

**San José State University**  
**Department of Electrical Engineering**  
**EE127: Electronics for Bioengineering Applications**  
**Fall 2018**

**Course and Contact Information**

Instructor:	Nhat Minh Nguyen, Ph.D.
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Email:	nhat.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 7:30-9:15 PM (Lab)
Classroom:	Lecture: Engineering Building E345 Lab: Engineering Building E258
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 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

*Medical Instrumentation Application and Design* (4th edition), John G. Webster, Wiley (2009). ISBN: 978-0471676003. Available to rent or buy on Amazon.com. Students may select to use the eBook version.

#### Other Readings

- 1) *Introduction to Biomedical Engineering* (3rd edition), John D. Enderle, Academic Press (2011). ISBN: 978-0123749796. Chapters 9- 12.
- 2) *Electric Circuits*, James W. Nilsson, Prentice Hall.
- 3) *Biomedical Engineering, Trends in Electronics, Communications and Software* Edited by Anthony N. Laskovski, ISBN 978-953-307-475-7, 748 pages, Publisher: InTech, Chapters published January 08, 2011 under CC BY-NC-SA 3.0 license. **Link:** <https://www.intechopen.com/books/biomedical-engineering-trends-in-electronics-communications-and-software>

### 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](http://www.sjsu.edu/senate/docs/S16-9.pdf) at <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 Reports (20%).** Lab reports are important to reflect the students' understanding of the lab materials. While lab works are team based, lab reports must be done and submitted individually. Each lab report must include the names of all team members for cross checking of the measurement data. Lab reports are due one week after each lab session. There is no late submission.
- **Class Project and Report (10%).** 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

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

“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 webpage](http://www.sjsu.edu/gup/syllabusinfo/) 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](http://info.sjsu.edu/static/catalog/policies.html) 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/](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](http://www.sjsu.edu/advising/) 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

Week	Date	Topics, Assignments, Readings	Deadlines
1	8/24/2018	Course Overview (HW1)	
2	8/31/2018	Medical Instrumentation & Biosensors (HW2)	HW1
3	9/7/2018	Basic Electronic Components (HW3) Lab 1: Get-to-Know Equipment and Lab Facilities	HW2
4	9/14/2018	Operational Amplifiers (HW4)	HW3, Lab 1
5	9/21/2018	Midterm Exam Review Lab 2: Operational Amplifiers	HW4
6	9/28/2018	Midterm Exam #1 Filters I (HW5)	
7	10/5/2018	Filters II (HW5)	Lab 2
8	10/12/2018	Lab 3: Filters	HW5
9	10/19/2018	Analog-to-Digital Converters (HW6) Power Distribution and Regulators (HW6)	Lab 3
10	10/26/2018	Midterm Exam Review Lab 4: ADC	HW6
11	11/2/2018	Midterm Exam #2 Electrocardiography (ECG) (HW7)	
12	11/9/2018	Electromyography (EMG) (HW8) Electroencephalography (EEG) (HW8)	HW7, Lab 4
13	11/16/2018	Lab 5: ECG Lab 6: EMG	HW8
14	11/23/2018	NO CLASS – THANKSGIVING HOLIDAY	
15	11/30/2018	Project Demo	Lab 5, Lab 6
16	12/7/2018	Project Demo Final Exam Review	Class Project
17	12/14/2018	Final Exam (7:45 to 10:00 PM)	

## **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.*