

**1: Course Number and Name**

- a. **ENGR 3305:** Probability and Risk in Engineering, Spring 2022
- b. Section 010, MWF 11:00 – 11:50 pm

**2: Credits and Contact Hours**

- a. **Credits:** 3
- b. **Contact Hours:** 3 hours/week (Classroom)

**3: Instructor Information**

- a. **Course Coordinator:** Manuel Garcia
- b. **Instructors:**
  - i. Manuel García, 325-486-5515, [manuel.garcia@angelo.edu](mailto:manuel.garcia@angelo.edu). Office: VIN 274. For office hours see [faculty homepage](#).

**4: Required Course Materials**

Navidi, W. Statistics for Engineers and Scientists, 5th Ed. (2020). McGraw-Hill. Connect required.

**5: Technology Requirements**

To successfully complete this course, you need to

- a. McGraw Hill Connect access
- b. **Squarecap** is a web-based classroom response application that your instructor will be using during your course for in-class Q&A and verifying your attendance. Use any Wi-Fi capable device, visit <http://www.squarecap.com> and login with your Angelo State account. Subscription required.
- c. Python and Jupiter Notebooks. Projects are solved using Python in a Jupyter Notebook. You can access two ways:  
Via the VDI Server at Angelo State: <http://view.angelo.edu>  
Local installation in your personal computer: [Anaconda Python](#)
- d. Online access to the classes via GoogleMeet: <https://meet.google.com/akx-uxne-aca>

**6: Specific Course Information**

- a. **Catalog Description:** Modeling of random processes in engineering design and decision making. Fundamentals of probability spaces; random variables; dependence and independence; mean values and moments. Development of mathematical and simulation models, and their relevance to engineering design and decision making
- c. **Prerequisites:** MATH 3415
- d. **Required or elective:** Required (Engineering Principles)

**7: Specific Goals for the Course**

- a. Course Learning Outcomes:
  1. Describe uncertainty, randomness, and imperfect knowledge; and describe applications of decision making in various disciplines within civil engineering;

2. Identify probabilistic events, and calculate the probability of those events using various mathematical tools;
3. Analyze, construct, and communicate probability of outcomes using various mathematical tools;
4. Describe and construct probabilities based on multiple, dependent variables;
5. Utilize numerical and simulation methods in software programs (e.g. MS Excel, Python) to solve complicated probability scenarios;
6. Analyze probabilistic distributions and formulate engineering recommendations with known levels of confidence and risk;
7. Analyze sociotechnical probabilistic situations (including impacts of engineering solutions in global, economic, environmental, and societal contexts) and justify recommendations with known levels of confidence and risk.

b. Course Learning Outcome Mapping to ABET Criterion 3 Student Outcomes:

**Table 1: Course Learning Outcomes mapped to ABET Student Outcomes**

<b>ABET Student Outcomes</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
1. Solve Problems	X	X	X	X	X	X	X
2. Design							X
3. Communication							X
4. Ethics & Professionalism							X
5. Teamwork							X
6. Experimentation							
7. Acquire New Knowledge					X		X

**8: Topics Covered**

1. Sampling and Descriptive Statistics
2. Probability, Conditional Probability, and Events Space
3. Probability Distribution Functions
4. Propagation of Error
5. Hypothesis Testing and Confidence Intervals
6. Correlation and Regression Analysis
7. Special Topics: Programming and Statistical Projects

## **9: Course Delivery and Communications**

### **9.1: Delivery Method(s)**

This is a face-to-face course with learning resources and supplemental materials posted in Blackboard. Accommodations will be made for students who are in quarantine or isolation and are unable to attend. Exams will be face to face

### **9.2: Communications**

You may communicate with the instructor via Blackboard, email, phone, or GroupMe text. Faculty will respond to these within 24 hours during working hours Monday through Friday. Weekend messages may not be returned until Monday.

Written communication via email: All private communication will be done exclusively through your ASU email address. Check frequently for announcements and policy changes. In your emails to faculty, include the course name and section number in your subject line.

Office hours or advising may be arranged with the assistance of Collaborate, or Google Meet platforms

## **10: Professionalism**

Professional engineering standards apply in this class. You are expected to demonstrate a behavior consistent with the conduct of an individual practicing in the engineering profession. You are expected to: (1) come prepared for class; (2) respect faculty and peers; (3) demonstrate responsibility and accountability for your own actions; (4) demonstrate sensitivity and appreciation for diverse cultures, backgrounds, and life experiences; (5) offer and accept constructive criticism in a productive manner; (6) demonstrate an attitude that fosters professional behavior among peers and faculty; (7) be punctual to class meetings; (8) maintain a good work ethic and integrity; and (9) recognize the classroom as a professional workplace.

## **11: Graded Material**

You are expected to meet every class meeting on time and prepared. Attendance will be taken. Should you find it necessary to miss a class for any reason, you are expected to notify your instructor as early as the absence is known—preferably before the absence. Squarecap will be used to register your attendance.

