APM395/595: PROBABILITY AND STATISTICS FOR ENGINEERS

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Office Hours: To be announced. In general, will be during the 2 days before a homework assignment is due and by appointment.
Some office hours will occur online/Hours will be posted on Blackboard.

Lectures: APM395/595, Mondays and Wednesdays, 12:45 – 2:05 pm, a mixture of both in person and online class (via Zoom). **This is a blended class!**

Course Description: This course provides a rigorous introduction to calculus-based probability and statistical theory, with applications primarily drawn from engineering and the environmental sciences. Topics include: descriptive statistics and data presentation, probability, the theory and use of discrete and continuous probability distributions, confidence intervals, classical and distributional hypothesis testing, and regression analyses.

Prerequisites: One year of calculus, computer skills (or at least no fear of computers)

Course Packet: Course reader [posted on Blackboard]

Required Text: J.L. Devore, *Probability and Statistics for Engineering and the Sciences*, 9th edition

Grading:

Homework	20%
Semester Project	10%
Quizzes (administered during online classes)	10%
Exam 1, Oct 13	17.5%
Exam 2, Nov 17	17.5%
Final	25%

Homework assignments will count towards your final grade! If you don't do the homework your highest possible grade is a B-!

Grades:	A: 93 – 100	B: 83 – 87	C: 73 – 77	F: < 65
	A-: 90 – 93	B-: 80 – 83	C-: 70 - 73	
	B+: 87 – 90	C+: 77 – 80	D: 65 – 70	

Online Classes: We currently plan to have online classes on the following dates:
Sept 13th **Sept 27th** **Oct 11th** **Oct 25th** **Nov 8th** **Dec 6th**

Quizzes: Quizzes will be done as part of the online portion of this class.
Problem Sets:

a) Problem sets will be due prior to class, usually every Wednesday. In general, late assignments will be accepted only with prior permission from the TA or Professor.
b) For grading purposes, the lowest homework grade will be dropped.
c) You will be required to use the statistical package R in this class. This software is located in all computer clusters on campus and is available for free download online (http://www.r-project.org and https://www.rstudio.com/). R tutorials will be posted.

Course Objectives:
To provide an introduction to probability and statistical theory, statistical techniques, risk analysis, and uncertainty analysis with examples drawn from civil, environmental, water resources and related engineering and environmental disciplines. Topics include:

a) Descriptive statistics including visual and numerical data presentation;
b) Probability theory, including Bayes Theorem, conditional probability, independence, and counting;
c) Theory of discrete and continuous probability distributions, including the introduction to a variety of commonly implemented probability distributions, parameter estimation techniques, and percentile and moment estimation;
d) Classical hypothesis testing and confidence interval estimation; and
e) Linear regression and model building.

Program Learning Objectives:
By the end of the semester students should be able to:

a) Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (ABET Outcome 1)
b) Communicate effectively with a range of audiences (ABET Outcome 3)
c) Analyze and interpret data and use engineering judgment to draw conclusions (ABET Outcome 6)
d) Understand to need for statistical techniques in aiding with many aspects of their professional practice

College Learning Outcomes:
This course will contribute to students achieving the following College-wide learning outcomes:

a) Quantitative Reasoning: Students will be able to effectively describe, interpret, apply, and evaluate quantitative information.
b) Communication: Students will be able to formulate and present ideas that reflect critical thinking skills and show awareness of audience, context, and purpose, and present a well-developed argument
c) Technological and Information Literacy: Students will be able to: use critical thinking skills to determine the information needed to solve a problem, access information using appropriate technologies, and effectively and appropriately use information to accomplish a specific purpose.
d) Critical Thinking: Students will be able to: identify, analyze, evaluate, and develop well-reasoned arguments.

Academic Dishonesty:
Academic dishonesty is a breach of trust between a student, one's fellow students, or the instructor(s). By registering for courses at ESF you acknowledge your awareness of the ESF Code of Student Conduct (https://www.esf.edu/students/handbook/documents/19-20%20Student%20Handbook.pdf), in particular academic dishonesty includes but is not limited to plagiarism and cheating, and other forms of academic misconduct. The Academic Integrity Handbook contains further information and guidance (https://www.esf.edu/provost/documents/AcademicIntegrity.pdf). Infractions of the academic integrity code may lead to academic penalties as per the ESF Grading Policy (https://www.esf.edu/provost/documents/GradingPolicy.11.12.2013.pdf).

