

San José State University
Department of Biomedical Engineering
BME 115, Foundations of Biomedical Engineering, Spring 2020

Course and Contact Information

Instructor:	Patrick Journey
Office Location:	ENG 233L
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Office Hours:	Monday: 1:00 – 2:00 Wednesday: 2:00 – 3:00 (Or by Appointment)
Class Days/Time:	Tuesday: 3:00 – 4:20 PM Thursday: 3:00 – 4:20 PM
Classroom:	ENG 329
Prerequisites:	Engr 010, Chem 001B, Math 032, Phys 050, Biol 030

Course Format

The course adopts a combination of traditional and flipped lectures as a primary teaching method, combined with in-class problem solving sessions. Short quizzes (either in class, via iClicker; or online, via Canvas) will be assigned in review of the course material. Materials from the textbook or provided by the instructor will be reinforced with homework assignments. A term paper and presentation will also be completed covering a topic of the student's choosing within the field of Biomedical Engineering. 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.

This course incorporates a required lab component (BME 115L), for which a separate syllabus is provided.

Faculty Web Page and MYSJSU Messaging

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

Course Description

Introduction to the fundamental principles of biomedical engineering. Core conservation equations are applied to mass, energy, charge, and momentum transfer in biomedical systems. Additional topics provide a breadth of exposure in cell and molecular biology, diagnostics and analytical techniques, statistical analysis of biomedical data, bioinformatics, bioinstrumentation, FDA regulations, and biomedical ethics. Prerequisite: BIOL 30, CHEM 001B, ENGR 010, MATH 032 and PHYS 050. Misc/Lab: Lecture 3 hours / Lab 3 hours

BME 115 is the first BME course in the suggested sequence for the BS major, and required prerequisite for the MS BME degree. The purpose of this course is two-fold: introduce students to the breadth of the field and establish core engineering and problem solving skills applicable across biomedical engineering disciplines.

Course Goals

Course Learning Outcomes (CLO)

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

- **Identify** basic components of biological systems and their function
- **Apply** engineering approaches and prescribed problem solving techniques to modeling biological systems
- **Apply** accounting and conservation equations to mass, energy, and charge.
- **Perform** laboratory experiments and obtain measurements from living systems.
- **Analyze** ethical issues surrounding biomedical engineering practice
- **Describe** recent advances in biomedical engineering within the context of existing knowledge and technology
- **Investigate** novel biomedical engineering techniques by doing an in-depth research paper and presentation
- **Work** in teams to complete specified course assignments; namely laboratory work and term paper/presentations
- **Apply** quantitative skills learned in class to evaluate advances in biomedical engineering (via term paper/presentation)

Required Texts/Readings

Required textbook

- Madihally S.V., Principles of Biomedical Engineering, Artech House; 1st Edition (2010), electronic version (.pdf) **available free of charge** to SJSU students via the MLK library.

Recommended textbooks

- Ann Saterbak, Ka-Yiu San, Larry V McIntire, Bioengineering Fundamentals, Prentice Hall, 2nd Edition, (2017).
- Enderle J.D., Bronzino J.D., Introduction to Biomedical Engineering, 3rd Edition, Elsevier (2011).

Other Readings

- Alberts B., *et al.*, Essential Cell Biology, Taylor & Francis, 4th Edition, 2013.

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 [iClicker Reef](http://www.sjsu.edu/ecampus/teaching-tools/reef/index.html) (checklist) 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

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 practice. Other course structures will have equivalent workload expectations as described in the syllabus. More details about student workload can be found in [University Syllabus Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9) at <http://www.sjsu.edu/senate/docs/S16-9.pdf>.

Attainment of the learning objectives (as listed above) will be assessed via homework, quizzes (via iClicker, or in Canvas), two midterm examinations, the final examination, the term paper and presentation, and the assignments for the lab component (BME 115L).

Homework

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 assignments** will be assessed 50%/ off of the maximum possible score. Homework not submitted prior to evaluation and return will be given a score of zero.

In-class quiz (iClicker)

There will be regular in-class quizzes based on multiple-answer questions. iClicker will be used as a student response system in class. iClicker helps the instructor to understand what you know and gives everyone a chance to participate in class. iClicker will NOT be used to keep track of attendance. Refer to the Grading Policy and Student Technology Resources section for additional details on iClicker.

Midterm examinations

There will be two mid-semester examinations. Each examination will cover the entire course material covered until the time of the examination. Examinations 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 unless explicitly specified by the instructor. The dates of the midterms are indicated in the Lecture Schedule.

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 unless specified by the instructor.

