San José State University
Department of Electrical Engineering
EE127 Section 1: Electronics for Bioengineering Applications
Spring 2021

Course and Contact Information

Instructor(s): Nhat M. Nguyen, Ph.D.
Office Location: On-line
Telephone: N/A
Email: nhat.m.nguyen@sjsu.edu
Office Hours: Wednesday, 8:00-9:00 PM (tentative)
Class Days/Time: Friday, 6:30-9:15 PM
Classroom: Class sessions, midterm exams, and final exam will be held on-line
Prerequisites: EE 98 with C minus or better

Course Format

This course will be taught through on-line instructions. Course materials, syllabus, assignments, exams, grades and other information will be posted on the SJSU Canvas course site at http://sjsu.instructure.com/. Students are responsible to check Canvas regularly for class work and exams. Canvas video tutorials and documentations can be found at http://ges.sjsu.edu/canvas-students

If students have questions regarding the use of Canvas, please file a ticket at http://ges.sjsu.edu/instructional-design-help

Students will be evaluated based on 5 components: midterm exams, final exam, homework, labs, and a class project. Students can work as teams on the labs and the class project.

Technology Intensive, Hybrid, and Online Courses

1. Students are required to have an electronic device (laptop, desktop or tablet) with camera and built-in microphone. Students are responsible for ensuring that they have access to reliable Internet.

2. Zoom software will be used for on-line instructions. The following Zoom link is used for both office hours and class sessions:

   https://sjsu.zoom.us/j/82416880178?pwd=YU1aczU2dFJiSkoldTnNvUTBNRHpkUT09
   Meeting ID: 824 1688 0178
   Password: 609482
   US: +1 669 900 6833
3. **Zoom Protocol**
Students must turn on their computer camera while taking the midterm and final exams.

4. **Instructor may require the use of webcams during exams.** This may include software applications that use AI, eye-tracking, machine learning, key logging, and other technologies.

5. Any student who needs accommodations or assisted technology due to a disability should work with the Accessible Education Center (AEC) and the instructor.

6. **Students are not allowed to record without instructor permission.**
Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

However, class sessions will be recorded if students make the request. For academic integrity, students cannot share recorded videos outside the class.

7. **Academic Dishonesty**
Students who are suspected of cheating during an exam will be referred to the Student Conduct and Ethical Development office and depending on the severity of the conduct, will receive a zero on the assignment or a grade of F in the course. Grade Forgiveness does not apply to courses for which the original grade was the result of a finding of academic dishonesty.

8. **Excel, Matlab, and LTSPICE software will be used.** The university has purchased a university-wide license/
Students will be allowed to download a full version of Matlab on their personal computers at no cost.

9. There are 5 lab sessions.
Unless otherwise noted, the labs are hardware based and can be done at home. Students will be given take-home lab kits which include the ADALM2000 (power supplies, function generator, and scope), Arduino Mega 2560 Board, AD8232 Heart Rate Monitor, and MyoWare Muscle Sensor. Passive and active components that are required for the labs will also be provided by the department. Students will need to have access to LTSPICE and Matlab.

- For technical support, lab/room access codes, purchasing, lab kits, equipment repairs, etc., submit “Request Support” on ECS website at: [https://www.sjsu.edu/ecs/](https://www.sjsu.edu/ecs/)
- All teaching/research tools/software/resources are available at [https://www.sjsu.edu/ecampus/](https://www.sjsu.edu/ecampus/). The College of Engineering also provides additional supports to popular tools and software at [https://www.sjsu.edu/engineering/resources/instructional-design/index.php](https://www.sjsu.edu/engineering/resources/instructional-design/index.php)
- Since EE127 is classified as a hybrid class, students have the options for in-person labs - if requested 2 weeks prior to each lab session. Students will need to complete a COVID-19 training course before their request can be approved. Please see this link for more information: [https://sjsu.instructure.com/courses/1409553](https://sjsu.instructure.com/courses/1409553). Students also need to submit a Safety Acknowledgement.
10. The class project will also be done at home. Students are responsible for purchasing the components for their class project.

**Course Description**

Study of the fundamental concepts of electrical circuits relevant to the use and design of biomedical instruments and devices currently used for patient care using several examples.

**Course Goals**

In this course, students will learn the fundamental concepts of active and passive electronic components, sensors, amplifiers and filters, analog-to-digital converters and embedded systems which are relevant to the uses and implementation in biomedical instruments. The course is designed to help students understand architecture design, hardware platforms, and sensing technologies of some popular medical devices. Students also have opportunities to have hand-on experiences to measure physiological signals such as EKG, EMG, and EEG. Some critical aspects of wearable devices will also be discussed such as wireless telemetry communication, signal acquisition and conditioning, power consumption and power harvesting circuitry, and fabrication of implantable sensors.

This course aims to engineering students who have basic knowledge and understanding of electronic circuits and want to learn more about the system-level design of biomedical instruments. The course will cover examples and lessons learnt in designing of some common physiological measurement system. The lab and lecture materials will provide students methodological thinking process and strategic approaches to design some bio-related apparatuses including determine functionalities, establish block diagram, select necessary components and optimize the sensing and recording modules. The course is a preparation for students who want to move forward in medical device and bio-sensing industry.

**Course Learning Outcomes (CLO)**

Upon successful completion of this course, students will be able to:

- CLO 1 Understand the physiological sources for biomedical signals
- CLO 2 Understand biosensors, noise interferences in biomedical instruments
- CLO 3 Understand the key circuit components in biomedical instruments
  - Operational amplifiers
  - Filters
  - Analog-to-digital converters
  - Power distribution networks
  - Voltage Regulators
- CLO 4 Understand and explain block diagrams of biomedical instruments
- CLO 5 Understand biomedical devices such as ECG, EMG, and EEG
- CLO 6 Build prototypes of biomedical instruments in the lab
- CLO 7 Collect measurement data, and perform statistical data analysis

**Required Texts/Readings**

**Textbook**

Other Readings


Course Requirements and Assignments

“Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.”

