San José State University, College of Engineering
BME 207, Experimental Methods in Biomedical Engineering, Fall 2018

Course and Contact Information

Instructor:	Guna Selvaduray
Office Location:	E 233D
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Office Hours:	TBD
Class Days/Time:	Lecture: Mondays 16:30 – 18:20 Lab: Mondays 18:30 – 21:20 OR Fridays 18:00 – 20:45
Classroom:	Lecture: WSQ 109; Labs: Engr 221
Prerequisites:	**BME 115, graduate standing**

Course Format

This is a lecture-lab course. The seminar component adopts traditional lecturing as a primary teaching method, combined with in-class problem solving sessions. In class, each student is required to have an internet-connected device (e.g. smartphone, tablet, laptop computer) to be used exclusively for learning-related activities, including the iClicker technology available at SJSU.
The lab will consist of either wet-lab, hands-on experiments or computational simulations. The lab will typically start with a lecture on background material to help students understand the concepts of a particular experiment. Following this, students will work in teams to set up and perform the necessary tasks.

Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the Canvas learning management system course website. All communications relevant to the course will be sent out using the Canvas messaging system (Canvas email and announcement board). Students are responsible for regularly checking with the messaging system through Canvas to learn of any updates.

Course Description

The main objective in this class is to familiarize students with experimental methods and techniques used in Biomedical Engineering, how to design experiments, how to recognize the various factors that can affect the outcome (results) of experimental work, and how to analyze experimental data so that they are meaningful. **This is a hands-on course**. During the semester, the students will operate the equipment in the department's laboratories. They will also design, conduct, analyze and report on one full-length experiment.
This course will cover the principles of data representation, analysis, and experimental designs in bioreactors, biomaterials, and medical devices. Topics include error analyses, modeling, normality testing, hypothesis testing.

Development of team work skills is another important aspect of this course. Students will be divided into groups by the instructor. Each student will belong to two different groups – one for the class presentation and one for the term project. All team members in a team will receive the same grade for a particular assignment, based on their performance as a team

Course Learning Outcomes (CLO)

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

1. **recognize** commonly used lab equipment and their functions
2. **perform** preliminary experiments in different biomedical engineering areas
3. **identify** sources and types of error
4. **predict** the effects of potential sources of error on a physical measurement
5. **understand** and **identify** a significant hypothesis
6. **design** experiments to measure physical variables of biomedical relevance
7. **design** data acquisition systems for biomedical applications
8. **identify** and **describe** the various types of mechanical measurements
9. **interpret** results in context of assumptions and limitations of the model
10. **perform** data analysis
11. **apply** the acquired knowledge to improve presentation and writing skills as well as overall professional development.
12. **communicate** effectively, in written form and in oral presentations, information relating to the design and/or results of an engineering experiment.
13. **work** in teams to complete specified course assignments

Required Texts/Readings

Textbook

- J.P. Holman, Experimental Methods for Engineers, Eighth Edition, McGraw-Hill (2011).
- Blann, Data Handling and Analysis (Fundamentals of Biomedical Science), First Edition, Oxford University Press (2015).

Other technology requirements: iClicker (formerly REEF Polling)

You will have several options available to participate in clicker sessions:

iClicker REEF app (iOS, Android, web app): Allows you to use your smartphone, tablet, or even laptop in class as a clicker to participate.

Clicker Remote: You can request to borrow a Clicker remote from eCampus (eCampus@sjsu.edu) for free. Remotes are to be returned to eCampus at the end of the semester.

How to set up an iClicker account and add a course

Follow the instructions available on the dedicated eCampus webpage (Student Resources section) at http://www.sjsu.edu/ecampus/teaching-tools/reef/index.html.

Library Liaison

Anamika Megwalu
Phone: (408) 808-2089
Email: anamika.megwalu@sjsu.edu

Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf.

Attainment of the learning objectives (as listed above) will be assessed via homework, quizzes (via iClicker, or in Canvas), class projects, the final examination, the term paper and presentation, and the assignments for the lab component.

Homework assignments

Students are expected and encouraged to work together on assignments. However, submitted homework should be individual work. Homework must be turned in at the **beginning of class** on the due date. **Late submissions** will be assessed 10%/day off of the maximum possible score.

Laboratory assignments

Students will prepare laboratory reports, based on post-lab assignments, **working in groups**. The report must include an Acknowledgments section indicating the specific contributions of each student. Students with no contribution will receive no credit for the report.
Reports must be turned in at the **beginning of class** on the due date. **Late submissions** will be assessed 10%/day off of the maximum possible score.

Class project

There will be regular class projects throughout the semester. Students will work in small teams developing projects to identify, compare and discuss experimental techniques used to measure a physical variable. Each team will be assigned one class project. To complete the project, the team will design a laboratory activity around the technique they selected. The laboratory activity will be presented and discussed during one of the lab sessions.

In-class quiz (iClicker)

There will be regular in-class quizzes based on multiple answer questions. I will be using iClicker as a student response system in class this term. This will help me to understand what you know and gives everyone a chance to participate in class. I will not use iClicker to keep track of attendance. Refer to the Grading Policy and Student Technology Resources section for additional details on iClicker.

