Course Description

This course is an introduction to probability and statistics for electrical engineers. The course covers topics in probability, combinatorics, random variables, functions of random variables, moments, inequalities and limit theorems, statistics, regression and estimation theory, hypothesis testing, quality control, system reliability, and computer usage in solving problems involving probability and statistics.

Course Objectives

- To obtain a broad mastery of discrete and continuous probability theory and statistical data analysis and to appreciate their importance within many disciplines.
- To apply methods of probability and statistics to electrical engineering problems such as quality control, hypothesis testing, and system reliability.
- To develop skill in using computer methods for solving problems in probability and statistics.

Topics

- Uncertainty and randomness, random experiments, probability spaces and events, sets and fields, probability models, probability approaches and measures, joint and conditional probability, dependent and independence.
- Probability by counting methods, permutations, combinations, Bernoulli trials, binomial probability law and applications.
- Single and pairs of random variables, discrete and continuous random variables, functions of random variables, joint and conditional distribution functions, important distribution functions and their applications in electrical engineering.
- Expected value and moments of random variables, mean and variance, correlation and covariance of pairs of random variables.
- Sums of random variables, sample mean and sample variance, the law of large numbers, central limit theorem, sampling distribution and confidence intervals.
- Hypothesis testing, curve fitting and linear regression, data correlation.
- Estimation theory and applications, system reliability.
- Using MATLAB for solving problems involving probability and statistics.

Prerequisite: - EE112 (Linear Systems) with a grade of C or better
- Basic knowledge in statistics and its applications
- Knowledge of advanced mathematics such as differential equations, linear algebra, complex variables, discrete mathematics

PLEASE DO NOT CONSUME FOOD IN THE CLASSROOM
Relationships of Course Learning Objectives to Program Objectives

This course is different from some other upper-division technical courses. Students will not be able to master the material simply just by memorizing things and formulas. Students cannot expect the type of questions that will tell which equations to use or what part of the lecture is typically related to the questions. Instead, students often need to interpret the problems, to define the problem and given/initial information, to think very carefully, to make up models to analyze, to check the solution and to interpret the conclusion from the solution. This course is a good training to prepare students for critical thinking and analytical skills, which are always expected from an engineer. Listed below are the relationships between student learning objectives and the program objectives.

3a. An ability to apply knowledge of mathematics, science, and engineering,
3b. An ability to design and conduct experiments, as well as to analyze and interpret data,
3e. An ability to identify, formulate, and solve engineering problems
   - Think critically to analyze engineering problems.
   - Interpret probability problems in both text and figure formats.
   - Analyze the engineering problems and solve them by using different probability axioms and counting models.
   - Master the probability counting formulas, the relative frequency and axiomatic probability approaches, and the analysis of uncertain data.
   - Physically understand the importance of random variables, common distribution functions, correlation of random variables, the law of large numbers, and elementary statistics.
   - Understand the relationship among probability mass functions, cumulative distribution function, and probability density functions, and how to obtain one from another.
   - Apply various probability functions to total signal energy, total signal power, energy spectral density, or power spectral density.
   - Apply probabilistic and statistical methods to engineering problems such as quality control, hypothesis testing, and system reliability.

3f. An understanding of professional and ethical responsibility
   - Discuss the important of quality control, testing, and system reliability.
   - Analyze some examples regarding the costs for engineering analysis versus failure rates.

3i. A recognition of the need for, and an ability to engage in life-long learning
   - Discuss some research problems and future trends in technology that partially can be solved/improved by deeper understanding of probability and statistic.

3k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
   - Use computer software (MATLAB) to solve complex problems involving probability and statistics.

PLEASE DO NOT CONSUME FOOD IN THE CLASSROOM
Outcome Assessment

- Class participation.
- Two midterm exams, a final exam, computer lab assignments and homework assignments.
- End-of-semester course and instructor evaluation.

ELECTRICAL ENGINEERING HONOR CODE

The Electrical Engineering Department will enforce the following Honor Code that must be read and accepted by all students.

“I have read the honor code and agree with its provisions. My continued enrollment in this course constitutes full acceptance of this code. I will not:

- Take an exam in place of someone else, or have someone take an exam in my place
- Give information or receive information from another person during an exam
- Use more reference material during an exam than is allowed by the instructor
- Obtain a copy of an exam prior to the time it is given
- Alter an exam after it has been graded and then return it to the instructor for re-grading
- Leave the exam room without returning the exam to the instructor.”