*More details can be found from University Syllabus Policy S16-9 at* [http://www.sjsu.edu/senate/docs/S16-9.pdf](http://www.sjsu.edu/senate/docs/S16-9.pdf)

Grading Information

- **Problem Sets (20%).** A problem set is given after each lecture. The problem sets are related to the class lectures and are due one week after assigned. There will be no late submission because the solutions will be posted online after the due dates.
- **Lab (15%).** Lab works and lab reports are team based. For everyone to receive the proper credit, team members should divide the work appropriately, including the possibility of taking turn to perform the lab work. Lab reports are normally due one week after each lab session. Late submission will not be accepted.
- **Class Project and Report (15%).** Class project is team based and is due near the end of the semester. Students must specify their roles in the team project to receive credits according to their contributions.
- **Midterm Exams (30%).** Two midterm exams are given per semester. Make-up exam is only allowed if situation warrants it.
- **Final Exam (20%).** The exam date is set according to the university calendar. Make-up exam is only allowed if situation warrants it.

**Determination of Grades**

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<tr>
<th></th>
<th>&lt;</th>
<th>Grade</th>
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<tbody>
<tr>
<td>91</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>88</td>
<td>91</td>
<td>A minus</td>
</tr>
<tr>
<td>84</td>
<td>88</td>
<td>B plus</td>
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<tr>
<td>81</td>
<td>84</td>
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<td>D minus</td>
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<tr>
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“This course must be passed with a C minus or better as a CSU graduation requirement.”
Refer to the “Spring 2021 Special University Grading Policy” (https://www.sjsu.edu/registrar/academic-records/grade-changes.php) for special consideration during the COVID-19 pandemic.

Classroom Protocol

If need to be on campus, students must follow the university Health/Safety Protocols. It is at https://www.sjsu.edu/healthadvisories/health-safety-protocols/index.php

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ Syllabus Information webpage at http://www.sjsu.edu/gup/syllabusinfo/

Policy on Cheating

A student or students involved in a cheating incident in a test, homework, report, quiz or lab project will receive an F in the course and will be reported to the judicial affairs office and subjected to disciplinary action. See more information at: http://info.sjsu.edu/static/schedules/integrity.html.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester’s Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendar webpage at http://www.sjsu.edu/provost/academic_affairs/resources/academic_calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/. Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.
**Course Schedule**

The schedule is tentative and subjected to change. Students are responsible to check the email or Canvas to get the most updated information.

## Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics, Assignments, Readings</th>
<th>Due</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1/29/2021</td>
<td>Course Overview &amp; Review (HW1)</td>
<td>Form Team</td>
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<tr>
<td>2</td>
<td>2/5/2021</td>
<td>Basic Electronic Components (HW2)</td>
<td>HW1</td>
</tr>
<tr>
<td>3</td>
<td>2/12/2021</td>
<td>Operational Amplifiers (HW3)</td>
<td>HW2</td>
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<tr>
<td>4</td>
<td>2/19/2021</td>
<td>Exam 1 Review Lab 1: Operational Amplifiers</td>
<td>HW3</td>
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<tr>
<td>5</td>
<td>2/26/2021</td>
<td>Exam 1</td>
<td>Lab 1</td>
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<td>3/5/2021</td>
<td>Filter (HW4)</td>
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<td>7</td>
<td>3/12/2021</td>
<td>Lab 2: Filters</td>
<td>HW4 Project Proposal</td>
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<td>8</td>
<td>3/19/2021</td>
<td>Analog-to-Digital Converters (HW5)</td>
<td>Lab 2</td>
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<tr>
<td>9</td>
<td>3/26/2021</td>
<td>Power Distribution and Regulators (HW6) Lab 3: ADC</td>
<td>HW5</td>
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<tr>
<td>10</td>
<td>4/2/2021</td>
<td>SPRING RECESS – NO CLASS</td>
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<tr>
<td>11</td>
<td>4/9/2021</td>
<td>Exam 2 Review Medical Instrumentation &amp; Biosensors (HW7) Electrocardiography (ECG) (HW7)</td>
<td>HW6</td>
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<td>12</td>
<td>4/16/2021</td>
<td>Exam 2</td>
<td>Lab 3</td>
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<tr>
<td>13</td>
<td>4/23/2021</td>
<td>Electromyography (EMG) (HW8) Electroencephalography (EEG) (HW8)</td>
<td>HW7</td>
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<tr>
<td>14</td>
<td>4/30/2021</td>
<td>Lab 4: ECG Lab 5: EMG</td>
<td>HW8</td>
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<tr>
<td>15</td>
<td>5/7/2021</td>
<td>Final Exam Review</td>
<td>Lab 4, Lab 5</td>
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<tr>
<td>16</td>
<td>5/14/2021</td>
<td>Project Demo</td>
<td>Project Report</td>
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<tr>
<td>17</td>
<td>5/21/2021</td>
<td>Final Exam (7:45 – 9:45 PM)</td>
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EE Department Honor Code

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“I have read the Honor Code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will NOT:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor.”

Measures Dealing with Occurrences of Cheating

- Department policy mandates that the student or students involved in cheating will receive an “F” on that evaluation instrument (paper, exam, project, homework, etc.) and will be reported to the Department and the University.
- A student’s second offense in any course will result in a Department recommendation of suspension from the University.