EE345/EE485 Probability and Statistics for Engineers
Syllabus

Course Name: **Probability and Statistics for Engineers**
Course Number: **EE 345/EE 485**
Instructor: **Donald Estreich, Ph.D.**
Section: **001;** Course number: **3801**
Credit Hours: **3.0**
Semester Offered: **Fall 2018**
Meeting Days/Time: **Tuesday & Thursday from 2:30 PM to 3:45 PM**
Classroom: **Salazar Hall 2001**
Class Webpage: ***http://web.sonoma.edu/esee/courses/ee345/***

Sec	Lectures	Location	Instructor	Office	Office Hours	Email	Tel
001	**Tu Th 2:30 PM to 3:45 PM**	**Salazar 2001**	**Dr. Donald Estreich**	**Salazar Room 2010C**	**Tu/Th -- 2:00 PM until start of class and after class from 3:45 PM until 4:30 PM; Wed -- 2:15 PM until 2:45 PM; or by special arrangement**	**dbe@sonic.net (you can always e-mail me with any question)**	**(707) 664-2030**

Course Description: Basic concepts (set theory, elementary & conditional probability); combinatorics (sampling & counting methods); random variables (discrete & continuous random variables, PMF & PDF, independence, CDF, expectation values & variances); distributions (uniform, exponential, binomial, Poisson & Gaussian); joint distributions (functions of two random variables); limit theorems (law of large numbers and central limit theorem); important random processes (examples drawn from electrical engineering).

Prerequisite: Math 161, Math 211 and Math 241 (with a C- or better grade); or instructor's consent.

Required Textbook: Hossein Pishro-Nik, ***Introduction to Probability, Statistics, and Random Processes***, Kappa Research, LLC; 2014. Published simultaneously online at www.probabilitycourse.com. ISBN 978-0-9906372-0-2

Note: This book can be read in its entirety at https://www.probabilitycourse.com/ by clicking on the table of contents box on the left side of the webpage. Alternatively, it can be purchased in paperback format from Amazon.com for $34.19 plus shipping and tax (as of August 2018).

Additional References (optional):
Hossein Pishro-Nik, ***Student's Solutions Guide for Introduction to Probability, Statistics, and Random Processes***, Kappa Research, LLC, 2016. It is also available at **Amazon.com**

in both a Kindle version (Kindleunlimited) and a paperback version ($18.50 plus shipping and tax as of August 2018). ISBN 978-0-9906372-1-9

Contacting Instructor Outside of Classroom: Professor Estreich can best be contacted in person by visiting his office hours, immediately before and after class lectures on Tuesdays and Thursdays, or via his personal e-mail at sonic.net,

dbe@sonic.net

General information about class procedures, class requirements, academic content and schedule information can be found on the **EE 345 Webpage** and in the syllabus;

Online Course Material – EE 345 Class Website: The EE 345 Website is located at:

http://web.sonoma.edu/esee/courses/ee345/

Homework assignments, solutions to homework problems, lecture notes, copies of handouts, along with formal assignments, are available on the EE 345 Website in a timely manner.

Course Learning Objectives:

Upon completion of EE345/EE485, a student will be able to:

A. Understand the concepts of discrete probability, conditional probability, independence, and be able to apply these concepts to engineering problems.

B. Understand the mathematical descriptions of random variables including probability mass functions (PMF), cumulative distribution functions (CDF), probability distribution functions (PDF), and associated conditional PMF, CDF and PDF functions.

C. Be familiar with the more the commonly used random variables (such as the Gaussian random variable, Poisson random variable and others).

D. Be able to calculate the various moments of random variables such as mean values, variances and standard deviations (and higher order moments).

E. Be able to mathematically characterize multiple random variables using joint PMFs, CDFs and PDFs.

F. Be able to apply the concepts of multiple random variables to select engineering applications.

G. Understand the law of large numbers, the central limit theorem and how these concepts apply to engineering applications.

