to the course website: http://web.sonomah.edu/engineering/schedules/web/
Highly recommended book for Arduino (inexpensive):

Optional References:
- Arduino Projects for Dummies, by Brock Craft (2013)
- Programming Arduino – Getting Started with Sketches, Simon Monk (2016)

Other Equipment/Material Requirements/Software
Students are encouraged to consult Resources page on Engineering website for parts suggestions and purchase the ones that meet above specifications.

Each student is required to have the following tools and components:

1. Digital Multimeter (Required)
   A multimeter with following minimum requirements:
   - Measures (with 5% accuracy): DC (0.01 mV – 50 V), AC (1 mV – 150 V), Resistance (1 Ω – 10 MΩ), Capacitance (1 pF – 1 mF), Continuity Test, Diode Test, Optional Features - Frequency and Transistor
   - Has probe and clip leads
   - Suggested: Extech EX350 True RMS Professional MultiMeter with NCV

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

3. Arduino Board Kit (Required): Student must purchase an Arduino UNO R3 board (experiments 10 through 12). Students will also purchase parts containing a breadboard, electronic components and wires. Kits containing the board and parts can be purchased online for less than $50 (see the Arduino kit offered by Vilros: https://amzn.com/B00BT0NDB8). Since the breadboards included in the kits may be a little too small, students may choose to obtain larger breadboards separately.

4. Lab Notebook (Required): An inexpensive bound lab notebook with graph papers and page numbers. To get credit for your work each laboratory exercise must be signed by the instructor.
5. **Resistor and Capacitor Kits**: Resistor and capacitor kits are not required. But if you choose to purchase those kits, please buy the ones that meet following requirements:

   - **Resistor kit** *(Required)*: Resistor values ranging from 10 Ω to 10 MΩ and with maximum 5% tolerance. *(Suggested: Assorted Resistor Kit)*
   - **Capacitor kit** *(Recommended)*: Capacitors with values ranging from 4.7 pF to 470 µF. *(Suggested: Capacitor Assorted kit)*

**Discovery Scope**: Students can borrow a Digilent Discovery Scope (DS) from the department. A DS (about the size of a calculator) functions as a virtual set of test and measurement instruments including a power supply, a multimeter, a function generator and an oscilloscope. These units will be loaned to the students so they can perform parts of their experiments at home. Students are required to return the units to the department during the last laboratory session. Discovery scopes can be connected to the students’ desktop or laptop computers via a USB cable (provided). The PC or laptop provide power to the DS and function as a display. The details of software installation and use of the Discovery scopes will be given during the second laboratory session. In the event that a student loses or damages their device, he/she will be responsible for purchasing and returning a working unit back to the department.

**Tools**: Purchasing some basic tools (soldering iron, pliers, wire cutters, etc…) is optional. Information about tools and parts will be provided during the first session of the lab.

**Text and Materials Costs**: Students are encouraged to search online for best prices.

**Tentative Course Schedule** *(Changes will be announced in the class and/or in Canvas)*

<table>
<thead>
<tr>
<th>Laboratory Exercises</th>
<th>Date</th>
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<tbody>
<tr>
<td>0. Lab Introduction and Syllabus Discussion</td>
<td>Jan 28</td>
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<tr>
<td>1. DC Concepts and Measurements standard equipment; Sign Up for Discovery Scope (DS), Download DS software.</td>
<td>Feb 4</td>
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<tr>
<td>2. DC Measurements: Series and Parallel Resistor Combinations and Current Measurements</td>
<td>Feb 11</td>
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<tr>
<td>3. DC Measurements: Circuit Laws and Voltage Dividers</td>
<td>Feb 18</td>
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<tr>
<td>4. AC Concepts and Measurements (Standard Laboratory Equipment)</td>
<td>Feb 25</td>
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<tr>
<td>5. AC Concepts and Measurements: Introduction to Capacitors</td>
<td>Mar 4</td>
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<tr>
<td>6. Introduction to Rectifying Diodes <em>(Written Lab Report-1)</em></td>
<td>Mar 11</td>
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<tr>
<td><strong>Spring Break</strong></td>
<td>Mar 18</td>
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<tr>
<td>7. Introduction to Transistors <em>(Written Lab Report-2)</em></td>
<td>Mar 25</td>
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<tr>
<td>Cesar Chavez Holiday</td>
<td>Apr 1</td>
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<tr>
<td>8. Introduction to Operational Amplifiers <em>(Written Lab Report-3)</em></td>
<td>Apr 8</td>
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<tr>
<td>Project title due</td>
<td>Apr 15</td>
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<tr>
<td>9. The 555 Timer <em>(Written Lab Report-4)</em></td>
<td>Apr 15</td>
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<tr>
<td>Project proposal with the title and description due, order parts!</td>
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<tr>
<td>11. Arduino Sketch 3, Ethics Quiz</td>
<td>Apr 29</td>
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<tr>
<td>12. <strong>Project Demo and Presentation</strong></td>
<td>May 6</td>
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Pre-Lab Assignments
First 15 to 30 minutes of each class will be dedicated for lab discussion. Students will be asked questions about the previous labs and the lab exercise being conducted that day. All students must participate in the discussion.

Laboratory Exercise, Lab Reports & Lab Notebook
Laboratory instructions will be posted in Canvas. Students must consult these materials prior to coming to the lab. Instructions can be opened on the computer in the lab or students’ personal laptop. If students prefer printed copies, they must bring them themselves. During the laboratory exercise, students should follow the directions in the instruction and record the details of work including circuit diagrams, data and results must in the lab notebook. Conclusion should be concise and accurate. Make sure that the professor approves and signs on the lab notebook. Students are required to turn in a total of four complete laboratory reports. The format of lab reports will be described in the class. The reports are due at the beginning of the following lab session. Late lab report will not be accepted. The report must be stapled on the top left corner at 45° angle.

