San José State University
College of Engineering
Biomedical, Chemical and Materials Engineering

BME 147, Quantitative and Statistical Methods for Biomedical Engineers

Fall 2016

Course and Contact Information

Instructor:	Tracy Holsclaw
Office Location:	EE ???
Email:	tracy.holsclaw@sjsu.edu
Office Hours:	Thursdays: 2:00 - 3:00 PM
Class Days/Time:	3-4:15 Tuesdays and Thursdays
Classroom:	IS 216
Prerequisites:	**Math 32, BME 115, BME 117, BME 177 (all with C- or better)**

Course Format

The course adopts a hybrid approach, combining lecture-based delivery format with active learning methods, such as problem-solving sessions and in-class group-based activities. Computer-based learning activities will be held weekly and will be based on free open-source software, such as R (statistics), as well as commercial software available in the computer-equipped classrooms (Matlab, SPSS, Minitab).

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. You are responsible for regularly checking announcements posted on Canvas or email messages sent out through Canvas to learn of any updates.

Course Description

Descriptive statistics; discrete and continuous random variables and distributions; hypothesis testing involving continuous and categorical variables, two and more treatments; linear and nonlinear model regression and optimization; analysis of survival data; design of clinical trials; algorithms of bioinformatics.

Learning Outcomes

The fundamental objective of this course is to introduce quantitative and computational methods for making inferences in biomedical engineering. Students will learn a number of essential statistical techniques for use in analyzing data from different types of experiments and will apply them to data from biomedical experiments and clinical studies.

Required Texts/Readings

Textbooks

Vidakovic, Brani. Statistics for Bioengineering Sciences: With MATLAB and WinBUGS Support (Springer Texts in Statistics) (2011).
Solution set at: http://springer.bme.gatech.edu/solbook.pdf

Other Readings

Nigel Bruce, Daniel Pope and Debbi Stanistreet, Quantitative Methods for Health Research. A Practical Interactive Guide to Epidemiology and Statistics, 1st Edition, Wiley-Interscience (2008).

Michael R. King and Nipa A. Mody, Numerical and Statistical Methods for Bioengineering. Applications in Matlab, 1st Edition, Cambridge University Press (2010).

Library Liaison (Biomedical, Chemical & Materials Engineering Department)

Linda Crotty Phone: (408) 808-2038 Email: linda.crotty@sjsu.edu

Assignments

Theory-based homework will not be collected but similar problems will appear on quizzes. It is expected that students do ALL theory-based problems assigned to master the course content and perform well on quizzes.

Computer-based homework will include data analysis and graphing. Homework must be submitted on the due date. Late assignments will lose 10% per calendar day.

Examinations

There will be a mid-semester examination and a final examination. Each examination will cover the entire course material covered until the time of the examination. The dates of the mid-semester examinations are indicated in the Lecture Schedule. The final examination will be held on **Tuesday 12/20 from 2:45-5:00.** There will be no make-up examinations.

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."

Weight of class assignments and examinations:

Final project	
Written report	15%
Oral report	5%
Quizzes: 10 quizzes will be graded (2 lowest dropped)	20%
Labs: 5 computer-based homework	30%
Midterms	30%

Absence during examinations and quizzes, without prior approval, will result in a zero. Prior approval will be given only under exceptional circumstances.

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Tentative Course Schedule

Ch 3- Elements of Probability
Ch 2- Descriptive Statistics and Matlab
Ch 5,6- Discrete and continuous random variables and their distributions.
Ch 7,9- Hypothesis testing involving continuous variables and confidence intervals. Hypothesis testing involving parametric variables.
Ch10 – two sample tests of the mean
Ch 11 - Design of clinical trials –Types and sources of data and numerical errors. Propagation of error and methods of calculating magnitude of the error.
Ch 12- non parametric tests of two data sets
Ch 14,15- displaying data outcomes
Ch 16 – Regression modeling
Ch 17 – Generalized linear models- non-linear regression
Ch 18 – Survival analysis, basic algorithms of bioinformatics
Ch 8, 19 – Overview of Bayesian method