H. Use statistical concepts to analyze and interpret engineering data.

Course Grading:

Homework Assignments (approximately weekly)	**25%**
Two Midterms	**25%**
Class Short Quizzes (minimum of four quizzes)	**20%**
Final Examination	**30%**
Total =	**100%**

Grading:

Letter Grade	Score (Percentage)
A	90% to 100%
B	80% to 78%
C	70% to 79%
D	60% to 69%

The class grade will be based upon the following activities:

1. **Homework:** Homework will be assigned approximately weekly depending upon the topics. Homework is an important part of the process of learning for engineers. It both reinforce topics covered in class and introduces auxiliary topics extending the material covered in class lectures. Homework must be turned in by the end of the class period of the day it is due. After that, late homework will be penalized by 10% the first late day and 15% for each additional late day. **Homework will be assigned a zero score after one week beyond its due date.** Collaboration and checking answers on homework is allowed and encouraged. However, copying homework is not tolerated and categorized as cheating. In summary, you may collaborate on homework provided you first attempt to solve each problem on your own. Then if you get stuck on a problem, you are free to talk with other currently enrolled students about the problem solution. This is in the spirit of learning the course material.
2. **Examinations**: There will be three scheduled examinations during the semester – two midterms and one final examination. Examinations are based upon class lectures and assigned reading in the textbook. The final examination will test the content of the entire course and the student's ability to apply the principles learned during the course. **A student will receive a score of zero on the examination if he or she does not appear for the examination without an acceptable and pre-approved excuse. You must let the instructor know in advance if you must miss an examination, at which time you will be given an opportunity to take the examination early by special arrangement. There will be unannounced "short quizzes" at any time at the discretion of the instructor. No makeup is possible for missing a "short quiz."**

Examination summary:

Midterm 1	**Sept. 25, 2018 @ 2:30 PM**	**75 minutes in Room 2001 (closed notes and book; one page of notes allowed)**
Midterm 2	**Oct. 30, 2018 @ 2:30 PM**	**75 minutes in Room 2001 (closed notes and book; one page of notes allowed)**
Final Exam	**Dec. 11, 2018 @ 2:00 PM to 3:50 PM**	**110 minutes in Room 2001 (closed notes and book; two pages of notes allowed in final)**

All exams are closed book, closed notes. However, you may bring one page (8.5" by 11" in size) of notes (definitions, equations, diagrams, etc.) into the midterms and two pages of notes into the final examination.

3. **Class attendance and participation: You are expected attend all class sessions.** If you know you are going to miss a class, it is common courtesy to inform the instructor. Learning the course material is your responsibility. Instructors are not responsible for re-teaching the material you missed due to an absence or being late. Regular attendance is strongly encouraged because course content beyond that of the textbook itself may be presented and special clarifying examples may be worked out in the class period. In addition, questions during lectures are strongly encouraged to clarify course material. Part of a student's grade may be assigned for class participation at the discretion of the instructor. For SSU policies regarding class attendance see

   http://www.sonoma.edu/uaffairs/policies/studentinfo.shtml

4. **Academic Honesty:** You are responsible to behave ethically & honestly. Copying, cheating, forgery, and other unethical or dishonest actions are not tolerated, will result in a zero grade, and may be reported to SSU authorities. For statement of the SSU academic honesty policy refer to

   http://www.sonoma.edu/uaffairs/policies/cheating_plagiarism.htm

5. **Learning Disabilities:** Students requiring special accommodations should meet with the instructor the first or second week of the course to discuss how to meet your needs for the semester. Prior to meeting with the instructor, be sure you have met with the SSU Disability Services office on the first floor of Salazar Hall to be familiar with their policies. You may consult their website at

   http://web.sonoma.edu/dss/students/dss_services.html

6. **Other SSU policies:** Be sure you understand the policies that specifically affect you as a student of this course. For example:

   Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. How to Add a Class ***http://www.sonoma.edu/registration/addclasses.html*** has step-by-step instructions.

Grade Appeal Policy:
http://www.sonoma.edu/policies/grade-appeal-policy

Diversity Policy:
http://sonoma.edu/about/diversity

7. **Civility:** Keep cell phones and pagers TURNED OFF during the lecture periods – no exceptions! Show respect for your fellow students and keep in mind that SSU is a learning environment. If for some reason issues arise during the semester, please inform the instructor of the situation so that they can be resolved before the end of the semester.

Updated ABET Student Outcomes (Fall Semester 2018):

U0dated Student Outcomes	Performance Criteria	Level of Support
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics	Evaluated using homework and examinations; plus, class participation	**4**
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors		Not Supported
(3) an ability to communicate effectively with a range of audiences		Not Supported
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts		Not supported
(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives		Not supported
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions		Not Supported
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies		Not supported

EE Program Specific Criteria:

- The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.
- The curriculum must **include probability and statistics, including applications appropriate to the program name; mathematics through differential and integral calculus**; sciences (defined as biological, chemical, or physical science); and **engineering topics (including computing science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.**
- The curriculum for programs containing the modifier **"electrical,"** "electronic(s)," "communication(s)," "or "telecommunication(s)" in the **title must include advanced mathematics, such as differential equations, linear algebra, complex variables, and discrete mathematics.**