Final Examination

The final examination will be held on the date and time stipulated by SJSU's Final Examination Schedule**.** The final examination will cover the entire course material covered during the semester. The final examination may include multiple-choice questions, open-ended questions, and problems. During the exam, students can have only a non-programmable scientific calculator. Internet-connected devices, books and notes are not allowed.

Term paper

All students are required to prepare a term paper on a subject relevant to the biomedical engineering, and present it in class during a dedicated session. The requirements for the term paper and the evaluation criteria will be posted on Canvas. Teams of two students will collaborate on a subject of their choice. The term paper must include an Acknowledgments section indicating the specific contributions of each student. Students with no contribution will receive no credit for the term paper. Both term paper and presentation will be assessed by the instructor and two students, according to a rubric that will be made available at the beginning of the semester.

The term paper must be prepared in accordance with the Biomedical, Chemical & Materials Engineering Department's Thesis Guidelines (posted on Canvas in the "Files" section). One electronic copy of the term paper must be submitted by the indicated deadline. Acceptable file formats are: .doc, .docx, .pdf.

Students must cite any and every source of data or information used in the term paper. Quoting verbatim (i.e. "copy and paste") from papers, textbooks, websites or other is strongly discouraged. Very limited use of verbatim quotes is acceptable only if (1) the quoted text is short, (2) quote marks are used to delimit the quoted text, and (3) an appropriate reference is provided, with a citation number added immediately after the quoted text. Failure to comply with this requirement may be interpreted as plagiarism, which constitutes a violation of academic integrity. All term paper submissions will be automatically scanned in Turnitin to locate matching or similar text within the paper. The instructor will decide whether there is plagiarism case-by-case, in which case academic and administrative sanctions will be assigned according to the University Academic Integrity Policy S07-2 (http://www.sjsu.edu/senate/docs/S07-2.pdf)

Please view the video on plagiarism at the library's website for more information:
http://libguides.sjsu.edu/plagiarism

Late submissions are strongly discouraged. However, under exceptional circumstances and pending instructor approval, in case of late submission of the term paper, points will be deducted as follows:

- One day late: -10%
- Two days late: -25%
- Three days late: -50%

No submission will be accepted later than three days after the deadline. Please note that this late submission policy only applies to the term paper assignment.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

Grading Policy

Letter Grades:

A+	> 97%
A	> 93% – 97%
A-	> 90% – 93%
B+	> 87% – 90%
B	> 83% – 87%
B-	> 80% – 83%
C+	> 77% – 80%
C	> 73% – 77%

C-	> 70% – 73%
D+	> 67% – 70%
D	> 63% – 67%
D-	> 60% – 63%
F	< 60%

Weight of class assignments and examinations:

Homework and Quizzes	5%
Class project	15%
Final Exam	35%
Term Paper	15%
Presentation	10%
Laboratory	20%
Extra-credit (iClicker)	1%

Participation with REEF Polling will be the only extra credit assignment. Participating in at least 75% of the REEF Polling quizzes over the semester is necessary to obtain the extra credit.

Absence during examinations, without prior approval, will result in a zero. Prior approval will be given only under exceptional circumstances. Please contact the instructor as soon as possible if you have such a situation.

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

Classroom Protocol

Attendance and arrival times

Students are expected to be set up for lecture by the time the class begins. Attendance in class is not mandatory and shall not be used per se as a criterion for grading. However, class attendance and participation are highly recommended.

Behavior

Students should remain respectful of each other at all times. Interruptive or disruptive attitudes are discouraged. While in the classroom, the use of electronic devices (laptops, tablets, smartphones) should be limited to activities closely related to the learning objectives. While in the classroom, electronic devices should not be used for personal communication, included messaging and use of social media. All cell phones must be silenced prior to entering the classroom.
Students will respect a diversity of opinions, ethnicities, cultures, and religious backgrounds. Students will treat online discussions with their peers as if they were in-class, face-to-face interactions.

Safety

Students should familiarize themselves with all emergency exits and evacuation plans. Especially since class concludes in the evening, when departing the building, students should be aware of their surroundings, and carry a cell phone.

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 at http://www.sjsu.edu/gup/syllabusinfo/

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Course Schedule

(subject to change with fair notice)

Week	Lecture	Laboratory
1	Intro to data types in BME	Good laboratory practices
2	Types of experimental error. Error analysis.	Handling quantities. Aqueous solutions. Buffers.
3	Uncertainty. Error propagation.	Intro to lab report writing
4	Design of experiments.	Biological and chemical assays. Spectrophotometry
5	Experiment design factors. Test matrices	Biological and chemical assays. Microplate readers
6	Writing a project report: materials and methods	Imaging. Particle sizing using microscopy
7	Pressure, temperature, flow measurement.	Particle sizing using dynamic light scattering
8	Writing a project report: experimental results	Motion tracking and gait analysis
9	Force, torque and strain measurement	Accelerated aging of a biomaterial.
10	Bioelectrical signal measurements	Fatigue of a biomaterial
11	Data acquisition. Analog-to-digital conversion	Cell culture: basic operation
12	Writing a project report: experimental results	Cell culture: cytotoxicity
13	Data analysis. Time-domain analysis	Biocompatibility testing:
14	Data analysis. Frequency-domain analysis	Hematology essays
15	Secure management of biomedical data	Thrombogenicity testing
Final Exam	Venue and Time TBD	