Tuesday		Thursday	
		8/25 - Syllabus and intro, ch3: probability	
8/30 - ch3: probability		9/1 - ch3: review	**quiz 1-ch3**
9/6 - ch2: descriptive statistics		9/8 - ch5: discrete	
9/13 - ch 5: discrete/cont	**lab 1 due- ch2**	9/15 - ch 5,6: cont/Normal	**quiz 2- discrete**
9/20 - ch 13	**quiz 3- continuous**	9/22 - ch 6- CLT	**quiz 4 - Normal**
9/27 - ch 7,9 –hypothesis/CIs	**lab 2 due- ch13**	9/29 - ch 7,9	
10/4 - ch 7,9	**quiz 5-mean,var**	10/6 - review	**quiz 6-props, power**
10/11 - review		10/13 - **Midterm 1**	
10/18 - ch10 – two sample test		10/20 - ch11 – ANOVA	**quiz 7- ch10**
10/25 - ch11	**lab 3a due – ch11**	10/27 - ch11	**quiz 8 – ch11**
11/1 - ch12 –non-param tests		11/3 - ch 14 & 15	**lab 3b due-ch11,12**
11/8 - ch 14 & 15	**quiz 9- ch 11,12**	11/10 - ch 16-reg	
11/15 - ch 16 – reg		11/17 - ch 17 -GLM	**lab 4 due –ch 16**
11/22 - ch 17 – GLM	**quiz 10 – ch16**	11/24 - Thanksgiving Holiday	
11/29 - ch 18 –survival		12/1 - ch 8-Bayesian	**lab 5 due- ch 17,18**
12/6 - review		12/8 - **Midterm 2**	
12/13 - no class		12/15 - no class	
12/20 **Final** –2:45-5:00			

Learning objectives

- explain and apply descriptive statistics (including measures of central tendency and dispersion) to summarize experiment data; ch2
- know what a random variable is (discrete and continuous), some common probability distributions and how to calculate expected values; ch 5

- explain and implement methods for testing differences between treatment groups when the measurements are continuous, including: F-test; unpaired and paired t-test; analysis of variance; repeated measures ANOVA; ch 11
- explain and implement methods for testing differences between treatment groups when the measurements are categorical, including: Chi square analysis; Mann Whitney test; Kruskal-Wallis statistic; Wilcoxin signed-rank test; McNemar's test; ch12-13
- know how to identify sources of error, manner in which experimental errors interact with one another, and how errors are propagated
- know how to calculate the magnitude of the propagated error
- describe and implement methods for assessing the relation between two variables using linear and nonlinear regression analysis; ch 16 17
- explain and implement analysis of survival data and tests for evaluating the effects of treatments using survival data; ch 18
- design a clinical trial to test whether a treatment produces an effect (type of experiment, number of subjects, etc.), considering ethical issues of human trials;
- select and implement the appropriate statistical procedure needed for a particular experiment paradigm, data collected and question to be answered;
- understand algorithms used in bioinformatics

Classroom Protocol

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.

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.

Assignments

Students are encouraged to collaborate on all types of assignments. However, assignments must be individually prepared and submitted by each student.

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.

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%

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- 9 hours total), 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 and in-class assignments, computer-based activities, quizzes, mid-term examination, and the final examination.

University Policies

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Consent for Recording of Class and Public Sharing of Instructor Material

University Policy S12-7, http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor's permission to record the course and the following items to be included in the syllabus:

- "Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material."
    - It is suggested that the greensheet include the instructor's process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
    - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- "Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent."

Academic integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at http://www.sjsu.edu/senate/docs/S07-2.pdf requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sjsu.edu/studentconduct/.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) at http://www.sjsu.edu/aec to establish a record of their disability.

Accommodation to Students' Religious Holidays

San José State University shall provide accommodation on any graded class work or activities for students wishing to observe religious holidays when such observances require students to be absent from class. It is the responsibility of the student to inform the instructor, in writing, about such holidays before the add deadline at the start of each semester. If such holidays occur before the add deadline, the student must notify the instructor, in writing, at least three days before the date that he/she will be absent. It is the responsibility of the instructor to make every reasonable effort to honor the student request without penalty, and of the student to make up the work missed. See University Policy S14-7 at http://www.sjsu.edu/senate/docs/S14-7.pdf.