San José State University  
Department of Electrical Engineer  
EE127: Electronics for Bioengineering Applications

Course and Contact Information

Instructor: Dr. Cuong M. Nguyen  
Office Location: Lab: ENG290  
Telephone: TBD  
Email: cuong.m.nguyen@sjsu.edu  
Office Hours: Friday 8:00-9:00 PM or by appointment  
Class Days/Time: Friday 6:30-7:30 PM (Lecture)  
           Friday 7:30-9:15PM (Lab)  
Classroom: Lecture: Engineering Building 345  
           Lab: Engineering Building ENG290

Prerequisites: EE 98 with C or better

Course Format

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

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

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.

Prerequisite: EE 98 with C or better

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 the physiological signals such as EKG, EMG, and EEG from a real human model. 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 basics of circuits and physiological sources for many biomedical signals
- CLO 2 Solve fundamental problems involving operational amplifiers
- CLO 3 Build circuits for operational amplifiers
- CLO 4 Explain the operational characteristics of bio-potential amplifiers
- CLO 5 Build basic bio-potential amplifiers and record data for future analysis
- CLO 6 Record data for data-acquisition equipment for biomedical signals
- CLO 7 Solve fundamental signal processing problems
- CLO 8 Explain several biomedical devices and some advanced technologies
- CLO 9 Understand and explain the block diagrams of some biomedical instruments
- CLO 10 Explain the power distribution network and compliance requirements of medical devices

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 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, 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)

- **Attendance (5%)**: Students are required to attend all class and lab sessions. Sign-in list will be provided for each class session. Leave of absence will be emailed to the ISA one weeks in advance. Each absence results in a 1% penalty (within the maximum of 5% penalty) of the final grade.
- **Problem sets (10%)**: Problems are given every one or two weeks. The problem sets will relate to the class lecture. The problems normally are due one (1) week after being given. There is no late submission because the solution will be uploaded online after the due date.

- **Quizzes (15%)** are unannounced and random. There will be three (3) or four (4) pop quizzes during the semesters, which require student to be always on top of the class materials.

- **Lab reports (20%)** are important to reflect the students’ understanding about the lab materials. While the lab required teamwork, lab reports must be done individually. Each lab reports should include the names of all team members for cross checking the measurement data. The lab reports are due one (1) week after each lab session. There is no late submission.

- **Midterm exam (20%)** is given once per semester. Make-up exams are only allowed if the situation warrants it.

- **Project and project reports (10%)** will be the team projects and due near the end of the semester. Students need to specify their roles in the project and receive the credits according to their contribution.

- **Final exam (20%) date** is following the university calendar. Make-up exams are only allowed if the situation warrants it.

### 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/policies/integrity.html](http://info.sjsu.edu/static/policies/integrity.html)

### Grading Information

#### Determination of Grades

- 0 to 49  F
- 50 to 54  D
- 55 to 59  C-
- 60 to 64  C
- 65 to 69  C+
- 70 to 74  B-
- 75 to 79  B
- 80 to 84  B+
- 85 to 89  A-
- 90 to 100 A

“This course must be passed with a C- or better as a CSU graduation requirement.”

### 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 web page](http://www.sjsu.edu/gup/syllabusinfo/)

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc.

### 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](http://info.sjsu.edu/static/catalog/policies.html) section at [http://info.sjsu.edu/static/catalog/policies.html](http://info.sjsu.edu/static/catalog/policies.html).

Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars](http://info.sjsu.edu/static/catalog/calendars.html)
webpage at http://www.sjsu.edu/provost/services/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, Readings, Assignments, Deadlines</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>01/26</td>
<td>Course Overview&lt;br&gt;Introduction to Medical Instrumentation</td>
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<tr>
<td>2</td>
<td>02/02</td>
<td>Basic Electronic Components&lt;br&gt;Operational Amplifiers (I)</td>
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<tr>
<td>3</td>
<td>02/09</td>
<td>Operational Amplifiers (II)&lt;br&gt;Lab 0: Get-to-know equipment and lab facilities</td>
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<tr>
<td>4</td>
<td>02/16</td>
<td>Filters (I)&lt;br&gt;Filters (II)</td>
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<tr>
<td>5</td>
<td>02/23</td>
<td>Lab 1: Basic Electronic Components&lt;br&gt;Lab 2: Operational Amplifiers</td>
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<tr>
<td>6</td>
<td>03/02</td>
<td>Analog-to-digital Converters&lt;br&gt;Homework Review</td>
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<tr>
<td>7</td>
<td>03/09</td>
<td>Lab 3: Operational Amplifiers-Instrumental Op-Am</td>
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<tr>
<td>8</td>
<td>03/16</td>
<td>Wireless power transmission&lt;br&gt;Lab 4: Filters</td>
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<tr>
<td>9</td>
<td>03/23</td>
<td>Mid-term&lt;br&gt;Lab 4: Analog-to-digital converters</td>
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<td></td>
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<td>Spring Break</td>
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<tr>
<td>10</td>
<td>04/06</td>
<td>Electroencephalography (EEG)&lt;br&gt;Electrocardiography (ECG)</td>
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<td>11</td>
<td>04/13</td>
<td>Lab 5: EEG</td>
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<td>12</td>
<td>04/20</td>
<td>Electromyography (EMG)&lt;br&gt;Lab 6: EMG</td>
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<tr>
<td>13</td>
<td>04/27</td>
<td>Pedometer Sensors&lt;br&gt;Lab 8: Project</td>
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<tr>
<td>14</td>
<td>05/04</td>
<td>Electrochemical Sensors&lt;br&gt;Lab 8: Project</td>
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<tr>
<td>15</td>
<td>05/11</td>
<td>Temperature Sensors&lt;br&gt;Homework Review</td>
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<tr>
<td>16</td>
<td>05/18</td>
<td>Project demo</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.