All significant engineering projects are completed by teams. You will be assigned to a team for most labs. The purpose of the teams is to give you practice working together and to provide a support group for you within the class. Outside of class, please collaborate and work with anyone you wish.

### **11.1: Class Attendance, Participation, Timeliness and Teamwork**

The number one complaint of engineering clients is the timeliness of deliverables (reports, drawings, specifications, etc.). As a professional engineer you will be expected to arrive at scheduled meetings on time and prepared. Late proposals are not generally accepted. Late specifications or drawings may cost the engineer a monetary penalty. Professional engineering standards apply in this course.

You are expected to meet every class meeting on time and prepared. Attendance will be taken. Should you find it necessary to miss a class for any reason, you are expected to notify your instructor as early as the absence is known—preferably before the absence. It's important that you communicate clearly your instructors.

Your online assignments will be due at the time specified on McGraw Hill Connect. Any assignments submitted in hard copy are due at the beginning of class on the due date. Your instructor may assess penalties for late work.

### **11.2: Reading Assignments and Homework**

You will be given reading and homework assignments nearly every lesson. Reading assignments will come from the assigned textbooks or other materials provided or available via the web. The homework assignments will consist of questions to be answered during your reading and preparation for class. Reading and homework assignments will be distributed via the Blackboard and McGraw Hill Connect.

Readings and homework assignment will be posted on McGraw-Hill Connect and Blackboard. Readings are due before the lecture and homework assignments contains practice problems and it is posted once a week or every two lectures. Online assignments will be due at the time specified on McGraw Hill Connect. Writing assignments are submitted in **PDF format only** before the due date via Gradescope. Programming assignments will be submitted in the Jupyter notebook format via Gradescope. Your instructor may assess penalties for late work

### **11.3: Quizzes**

Instructors will use a Student Response System SRS for in class questions and interaction<sup>1</sup>. The SRS questions will be unannounced and unscheduled. They are intended to quickly determine student comprehension, provide instant feedback, and adapt the pedagogy during class. They encourage engagement and are graded instantly.

### **11.4: Course Exercises**

There will be in-class exercises in this course. Participation in exercises is expected from all students. Zero points will be awarded for missed exercises. These exercises cannot be made up.

### **11.5: Exams**

Make-up exams will only be given for extenuating circumstances, unless prior arrangements with the instructor are agreed upon. Proof, such as a doctor's note or other official document, may be required for unexcused absences during an exam. Approval from the Disability Services office is needed if you are under quarantine due to a close contact or sickness. Please complete the COVID-19 Wellness Screening daily.

Exams will not be open textbook or notes, but a formula sheet will be provided. Details will be discussed closer to the exam time.

### **11.6: Term Project Reports**

There will be projects assigned in this class. The projects can be completed by group effort (2 people maximum). These reports must be completed *clearly* and *legibly* for full credit. The reports will be prepared using a word processor (e.g., Word, Pages, LaTeX). Tables and graphs must also be completed using a software program (e.g. Python). Any sloppy report that is not formatted correctly will receive reduced credit down to zero credit.

A technical report must include the following sections:

- A *cover page* that states the title of the report, the author(s) of the report, the course number, the semester, and any other organizational information;
- An *abstract* or *executive summary* that presents a short summary and motivation of the entire report (between 100 to 200 words);

- An *introduction* that provides the purpose, technical background, motivation for the report, and a description of theoretical considerations and an explanation of why those theories and equations are included in the report;
- A detailed *procedure* that explains the type of data being considered, how various probabilistic models were applied to the data set, and any other applied theoretical considerations. This procedure should not be a bulleted list of tasks that are done – instead, this procedure must explain using complete sentences. Finally, equations are part of the sentences and paragraphs and help explain the procedure. A list of equations is not self-explanatory and should be avoided.
- A *results* section that includes necessary sample calculations, and graphs, and tables containing major results. Tables/graphs with intermediate calculations, researched data or long computational results should go in the appendix section;
- A *discussion* that specifically answers the assigned questions given by your instructor where the discussion is supported by theory described in your *introduction* and supported by data presented in your *results* section;
- A list of *conclusions* that is drawn from your *results* and *discussion*. Your conclusions must clearly reiterate thoughtful statements and not simply re-state facts; and
- A list of bibliographic references cited in the report. Do not include a referenced not cited in the body of the text
- An *appendix* that includes additional tables, followed by figures, followed by sample calculations, all listed in numerical order. Numerical order is dictated by the order in which the table, figure, or sample calculation is mentioned in the main body of the technical report. Do not repeat tables or graphs both in the body of text and appendices. Do not include a figures or tables not referenced in the body of the text. Do not include list of equations in the appendix
- **Do not include** handwritten material

In general, your reports must be organized according to this format, sections must be clearly labeled and contain the correct content, grammar and sentence structure must be correct, the overall appearance must be neat and professionally assembled, and the technical content must be correct.

