



Syllabus for BIOE113-01: Bioinstrumentation

Spring 2019

Instructor: Sushma Shrinivasan

Designation: Bioinstrumentation

Catalog Description: This course has been designed to introduce fundamental principles of biomedical instrumentation commonly used in biomedical engineering research labs and hospitals. Techniques and principles of bioinstrumentation include biosignal and noise, biosensors, electrodes, electrocardiogram (ECG), defibrillators, pacemakers, electroencephalography (EEG), electromyogram (EMG), respiratory instruments, and optical microscopy. Biomedical circuit and electronics will be reviewed

Text Books and Other Required Materials: Required: Biomedical Instrumentation Systems, Jerry L. Shakti Chatterjee, Aubert Miller, 2010. Inc., ISBN-13 978-1-4180-1866-5

Recommended: Principles of Bioinstrumentation, Richard A. Normann, 1988, ISBN 0-471-60514-X.

**Course Objectives/
Student Learning
Outcomes:**

COURSE OBJECTIVES / STUDENT LEARNING OUTCOMES

After successful completion of this class, students will be able to:

Demonstrate an understanding of physics and engineering in biosensor, electrodes;

Demonstrate an understanding of the biomedical instrumentation principles in aspects of device design and applications.

Apply these principles in the context of bioinstrumentation interactions with tissues, organs and human body to explain the measurement results and to develop the instrumentations.

Students will demonstrate these abilities and hone the appropriate information gathering, computational and data-handling skills in homework and lab exercises. They will demonstrate their proficiency formally in examinations.

LEARNING OUTCOMES: By the end of the course, students will demonstrate:

1. An understanding of physics in biosensor, electrode.
2. An understanding of biomedical instrumentation principles in aspects of device design and applications.
3. An understanding of the techniques, skills and modern engineering tools necessary for engineering practice.
4. An ability to analyze contemporary bioinstrumentation studies to make connections and decisions based on their scientific merit.
5. An ability to communicate and function effectively on a multi-disciplinary team.
6. An ability to strengthen self-learning methods and organizational skills to enhance problem-solving abilities and efficiency.

**Program Learning
Outcomes:**

Prerequisites by Topic: MATH 022, PHYS 009, Bio 001; and Engr 166 or BIOE 166; Or permission by instructor

Designation:

Bioinstrumentation

Course Policies:

LECTURE AND LAB SECTIONS Lab section attendance is mandatory. Your lab sections are designed to support your efforts to learn the course material by practicing with it in as many ways as possible. Attendance will be recorded. Attending the lab sections you have registered for is mandatory and if any excuse is required for a specific week with a valid reason, please provide required proof and discuss with instructor and the TA before doing so.

HOMEWORK AND LAB REPORT Homework and lab report are critical components of this course and are designed to help you learn, understand and practice the material. Homework and lab report will be due on the dates indicated on catcourses. Homework and lab report will be accepted up to 24 hours after the deadline but at a reduced credit of 75%. Lab report format will be posted on catcourse. You are encouraged to work with your peers when doing homework. However, each student must turn in his/her own homework assignment and it must reflect his/her own work. You must explicitly identify all peers with whom you worked.

PRESENTATIONS Students will be teamed and will select a project topic (after discussing options with the instructor) for their presentation. Each team will present 10-15 minutes followed with a 5 minutes question section. A 5-page report for each team will be required.

EXAMS AND QUIZZES There will be 1 in-class midterm exam (1 hour 15 min duration) and two in-class quizzes (each ~30 minutes; dates will be indicated for the quizzes as the course progresses). There will also be a comprehensive final exam. There will be no make-up exams and quizzes. If you are sick during a regularly scheduled exam, please bring a note from the university clinic or your own doctor verifying your illness. Your course grade will then be determined by the rest of your work. Cheat sheets will not be allowed during any of the exams. However, calculators will be allowed when necessary, provided that they are not used to store data or formulae pertaining to the course.

DROPPING THE COURSE Please see the UC Merced General Catalog and the Registrar's / Student First website for details.