Fall 2018 Class Lecture and Exam Schedule:

#	Date	Day	Topic	Textbook Reading
1	Aug 21	Tues	Introduction to course; present important information on the class; expectations of students	Begin reading Chapter 1
2	Aug 23	Thurs	Review of set theory with examples; Venn diagrams	Chapter 1 – Section 1.2 (pp. 2-19)
3	Aug 28	Tues	Set operations (union & intersection); Cardinality (countable & uncountable sets); Concept of a function	Section 1.2 (pp. 2-19)
4	Aug 30	Thurs	Random experiments & probability – Axioms of probability; Calculating probability	Section 1.3 (pp. 20-38)
5	Sept 2	Tues	Discrete and continuous probability models	Section 1.3 (pp. 20-38)
6	Sept 4	Thurs	Conditional probability (tree diagrams); Independence in probabilities	Section 1.4 (pp. 39-65)
7	Sept 11	Tues	Law of total probability; Bayes' rule	Section 1.4 (pp. 39-65)
8	Sept 13	Thurs	Combinatorics: counting methods; Ordered sampling with & without replacement (permutations)	Chapter 2 – Section 2.1 (pp. 81-103)
9	Sept 18	Tues	Unordered sampling without replacement (combinations)	Section 2.1 (pp. 81-103)
10	Sept 20	Thurs	Bernoulli trials and binomial distribution; applications	Section 2.1 (pp. 81-103)
11	**Sept 25**	**Tues**	**Midterm Exam #1**	**In class**
12	Sept 27	Thurs	Review examination; begin topic of discrete random variables	Chapter 3 (Basic Concepts) – Section 3.1 (pp. 107-125)
13	Oct 2	Tues	Probability mass function (PMF); Special distributions	Section 3.1 (pp. 107-125)
14	Oct 4	Thurs	Cumulative distribution function (CDF); Expectation and variance	Section 3.2 (pp. 134-149)
15	Oct 9	Tues	Continuous random variables and distributions; Probability distribution function (PDF); Expected values and variance	Chapter 4 – Section 4.1 (pp. 161-179)
16	Oct 11	Thurs	Functions of continuous random variables	Section 4.1 and Section 4.2 (pp. 179-199)
17	Oct 16	Tues	Special distributions – uniform, exponential, normal (Gaussian), and other distributions; Examples	Section 4.2 (pp. 179-199)
18	Oct 18	Thurs	Mixed random variables; Introduction to the Dirac delta function	Section 4.3 (pp. 199-214)
19	Oct 23	Tues	Joint distribution (two random variables); Joint PMFs; Joint CDFs	Chapter 5 – Section 5.1 (pp. 219-246)
20	Oct 25	Thurs	Joint distributions: Conditional PMF and CDF; Conditional expectations and variances	Section 5.1 (pp. 219-246)

21	**Oct 30**	**Tues**	**Midterm Exam #2**	**In class**
22	Nov 1	Thurs	Two continuous random variables; Joint PDFs; Joint CDFs	Section 5.2 (pp. 250-290)
23	Nov 6	Tues	Conditioning by another random variable; Independent random variables; Law of Total Probability	Section 5.2 (pp. 250-290)
24	Nov 8	Thurs	Two random variables: Covariance & correlation; Variance of a sum; Correlation coefficient; Bivariate normal distribution	Section 5.3 (pp. 291-303
25	Nov 13	Tues	Statistical inference; Maximum likelihood estimation (MLE)	Chapter 8 – Section 8.1 (pp. 423-428) & Section 8.2.3 (pp. 435-442)
26	Nov 15	Thurs	Statistical inference continued	Section 8.2.3 (pp. 435-442)
27	Nov 20	Tues	Limit theorems: Law of large numbers;	Chapter 7 – Section 7.1 (pp. 377-392)
28	**Nov 22**	**Thurs**	**Thanksgiving Break (No class)**	**No assignment**
29	Nov 27	Tues	Noise in electric circuits as an example of a random variable; Thermal noise and shot noise	Lecture notes to be handed out
30	Nov 29	Thurs	Random variables in communication systems	Lecture notes to be handed out
31	Dec 4	Tues	Random variables in other fields of engineering	Lecture notes to be handed out
32	Dec 6	Thurs	Wrap up course -- Review for final examination	Covers all material listed above (that means the entire course is on the final)
--	**May __**	**Tues**	**Final Exam – Time and Room**	**1 hour 50 minutes**

Note: This schedule is as of August 20, 2018. The instructor reserves the right to change the schedule during the semester if warranted to accommodate the needs of the class.

Last updated on September 5, 2018
DBE