Measures Dealing with Occurrences of Cheating

- The student or students involved in cheating should get an F in the evaluation instrument (paper, exam, project, homework etc.) and should be reported to the Department and the University
- Second offense will result in suspension

Examples of some inappropriate acts

- I do not come to the lecture and ask my friend to sign up the attending sheet for me.
- I want to help my friend by signing up the attending sheet for him/her.
- I do not come to the lecture but will call the instructor asking for summarizing the lecture note just for me.
- I come to the class to sign up the attending sheet and then just leave.
- I come to the class at the end or close to the end of the lecture to just sign up the attending sheet.
- I can come to the class any time I want and leave any time I want to. There is no policy to keep me there to the end of the lecture or to force me to go to the class on time.
- I live far away from the school and so I can not come to the class often.

I think I can come up with good excuses for my academic performance:

- I am working full-time and so I do not have enough time for the class.
- I have quite many classes this semester.
- I am graduating this semester and so I just need to pass the course.
- I had several similar classes before and I got good grades from those. So maybe because of this class textbook is not right for me or may be I am not right with the instructor teaching style.
- I did not know that these topics will be included in the exam.
- I can not find the material related to this exam question in the text.

PLEASE DO NOT CONSUME FOOD IN THE CLASSROOM
Instructor: Thuy T. Le

Office: ENGR 383

Office hrs: TTH: 20:15 - 22:30, ENGR383

Contact inf.: Email: thuyle@email.sjsu.edu
Phone: 408-456-7480
Web: http://www.engr.sjsu.edu/tle

Meetings: MW: 07:05 - 08:20, ENGR337


Handouts: Handouts on MATLAB tutorials, probability by counting methods, Chebyshev’s inequality, sums of random variables, the law of large numbers, Central Limit Theorem, estimation theory, and system reliability.

Exams:

There will be two midterm exams and a comprehensive final exam. The dates of the midterm exams will be determined. The final exam date is **Friday December 15, 07:15 – 09:30**

- Exams are open-book and open-notes.
- Exams will cover the assigned reading materials and topics discussed in the lectures.
- There will be no make-up exams (except for very special circumstances, which require a written excuse and documentation).

Computer lab assignments

Small computer lab assignments will be assigned periodically and will be due in one week. The MATLAB is available on the PCs in room ENG387. If you have access to a Windows 95, 98, or NT based PC or to a Macintosh PowerPC and prefer to do the computer assignments elsewhere, you can purchase the Student Edition of Matlab from the Spartan Bookstore (manual + CD-ROM software). Version 5.3.1 is the current version for PC and version 5.2.1 is the current version for Macintosh PowerPC. The PCs in room ENG387 run an older version of Matlab (4.2c) on windows 3.1.

For each computer lab assignment, you must turn in:

- Both source program and output must be submitted on time (paper copy and a soft copy on a 3.5" diskette). **Late submissions will not be accepted.**
- There is no make-up for computer projects.
- To get full credit, the source program and output **must include reasonable comments.**

*PLEASE DO NOT CONSUME FOOD IN THE CLASSROOM*
Homework assignments

Homework assignments will be given periodically and will be due in one week. Homework solutions will be made available after the due date.

- Homework assignments must be submitted on time. Late submissions will not be accepted.
- There is no make-up homework.
- Each homework will be graded as 1 or 0 point only
- To get credit for your homework assignments, submissions must be neat, clean, and must be done professionally and seriously.

Lectures

The course will follow the selected subjects as listed on the course schedule. Additional lecture notes and examples will be given and discussed during the lectures.

- Students are responsible for the reading assignments from the text, notes, and handouts
- Students are responsible for following up the lecture materials.
- Students are responsible for reading additional information and examples in order to understand the materials discussed in the lectures.

Grading policy

The overall course grade (letter-grade) will be assigned based on the overall class distribution. The weights of the projects, homework assignments and the exams are listed below:

- Class participation and homework assignments: 10%
- Computer lab assignments 10%
- First midterm exam: 20%
- Second midterm exam: 20%
- A comprehensive final exam: 40%

PLEASE DO NOT CONSUME FOOD IN THE CLASSROOM
# Tentative Lecture Schedule

<table>
<thead>
<tr>
<th>Lecture #</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 1         | Green-sheet and policy, introduction to deterministic and probabilistic models  
MATLAB: Appendix G and handouts |
| 2 – 3     | Chapter 1: Introduction to Probability |
| 4 – 7     | Handouts: Probability by counting methods |

**First Midterm Examination**

| 8 – 12    | Chapter 2: Random Variables |
| 13 – 16   | Chapter 3: Several Random Variables |

**Second Midterm Examination**

| 17 – 19   | Handouts: Chebyshev’s inequality, sums of random variables, Central Limit Theorem, the law of large numbers |
| 20 – 23   | Chapter 4: Elements of Statistics |
| 24 – 28   | Handout: Estimation theory and system reliability |

**Final Examination**