San José State University
College of Engineering
Biomedical Engineering Department
BME 147, Quantitative and Statistical Methods for Biomedical Engineers, Fall 2022

Course and Contact Information

Instructor:	Kathy Le
Email:	Kathy.le@sjsu.edu

Office Hours:	Tuesday & Thursday: 2:30PM - 3:00PM
(via Zoom)	(*one-on-one meetings* or drop in)
Class Days/Time:	Tuesday, 3:00 – 4:15PM
(via Zoom)	Thursday, 3:00 – 4:15PM
Prerequisites:	**Math 32, BME 115, BME 177 all with C- or better.**

Course Format

The course is a synchronous online course using Zoom. The live Zoom sessions will include lectures, collaborative problem-solving activities, discussions, workshops. Computer-based learning activities will be integral to the learning outcomes of this course.

Course materials and activities are organized into Modules, available in Canvas. Each module is tied to general Course Learning Goals (listed below) and specific Course Learning Outcomes (available in Canvas).

Communications

Course materials such as syllabus, handouts, notes, slides, videos, assignment instructions, etc. can be found on Canvas Learning Management System course login website at http://sjsu.instructure.com. Recordings of the live Zoom sessions will be shared with the students via Canvas and will be considered an essential component of the course materials.

All communications relevant to the course will be shared with the students using at least one of the following channels: (1) the live Zoom sessions, (2) the Canvas announcement board, and (3) Canvas email. You are responsible for regularly checking all of those channels through Canvas to learn of any updates.

Course Description

Principles of experimental design; types of data and variables; descriptive statistics; elements of probability; probability distributions; sampling distributions and the Central Limit Theorem; hypothesis testing: ANOVA, one-sample and two-sample t-test, multiple comparisons, confidence intervals; power analysis; linear regression; statistical approach to medical device design.

Statistics is present in all aspects of our lives and affects many decisions that we make, whether we make them consciously or unconsciously. In engineering, medicine and science, decisions are often based on data

obtained from experimental measurements, which are prone to errors, variability and uncertainty. This class will focus on the application of statistical methods to biomedical engineering problems. After a brief introduction of the fundamentals of data collections and design of experiments, the student will be guided through the basic methodologies used to summarize data (descriptive statistics), assume a probability model, formulate and test hypothesis, compare means and variances of two or more populations, perform a linear regression. Particular emphasis will be placed on topics that have been traditionally challenging to engineering students with little or no prior experience with statistical analysis, such as when and how to use t-tests instead of the more general analysis of variance (ANOVA), the meaning of the p-value, the importance of sample size on the power of a statistical test, the importance to verify the assumption of a normal distribution, how to choose a statistical test appropriate for the sample data and the question to be addressed. The course will include one or more of the following special topics of particular interest to biomedical engineers: such as, validation of a new test methodology or process validation using biomedical engineering data.

Office hours

Office hours will be offered twice a week, according to the tentative calendar specified elsewhere in this syllabus.

Course Learning Goals

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

1. **Understand** the role of statistics in mediating our understanding of real-world quantitative phenomena
2. **Understand** the basic concepts of probability and random variables
3. **Formulate** a problem (questions, hypotheses, design of experiment) that can leverage statistical analysis to gain quantitative knowledge about real-world phenomena
4. **Design** an appropriate experimental approach to collect meaningful quantitative data
5. **Analyze** and **interpret** quantitative data
6. **Apply** tools of inferential statistics, including confidence intervals and hypothesis testing
7. **Apply** linear regression analysis for building empirical models of engineering and scientific data
8. **Apply** tools of inferential statistics to nominal and categorical data
9. **Understand** the basic principles of statistical quality control
10. **Utilize** appropriate software tools for statistical data analysis
11. **Communicate** quantitative information and mathematical and statistical concepts using language appropriate to the context and intended audience

Required Texts/Readings

Textbook

Aleks Website: www. Aleks.com (Course Code: **K6CH3-NXFMN**) to purchase Aleks online with e-book.

William Navidi and Barry Monk, Essential Statistics, 2nd Edition, McGraw-Hill (2018).

Other Readings for References

Kristina Ropella, Introduction to Statistics for Biomedical Engineers, 1st Edition, Morgan & Claypool (2007).

Stanton Glantz, Primer of Biostatistics, 7th Edition, McGraw-Hill Medical (2012).