Post-Lab Discussion
Post-lab discussion will begin 30 minute prior to the end of the lab. Students must halt experiments at this point and participate in the discussion. Students will be asked questions on the laboratory exercise they performed that day. The experiments could be continued after the discussion.

Lab Project
Each group will choose a lab project that integrates knowledge and skills gained in the course. Students are strongly advised to start planning for their final projects in mid-semester. First explore the internet and find interesting and practical electronic circuits and applications relevant to each laboratory topics. Students are encouraged to search for their final project topics well ahead of the time. Project components and parts will be ordered after approval. The necessary electronic components and materials may be obtained from local or online electronic stores. Students should allow 1-2 weeks for delivery of project parts and components purchased online. Students will bring their “rough” projects to class prior to the final presentation for demo and troubleshooting.

Resources for Projects:
http://www.instructables.com/id/Arduino-60/
http://www.circuitstoday.com/simple-electronics-projects-and-circuits
http://www.buildcircuit.com/all-projects/basic-electronic-projects/
http://www.allaboutcircuits.com/
www.electronicsclub.info
Course Requirements & Grading Policy

Pre & Post-Lab Discussions------------------------ 10%
Laboratory Exercise -------------------------- 25%
Lab Notebook (notes, experiment details) -- 20%
Labs Reports (total of 4 reports) -------------- 20%
Ethics Quiz ------------------------------- 5%
Final project (success, details, report) ------ 20%

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<thead>
<tr>
<th>Grade</th>
<th>Minimum Percentage</th>
<th>Maximum Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 93.0%</td>
<td>100%</td>
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<tr>
<td>A-</td>
<td>≥ 90.0%</td>
<td>&lt; 93.0%</td>
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<tr>
<td>B+</td>
<td>≥ 87.0%</td>
<td>&lt; 90.0%</td>
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<tr>
<td>B</td>
<td>≥ 83.0%</td>
<td>&lt; 87.0%</td>
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<tr>
<td>B-</td>
<td>≥ 80.0%</td>
<td>&lt; 83.0%</td>
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<tr>
<td>C+</td>
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<td>&lt; 80.0%</td>
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<tr>
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<td>≥ 73.0%</td>
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<tr>
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<td>≥ 70.0%</td>
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<td>D+</td>
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**Late Work:** May be accepted only with the approval obtain prior to the lab exercise. When accepted, late work must be handed in directly to the instructor (may not be emailed, placed under a door or left in a mailbox). A 10% penalty applies to the first late day and 20% for each additional late day after the first. For example, if the assignment is due Tuesday and you turn it in Friday (3 days late), you lose 10% + 20% + 20% = 50%. Later work may not be accepted after the solution the solution has been posted.

**Makeup for Missed Laboratory Sessions:** Except in case of a documented medical or family emergency (an emergency recognized by the University policies), if accepted, 25% penalty will be applied.

Evidence of serious and compelling reasons, supported by the appropriate documents, is required for missing a lab. Students are required to perform the missing laboratory experiments on their own. They can ask questions about the missing labs during office hours or during help sessions given by the course tutor. Students will receive a zero for each unjustified absence and will fail the course for more than two unjustified absences.

**Regrades:** A re-grade request on an assignment or part of an assignment must be submitted in writing. Such request must be submitted within seven days of the return of the graded assignment. The request must include clear justification, the problem number(s), and the graded assignment.

**Returned Assignments:** If you were unable to collect an assignment when it was returned, you must collect it during the next available office hours. 10% penalty will be applied on any assignment not collected until after the Final Exam.
Classroom Protocol
To create an appropriate environment for teaching and learning, students must show respect for their instructors and fellow students. They must not use profanity and foul languages in the class. Listed below are a few guidelines for classroom behavior. Students are expected to follow these guidelines to ensure that the learning environment is not compromised.

Attendance: You are expected to be in class the entire class time. Please do not enter late or leave early, except due to an emergency or with an advance permission from the instructor.

Absences: You are expected attend all classes. If you know you are going to miss a class, inform the instructor. Take the responsibility of learning the materials. Instructors are not responsible for re-teaching the material you missed due to an absence or being late. Meet with the instructor when you can to find out if there were any important announcements in the class.

Computer Use: Unless stated by the instructor for a class, computers, laptops, tablets or cell phone are not permitted.

Cell Phone Use: Unless stated by the instructor for a class, cell phones are not permitted. You may not receive or send text messages or calls. Cell phones must be “turned off” or placed in “airplane” or “do not disturb” mode. If you need to use your cell phone for any reason, you must leave the classroom.

Headphones/Earphones/Ear-pods: Headphones, earphones or ear-pods are not permitted and should not be worn.

Active Participation: Students are expected to actively participate in the class. You may not sleep, eat, drink or carry on side conversations in class. You may not work on assignments or study materials unrelated to the current class topic. You may not take pictures or audio or video recordings in class.

Attitude: Students are expected to maintain civil attitude in class. You may not use inappropriate or offensive commentary or body language.

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 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 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 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 http://libguides.sonoma.edu/ provided by your subject librarian, contact information for the Subject Librarians http://library.sonoma.edu/research/subjectlibrarians/, and any applicable Information for distance learners 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/uaaffairs/policies/studentinfo.shtml.

Dropping and Adding the Course
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 http://www.sonoma.edu/uaaffairs/policies/disabilitypolicy.htm.

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.