While we don't discourage students discussing problems from the homework, we do discourage students from working entirely with others, and handing in assignments that are replicas of other student's submissions. Such submissions will be considered a breach of academic integrity and will be addressed according to university guidelines. The homework assignments are designed to help you understand and synthesize the course material. While they are worth 20% of your total grade, generally I do not lower someone's grade based on their homework assignments (and if so, no more than one step of a grade, such as a A- to a B+, unless someone has not handed in or fully completed multiple assignments). The exams are worth 60% of your final grade and are where you show what you have learned in this course.

I would encourage you to:

1. ALWAYS attempt every problem on the assignment on your own before coming to office hours or discussing problems with other students. Office hours are not a place to sit and do your entire assignment. You should come with questions.
2. If possible, come to office hours for help. While your fellow students are awesome, the TA and I generally know the material and can explain it better than your fellow students can.
3. If you work with others, you should:
    a. Avoid going problem-by-problem through the assignment with others.
    b. Always provide your own write-up and discussion.
    c. Never copy another student's work line-for-line.
    d. Indicate at the top of your assignment who you have worked with on the assignment.

Ultimately, academic integrity is a core value of our educational institution.

Sources of Support and Class Absence:
If you experience academic or personal difficulties that affect your studies or life, there are people and resources that will help you. There is a website that serves to answer many student questions: http://www.esf.edu/students/success. In addition, the ESF Office of Student Life, 110 Bray Hall (470-6660) will provide academic support, career guidance, personal counseling, or direct you to the proper source of help. If you encounter a situation beyond your control in which you will be missing 3 or more days of classes, you should contact the Office of Student Life and they will get in touch with all your instructors for you. Supportive documentation may be required.

Accommodations for Students with Learning and Physical Disabilities:
SUNY-ESF works with the Office of Disability Services (ODS) at Syracuse University, who is responsible for coordinating disability-related accommodations. Students can contact ODS at 804 University Avenue- Room 309, 315-443-4498 to schedule an appointment and discuss their needs and the process for requesting accommodations. Students may also contact the ESF Office of Student Affairs, 110 Bray Hall, 315-470-6660 for assistance with the process. To learn more about ODS, visit http://disabilityservices.syr.edu. Authorized accommodation forms must be in the instructor's possession one week prior to any anticipated accommodation. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

Inclusive Excellence Statement:
As an institution, we embrace inclusive excellence and the strengths of a diverse and inclusive community. During classroom discussions, we may be challenged by different ideas. Understanding individual differences and broader social differences will deepen our understanding of each other and the world around us. In this course, all people are strongly encouraged to respectfully share their unique perspectives and experiences. This statement is intended to help cultivate a respectful environment, and it should not be used in a way that limits expression or restricts academic freedom at ESF.

Religious Observance:
ESF protects the rights of students to observe religious holy days according to their tradition. Students will be provided an opportunity to make up any exam or work requirements that may be missed due to a religious observance provided they give the instructor reasonable advance notification.

TENTATIVE COURSE SCHEDULE:

Week of:	Topics:	Sections in Text:
August 30	Visual displays of data, Numerical displays of data	1.1 – 1.4
September 6	Elements of probability, Conditional probability, Bayes theorem, Independence	2.1 – 2.2 2.4 – 2.5
September 13	**Sept 13th Online**/Sept 15th In-Person Counting: Combinations and Permutations	 2.3
September 20	Discrete random variables, Probability and cumulative distribution functions, Expectation and moments of discrete random variables	3.1 – 3.3
September 27	**Sept 27th Online**/Sept 17th In-Person Bernoulli, geometric, and binomial distributions, Continuous random variables, expectations and moments of continuous random variables	 3.4 – 3.5 4.1 – 4.2
October 4	Uniform and normal distributions	4.1 – 4.3
October 11	**Oct 11th Online**/Oct 13th In-Person, Review for Exam 1 and Exam 1	
October 18	Normal approximation to binomial distribution Lognormal distribution Poisson and Gamma distributions	4.3 4.5 3.6, 4.4
October 25	**Oct 25th Online**/Oct 27th In-Person Covariance and correlation coefficients Hypothesis testing for mean of single sample P-values, choice of hypothesis	 5.1 – 5.4, 8.1 – 8.2 8.4 – 8.5
November 1	Hypothesis tests for means of multiple samples Hypothesis tests for variances of multiple samples	9.1 – 9.2 9.5
November 8	**Nov 8th Online**/Nov 10th In-Person Simple linear regression Multiple linear regression	 12.1 – 12.5 12.1 – 12.5
November 15	Review for Exam 2 and Exam 2	
November 29	Regression model building, inferences and predictions	13.4 – 13.5
December 6	**Dec 6th Online**/Dec 8th In-Person Confidence intervals for the mean Confidence intervals for the variance and standard deviation	 7.1 – 7.3 7.4
Finals Week	Final Exam	