Technology Requirements

Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students.

Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor, as soon as possible or at the latest one week before the test date to determine an alternative.

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 at http://www.sjsu.edu/senate/docs/S16-9.pdf.

Attainment of the learning objectives (as listed above) will be assessed via homework, in-class quizzes, two midterm examinations, the final examination, and the term project.

Homework

Homework assignments will include questions and problems related to the materials covered in the lectures, as well as assignments that require the use of statistical analysis software (e.g. Minitab).

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

EXAMS

Two midterm tests will be given on the following two dates:

Thursday, 29-September-2022

Thursday, 03-November-2022

The final exam will be given on Friday, December 9, 2022, from 2:45-5:00pm

Warning - Any student caught cheating during any exams will immediately get zero score for that exam.

Important - You are expected to complete all work and take all exams according to announced schedules. If you must miss the midterm exam due to documented illness or emergency and provide the necessary, document in 2 days from the exam date so that I can make some arrangement.

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.

GRADING

15% for all homework assignments

5% quizzes

20% for a group project

40% for two midterm exams (20% each)

20% for the final exam

1% Extra Credit

Grading Information

Letter Grades

A plus = 96 to 100%
A = 93% to 95%
A minus = 90% to 92%
B plus = 86% to 89%
B = 83% to 85%
B minus = 80% to 82%
C plus = 76% to 79%
C = 73% to 75%
C minus = 70% to 72%
D plus = 66% to 69%
D = 63% to 65%
D minus = 60% to 62%
F = 59% or lower

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: Live Zoom sessions

Students are expected to log into the live Zoom session by the time the class begins and use their real names. 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.

Recording Zoom Classes

The live Zoom sessions of this course 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 be deleted 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. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. University policy S12-7 (https://www.sjsu.edu/senate/docs/S12-7.pdf) 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.

Zoom Classroom Etiquette

Mute Your Microphone: to help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.

Be Mindful of Background Noise and Distractions: find a quiet place to "attend" class, to the greatest extent possible:

- Avoid video setups where people may be walking behind you, people talking/making noise, etc.
- Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.

Limit Your Distractions/Avoid Multitasking: you can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).

Use Appropriate Virtual Backgrounds: if using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

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 a live Zoom session, the use of electronic devices (laptops, tablets, smartphones) MUST be limited to activities closely related to the learning objectives. Electronic devices should not be used for personal communication, included messaging and use of social media. All cell phones must be silenced prior to logging into the live Zoom session.

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.

University Policies

Per University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/". Make sure to visit this page, review and be familiar with these university policies and resources.

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Tentative Course Schedule

(Subject to change with fair notice)

Module	Week Start Date	Topics, Readings, Assignments, Deadlines
1	August 23	Chapter 1: Introduction: why learn statistics? Basic Ideas about sampling, Types of Data, Design of Experiments Overview of Statistical Analysis Tool: **Minitab**
2	August 30	Chapter 2: Graphical Summaries of Data Chapter 3: Numerical Summaries of Data
3	September 6	Chapter 4: Probability
4	September 13	Chapter 5: The Binomial Distribution **(September 15 - Last Date to Add/Drop Courses)**
5	September 20	Chapter 6: The Normal Distribution
6	**September 27**	**Midterm Review** **Midterm Exam 1 (Chapters 1-4 and time starts at 15:00)**
7	October 4	Chapter 6: The Normal Distribution (Con't)
8	October 11	Chapter 7: Confidence Intervals
9	October 18	Chapter 8: Hypothesis Testing
10	October 25	Chapter 9: Inferences on Two Samples
11	**November 1**	**Midterm Review** **Midterm Exam 2 (Chapters 5-8 and time starts at 15:00)**
12	November 8	Chapter 10: Tests with Qualitative Data
13	November 15	Chapter 11: Correlation and Regression
14	November 22	**Team Project Part 1: Group discussion/data review** **(November 24 – Thanksgiving Holiday – Campus Closed)**
15	November 29	**Team Project Part 2: Team Project Report/Presentation**
16	December 1	**Final Exam Review** (Comprehensive 70% on Chapters 9-11 and 30% on other Chapters) **(December 06 – Last Day of Classes)**
	December 9	**FINAL EXAM {time starts at 1445 -1700 (2:45-5:00pm)}**