Fall 2018 Syllabus (CRN 19001)
EL 3373: Engineering Probability and Statistical Methods
Tuesday/Thursday 10:30 – 11:50

Instructor: Scott Starks, PhD, PE, Professor of Engineering Leadership
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TEXTBOOK: Ross, Sheldon, <u>A First Course in Probability</u>, 10th Edition, Pearson Publishing, 2014..

COURSE DESCRIPTION: Problems involving discrete and continuous random variables, distribution functions, moments, statistical dependence, and an introduction to statistical methods. Emphasis to be on formulation of physical problems. *Prerequisite:* MATH 2313 with a grade of "C" or better.

EL 3373 is a course that introduces the topic of probability, an important area of mathematics with many practical applications in electrical and computer engineering and computer science. At the conclusion of this course, you will have developed a number of practical skills that you can use in the future. Many of you will go on to graduate studies and will use concepts and techniques from probability to process data relating to your graduate projects, theses and dissertations. Additionally, many of you who go on to careers in industry will apply probability in the context of manufacturing, quality control and assurance, modeling, and simulation

LEARNING OBJECTIVES: At the end of the semester, a student will be able to:
1. Solve basic counting problems involving permutations and combinations of equally-likely events.
2. Use elements of set theory and axioms of probability to determine the probability of complex events, and apply Bayes Theorem to the solution of conditional probability problems.
3. Solve problems involving independent events and independent random variables.
4. Determine marginal and joint cumulative distribution functions (CDF), probability mass functions (PMF) and probability density functions (PDF) and use them to compute various expected values of discrete and continuous random variables.
5. Solve problems involving Gaussian, uniform, exponential, binomial, and Poisson random variables.
6. Compute PDF's and CDF's of a function of a random variable.
7. Computer expected values of sums of RV's and the covariance and correlation of pairs of random variables.
8. Use the Central Limit Theorem, significance tests and hypothesis tests in introductory statistics problems.

GRADING

The course grade will be based on the following:

1. **3 Mid Term Exams** (20% each)
2. **Final Exam** (25%)
3. **Homework (15%)**
4. **Binder** (10% Bonus)

90 – 100	A	80 – 89	B	70 – 79	C	60 – 69	D	< 60	F

Mid Term Exams: There will be three Mid Term Exams for this course. The date of each Mid Term Exam will be announced in class at least one week prior.

Final Exam: Final examinations are scheduled to be two hours, forty-five minutes in length and take place during the final examination period. It is the policy of the university not to administer a second final examination in the course. It is also university policy that students shall not have more than two final examinations in a single day. In the unlikely event that the examination schedule results in a student having three final examinations on a single day, the faculty member **upon the request of the student** shall reschedule the second of that student's three examinations.

Class Preparation and Participation: You should be an active participant in your class. Your participation will make the class not only good for you but also for your classmates and instructor. At a minimum, you should develop at least three questions, issues, or perspectives you would like to raise in class. **You should write these down prior to class and be ready to share them for discussion. Students will be called upon randomly by the instructor to present their questions to the rest of the class.**

Homework: Problems will be assigned on a routine basis. It is crucial that you learn how to work the assigned problems. You will find assignments posted on the course's Blackboard website.

Learning Environment: In order to do well in the course, it is advised that you complete reading assignments, homework, and other assignments **BEFORE** you arrive for class.

Attendance: Classroom attendance is mandatory. Excused absences will be granted according to the rules promulgated in the University Catalog. **Students may request an excused absence by bringing evidence related to their absence to the Instructor's Office. Every unexcused absence will reduce the student's grade by 3 points**.

Scholastic Integrity/Academic Honesty - In accordance with University regulations, scholastic dishonesty on a given assignment will be referred to the Dean of Students and may result in a zero on the assignment, an "F" in the course, or even suspension from the university. If you need assistance with your assignments, please consult authorized sources of help. "Plagiarism" is the unattributed use of someone else's work -- a classmate's, a website's, even a teacher's from another course. For more information on Scholastic Dishonesty and/or Plagiarism, consult the **Handbook of Operating Procedures: Student Affairs**, which is available in the Office of Student Life.

Classroom Etiquette: Part of being a professional is being on time and being prepared to do your job. This applies to your career as a student as much as it does to your future career as an engineer. Coming to class late is unprofessional and is very disruptive to the class. You are expected to be in the class and prepared to participate at the scheduled start time. If you are late to class, you are to come in quietly and take your seat. **A class roll will be provided each class period. You should sign the roll to indicate your presence in the class.**

Wireless devices are allowed in the classroom. However, please use professional discretion with wireless devices, shutting them off, or setting them to mute or silent mode before coming to class. Do not answer incoming calls or make outgoing calls except in an emergency. Do not use text messaging or web browser features while in class. Do not play games or aimlessly search the web during class. If you must answer the phone, leave the class discretely. You may return to the class once your call is finished.

The Center for Accommodations and Support Services (CASS): Students with special needs that are registered with CASS are to contact me immediately so that we can work out accommodations for your needs. CASS may be contacted at 747-5148, cass@utep.edu or go to Room 106 Union East Building.

Scientific Calculator: An inexpensive scientific calculator is **REQUIRED** for this class. All models of calculators approved for the Fundamentals of Engineering Exam (https://ncees.org/exams/calculator/) are permitted for use during exams and quizzes. You should bring your calculator to class daily because you never know when you might have an in-class quiz that will require its use.

You will not be allowed to use a cell phone, tablet or laptop in lieu of a scientific calculator on any in-class quiz or exam.

EL 3373　　Topical Outline

Combinatorial Analysis
Basic Principle of Counting, Permutations, Combinations, Multinomial Coefficients

Axioms of Probability
Sample Space and Events, Axioms, Equally Likely Events, Probability as Measure of Belief

Conditional Probability and Independence
Conditional Probability, Bayes' Formula, Independent Events,

Random Variables
Discrete Random Variables, Expected Value, Variance, Bernoulli and Binomial Random Variables, Poisson Random Variables, Expected Values of Sums of Random Variables, Cumulative Distribution Function

Continuous Random Variables
Expectation and Variable of Continuous Random Variables, Uniform Random Variable, Normal Random Variables, Exponential Random Variables, Distribution of a Function of a Random Variable

Jointly Distributed Random Variables
Joint Distribution Functions, Independent Random Variables, Sums of Independent Random Variables, Conditional Distributions, Order Statistics, Joint Probability Distribution of Random Variables

Properties of Expectation
Expectation of Sums of Random Variables, Moments, Covariance, Variance of Sums, Correlations, Conditional Expectation, Moment Generating Function

Limit Theorems
Chebyshev's Inequality and the Weak Law of Large Numbers, Expected Values of Sums, Random Sums of Independent Random Variables, Central Limit Theorem, Applications of the Central Limit Theorem

Hypothesis Testing
Significance Testing, Binary Hypothesis Testing