Laboratory

Students will work in teams to complete the laboratory activities. After each laboratory, student teams will submit a lab worksheet or report. See BME 115L syllabus for details. Students will keep **individual laboratory notebooks**. Students should write down all preliminary calculations, procedures, notes on results, and errors made during the experiment.

Term paper and presentation

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.

The term paper must be prepared in accordance with the Biomedical Engineering Department's Thesis Guidelines (posted on Canvas). One electronic copy of the term paper must be submitted to Canvas in one of the accepted formats (.doc, .docx, .pdf) by the assigned deadline.

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) quotation 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) (<http://www.sjsu.edu/senate/docs/S07-2.pdf>).

Late submissions of the term paper are strongly discouraged. However, under exceptional circumstances and pending instructor approval, in case of late submission of the term paper will trigger a 50% penalty.

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](http://www.sjsu.edu/senate/docs/F69-24.pdf) 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 Information

Letter Grades:

A+	> 97%
A	> 93% – 97%
A-	> 90% – 93%
B+	> 87% – 90%
B	> 83% – 87%
B-	> 80% – 83%
C+	> 77% – 80%
C	> 74% – 77%

C-	> 70% – 73%
D+	> 67% – 70%
D	> 64% – 67%
D-	> 60% – 63%
F	< 60%

Determination of Grades

Grades will be determined based on all the assignments and examinations, weighted as reported in the table below:

Homework and Quizzes	5%
Midterm 1	15%
Midterm 2	15%
Final Exam	30%
Term Paper	10%
Presentation	10%
Laboratory	15%
Extra-credit (iClicker)	1%

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

Failure to complete examinations as scheduled, 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](http://www.sjsu.edu/senate/docs/F13-1.pdf) 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. Students will respect a diversity of opinions, ethnicities, cultures, and religious backgrounds. Interruptive or disruptive attitudes are discouraged. While in the classroom, the use of electronic devices (laptops, tablets, smartphones) MUST 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.

Safety

Students should familiarize themselves with all emergency exits and evacuation plans. In particular, if the class meeting ends in the evening, students should be aware of their surroundings when exiting the building, and are encouraged to carry a cell phone for emergency communications.

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/) at <http://www.sjsu.edu/gup/syllabusinfo/>. Make sure to review these policies and resources.

Academic Integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy F15-7](#) requires you to be honest in all your academic course work. Any incident of academic dishonesty during an exam will result in an F in the course and the incident will be reported to the Office of Academic Affairs for additional review and possible sanctioning. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. Visit the [Student Conduct and Ethical Development](#) website for more information.

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Tentative Course Schedule (*subject to change with fair notice*)

Week	Date	Topics, Readings, Assignments	Term paper deadlines
1	January 23	Introduction - General information - Syllabus.	
2	January 28	Engineering Calculations.	
2	January 30	Conservation principles. Accounting equations.	Select partner, two tentative topics
3	February 4	Conservation of mass.	Topic assigned by instructor
3	February 6	Open non-reacting steady-state systems.	
4	February 11	More problems on non-reacting steady-state systems.	
4	February 13	Systems with chemical reactions.	
5	February 18	Dynamic systems.	1. Introduction: the problem
5	February 20	Midterm 1 review	
6	February 25	Midterm 1 exam	
6	February 27	Ethics in BME	
7	March 3	Conservation of Energy. Basic Concepts.	
7	March 5	Conservation of Energy. Changes in Enthalpy.	
8	March 10	Conservation of Energy. Dynamic systems	
8	March 12	Library Session: Navigating the Scientific Literature	
9	March 17	DNA Replication and PCR	2. Lit review; 3. Bibliography
9	March 19	<i>Guest Lecture: Bioinformatics</i>	
10	March 24	Biomedical optics. Light-tissue interactions	
10	March 26	Biomedical optics. Spectroscopic Measurements	4. One promising new technology 5. Pros, cons, alternative solutions
March 31 and April 2		Spring Break (Bay Area Medical Device Conf)	
11	April 7	Biomedical optics. Photothermal therapeutics	
11	April 9	Midterm 2 review	
12	April 14	Midterm 2 exam	
12	April 16	Bioinstrumentation. Conservation principles	6. Future perspectives
13	April 21	Bioinstrumentation. Electric circuits	Final draft submission
13	April 23	Bioinstrumentation. Amplifiers and filters	
14	April 28	Biomedical sensors. Electrophysiology of the heart	Peer reviews
14	April 30	Biomedical sensors. ECG and PPG. Wearables	
15	May 5	Biomedical sensors. Spirometry and VO ₂	Term paper submission
16	May 7	Final exam review	Term paper presentation
16	May 14	FINAL EXAM (14:45 – 17:00)	