Catcourse The Catcourse site will be used for periodic course announcements, and for the distribution of class notes, discussion exercises, homework sets, and (some) solutions. You can check the scores that you have received on your homework assignments and exams. **CONDUCT** Students are expected to complete their own work and to abide by the UC Merced academic honesty policy, which can be found on the Student Life website <http://studentlife.ucmerced.edu/> under the Student Judicial Affairs link. The material posted on catcourse is for your benefit and it should not be shared or posted online. Note that most of the handouts provided in this course are protected by copyright, and are flagged accordingly on Catcourses. They are for your personal use only. Re-posting the files or their contents on sites such as (for example) Course Hero is an explicit violation of this copyright. Students and instructors are expected to honor UC Merced's Founding Principles of Community: <http://www.ucmerced.edu/about-uc-merced/principles-community>.

SPECIAL ACCOMMODATIONS The instructor will make every effort to accommodate all students who, because of valid personal reasons provided with proof, have conflicts with scheduled exams, assignments or required attendance.

Designation:	<p>Bioinstrumentation</p> <p>Please speak with the lead instructor during the first week of class regarding any potential academic adjustments or accommodations that may arise.</p>
Academic Dishonesty Statement:	<p>a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.</p> <p>b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.</p> <p>c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.</p>
Disability Statement:	<p>Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.</p>
Topics:	<ol style="list-style-type: none"> 1. Biosignals and noises 2. Review of biomedical electronics 3. Review of low pass filter design 4. Review of linear system theory 5. Biosensors, electrodes and transducers 6. Electrocardiogram (ECG) 7. Defibrillators and pacemakers 8. Instrumentation in blood flow 9. Instrumentation in respiration 10. Electroencephalography (EEG) and electromyogram (EMG). 11. Optical microscopy 12. X-ray imaging 13. Nuclear medicine imaging 14. Ultrasound Imaging (if have time) <p>Note: Topics will be slightly adjusted according to class progress.</p>
Class/laboratory Schedule:	<p>Lecture: 1:30-2:45PM, TR, KOLLIG 217; Lab 02L: 9:00AM-11:50AM, M, SE2 150; TA: Romero, Ignacio; Lab 03L: 10:30AM-1:20PM, T, SE2 150; TA: Romero, Ignacio .Attendance and regular participation are mandatory.</p>
Midterm/Final Exam Schedule:	<p>Midterm Exam: Tentative date- March 21, 2019 In-class</p> <p>Final Exam: 6:30PM-9:30PM, CLSSRM 110, May 13, 2019</p>

Designation:	Bioinstrumentation
Course Calendar:	<p>Labs: The below schedule shows the lab project number with respective section dates (Section-02L and 03L respectively).</p> <p>Lab 1- Jan 28th and Jan 29th</p> <p>Lab 2- Feb 4th and Feb 5th</p> <p>Lab 3- Feb 11th and Feb 12th</p> <p>Lab 4- Feb 25th and Feb 26th</p> <p>Lab 5- March 4th and March 5th</p> <p>Lab 6- March 11th and March 12th</p> <p>Lab 7- March 18th and March 19th</p> <p>Lab 8- April 1st and April 2nd</p> <p>Lab 9- April 8th and April 9th</p> <p>Lab 10- April 15th and April 16th</p> <p>Lab 11- April 22nd and April 23rd</p> <p>Lab 12- April 29th and April 30th</p> <p>Lab 13- May 6th and May 7th</p>
Professional Component:	
Assessment/Grading Policy:	<p>Quiz: 10%</p> <p>Presentation and report: 15%</p> <p>Lab attendance and reports: 15%</p> <p>Homework: 10%</p> <p>Quiz: 10%</p> <p>Midterm: 20%</p> <p>Final exam: 30%</p>
Coordinator:	Sushma Shrinivasan
Contact Information:	<p>Sushma Shrinivasan</p> <p>sshrinivasan@ucmerced.edu</p> <p>Office: AOA 143</p>
Office Hours:	<p>Ignacio Romero</p> <p>iromero7@ucmerced.edu</p> <p>Instructor's Office Hours:</p> <p>M, W 9am-11am in AOA 143</p> <p>or by appointment.</p> <p>TA's Office Hours:</p> <p>Ignacio Romero- T: 3:30-5:30 pm in AOA 142</p> <p>or by appointment</p>