San José State University, College of Engineering
BME 207, Experimental Methods in Biomedical Engineering, Fall 2020

Course and Contact Information

Instructor:	Melinda Simon
Office Location:	E 233M
Telephone:	(408) 924-3956
Email:	Melinda.simon@sjsu.edu
Office Hours:	TBD
Class Days/Time:	Lecture: Mondays 18:00 – 19:20 Lab: Fridays 12:00 – 2:45 OR Saturdays 9:00-11:45 am
Classroom:	Lecture: Online via Zoom 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 a combination of wet-lab, hands-on experiments and online activities. 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. **This course satisfies graduate-level GWAR.**

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 and operate** commonly used lab equipment and their functions
2. **perform** experiments to characterize material, mechanical, chemical, biological, and electrical properties of application in biomedical engineering
3. **identify** sources and types of error in measurement and data analysis
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

Required

- G.R. Norman, Biostatistics: the bare essentials, 3rd Edition, B.C. Decker (2008), available online for free through the SJSU library

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.

This is a three-unit course, letter-graded. This course can be used to satisfy the Graduate Writing Assessment Requirement (GWAR) if the student passes this course.

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 participation problems

There will be regular in-class participation problems that you will work on individually or in groups. Some problems will request a response with iClicker and others will require a short submission via Canvas. 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. **If you cannot attend class synchronously (i.e. at the scheduled time), please email the instructor within the first week of class to make alternate arrangements.**

Final Examination

The final examination will be held online (via Canvas) 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. Details about the format and administration of the exam will be given toward the end of the semester.

Term paper

Each student is required to prepare and submit a term paper on a subject relevant to experimental methods in biomedical engineering (in consultation with the course instructor), and present it in class during a dedicated session.

The topic of the paper may cover (for example):

- measurement techniques or instrumentation systems for a particular application in biomedical engineering
- characterization and assessment strategies to evaluate suitability of a material, device, or system for use in biomedical engineering practice
- critical evaluation of performance and safety of an FDA-approved biomedical device, based on evidence provided in peer-reviewed journal articles and medical case studies

The term paper is an individual assignment. No collaboration with other students is allowed in the preparation and revision of this report. This report will be used to assess the student's competency in technical writing. **The competency demonstrated in technical writing accounts for 30% of the grade for this course.**

The paper must follow a minimum-length requirement of 3,000 words of text (approximately 12 double-spaced pages), **not including figures, tables, front and back materials**. *Front materials* should include a title page, abstract, table of contents, list of figures, list of tables, and list of symbols (when applicable). *Back materials* should include appendices (when applicable), acknowledgments (when applicable), and a list of all the references cited in the report. Page margins should be 1" on all sides and the font size should be 12 point. The term paper must be prepared in accordance with the Biomedical Engineering Department's Thesis Guidelines (posted on Canvas). **Citations and bibliography should follow the *Annals of Biomedical Engineering* referencing style**. In particular, references in the Bibliography section must list all sources that were used in preparing the report. They should be double-spaced, arranged alphabetically by author, and numbered serially, with only one reference per number. When using a citation manager software, such as EndNote, Mendeley, Zotero, PaperPile, etc., the proper citation format should be selected. **A minimum of 15 references from appropriate sources, such as books and peer-reviewed journal articles will be required.**

Students will complete the project report in three stages, with three deliverables. Feedback will be provided by the instructor for all three deliverables; only the final, complete draft will be graded. The purpose of the two early drafts is to provide students with adequate opportunity to receive instructor feedback and revise their paper accordingly. Each draft of the term paper must be submitted electronically to Canvas by the indicated deadline, and it will be scanned for plagiarism according to SJSU policy. Acceptable file formats are: .doc, .docx, .pdf. Additional, specific requirements for the term paper and the evaluation criteria will be posted on Canvas.

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. If you have questions about this policy, please ask the instructor. 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). For additional information, students are encouraged to review the video on plagiarism at http://libguides.sjsu.edu/plagiarism.

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

Late submissions are strongly discouraged. Special consideration for truly unavoidable and extenuating circumstances will depend on timeliness and supporting documentation (e.g., doctor's note, police report) 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	> 60% – 70%
F	< 60%

Weight of class assignments and examinations:

Homework	5%
Class participation via iClicker	10%
Final Exam	25%
Term Paper	30%
Presentation	10%
Laboratory	20%

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/

Recording Zoom Classes

This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will not be accessible at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording). 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.

Copyrighted Material

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.

Technical difficulties

Internet connection issues: Canvas autosaves responses a few times per minute as long as there is an internet connection. If your internet connection is lost, Canvas will warn you but allow you to continue working on your exam. A brief loss of internet connection is unlikely to cause you to lose your work. However, a longer loss of connectivity or weak/unstable connection may jeopardize your exam.

Other technical difficulties: Immediately email the instructor a current copy of the state of your exam and explain the problem you are facing. Your instructor may not be able to respond immediately or provide technical support. However, the copy of your exam and email will provide a record of the situation.

Contact the SJSU technical support for Canvas:

Technical Support for Canvas
Email: ecampus@sjsu.edu
Phone: (408) 924-2337
https://www.sjsu.edu/ecampus/support/

If possible, complete your exam in the remaining allotted time, offline if necessary. Email your exam to your instructor within the allotted time or soon after.

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.

BME 207, Experimental Methods in Biomedical Engineering, Fall 2020
Course Schedule

(subject to change with fair notice)

Week	Date	Lecture	Readings in Norman
2	24 Aug	Intro to data types in BME, Error analysis, propagation – accuracy, precision, calibration, sensitivity	Ch. 1 The Basics
3	31 Aug	Statistics – Probability, probability distributions, mean, median, variance, basic experimental design	Ch. 3 Describing the Data with Numbers; Ch. 5 Binomial distribution
4	7 Sept	Labor day holiday – no class	
5	14 Sept	Statistics part II – Gaussian distributions, statistical significance, confidence levels, Student's t distribution and t-tests	Ch. 4 The Normal Distribution, Ch. 6 Elements of Statistical Inference, Ch. 7 Comparing Two Groups
6	21 Sept	Statistics part III- ANOVA and Gage R&R	Ch. 8 One Way ANOVA
7	28 Sept	Statistics part IV–linear and multiple regression	Ch. 13 Simple Regression and Correlation
8	5 Oct	Midterm Exam	
9	12 Oct	Design of experiments – Introduction and Fisher's principles	
10	19 Oct	Design of experiments – Sample size justification and statistics for DoE	
11	26 Oct	Design of experiments – considerations for biological studies (controls, ROC, etc.), DoE case study from industry	
12	2 Nov	Writing a project report: materials and methods	
13	9 Nov	Image processing	
14	16 Nov	Writing a project report: experimental results, Graphical display of data using Python	
15	23 Nov	Writing a project report: discussion	
16	30 Nov	Data analysis. Time and Frequency-domain analysis	
17	7 Dec	Final Exam review	
Final Exam		Online, Time and date dictated by SJSU: https://www.sjsu.edu/classes/final-exam-schedule/fall-2020.php	