### 11.7: Grades: Weighting and Letter Grades

The weighting system shown in Table 2 will be used in determining final grade for the course

**Table 2: Grade Weighting**

<b>Item</b>	<b>Percent</b>
Homework	16%
Quizzes	8%
Readings	6%
Project	20%
Exams	30%
Final Exam	20%
Total	100%

The instructor will determine letter grades for the course using his professional judgment, and the following standards as described in the University Catalog:

A = excellent work      B = good work      C = average work      D = poor work      F = failing work

### **11.8: Incomplete Grade Policy**

It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 11 [Grading Procedures](#)<sup>2</sup> for more information.

### **12: Classroom and University Policies and Student Support**

All students are required to follow the policies and procedures presented in the [Angelo State University Student Handbook](#)<sup>3</sup> and [Angelo State University Catalog](#)<sup>4</sup>.

#### **12.1: Accommodations for Students with Disabilities**

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA) and subsequent legislation.

Student Disability Services is located in the Office of Student Affairs, and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student's responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at [ADA@angelo.edu](mailto:ADA@angelo.edu). For more information about the application process and requirements, visit the [Student Disability Services website](#).<sup>5</sup> The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dr. Dallas Swafford  
Director of Student Disability Services  
Office of Student Affairs  
325-942-2047  
[dallas.swafford@angelo.edu](mailto:dallas.swafford@angelo.edu)  
Houston Harte University Center, Room 112

#### **12.2: Title IX at Angelo State University**

Angelo State University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from sex discrimination of any kind. In accordance with Title VII, Title IX, the Violence Against Women Act (VAWA), the Campus Sexual Violence Elimination Act (SaVE), and other federal and state laws, the University prohibits discrimination based on sex, which includes pregnancy, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination and unwelcome behavior of a sexual nature. The term includes sexual harassment, nonconsensual sexual contact, nonconsensual sexual intercourse, sexual assault, sexual exploitation, stalking, public indecency, interpersonal violence (domestic violence or dating violence), sexual violence, and any other misconduct based on sex.

You are encouraged to report any incidents involving sexual misconduct to the Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator, Michelle Miller, J.D. You may submit reports in the following manner:

Online: [Incident Reporting Form](#)<sup>6</sup>

Face to Face: Mayer Administration Building, Room 210

Phone: 325-942-2022

Email: [michelle.miller@angelo.edu](mailto:michelle.miller@angelo.edu)

Note, as a faculty member at Angelo State, I am a mandatory reporter and must report incidents involving sexual misconduct to the Title IX Coordinator. Should you wish to speak to someone in confidence about an issue, you may contact the University Counseling Center (325-942-2371), the 24-Hour Crisis Helpline (325-486-6345), or the University Health Clinic (325-942-2171).

For more information about resources related to sexual misconduct, Title IX, or Angelo State's policy please visit the [Title IX website](#).<sup>7</sup>

### **12.3: Student Absence for Observance of Religious Holy Days**

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for [Observance of Religious Holy Day](#)<sup>8</sup> for more information.

### **12.4: Information About COVID-19**

Please refer to ASU's [COVID-19 \(Coronavirus\) Updates](#)<sup>9</sup> web page for current information about campus guidelines and safety standards as they relate to the COVID-19 pandemic.

### **12.5: Student Conduct Policies**

#### **12.5.1: Academic Integrity**

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

#### **12.5.2: Plagiarism**

Plagiarism is a serious topic covered in ASU's [Academic Integrity policy](#)<sup>10</sup> in the Student Handbook. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it off as one's own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list.

Papers are subject to be evaluated for originality via Turnitin or SafeAssign. Resources to help you understand this policy better are available at the [ASU Writing Center](#)<sup>11</sup>.

#### **12.5.3: Copyright Policy**

Students officially enrolled in this course should make only one printed copy of the given articles and/or chapters. You are expressly prohibited from distributing or reproducing any portion of course readings in printed or electronic form without written permission from the copyright holders or publishers.

### 13: Course Outline

The course outline is presented in the table next page. Detailed reading and homework assignments along with updates to this schedule will be provided via Bb. The following schedule may be modified as the semester progresses.

**Table 3: Course Lesson Outline**

Week	Date	Lesson	Topic	Reading
1	Jan 19	1	Introduction	
	21	2	sampling	1.1
2	24	3	summary Statistics	1.2
	26	4	Graph Summaries	1.3
	28	5	Graph Summaries	1.3
3	31	6	Probability basics	2.1
	Feb 2	7	Probability basic 2	2.1
	4	8	Exercises	
4	7	9	Counting Methods	2.2
	9	10	Counting Methods	2.2
	11	11	Conditional Probability	2.3
5	14	12	Conditional Probability	2.3
	16	13	Random Variables	2.4
	18	14	Random Variables	2.4
6	21		<b>Exam 1</b>	
	23	15	Linear Functions	2.5
	25	16	Linear Functions	2.5
7	28	17	Jointly Distributed Random Variable	2.6
	Mar 2	18	Jointly Distributed Random Variable	2.6
	4	19	Propagation of Error	3.1
8	7	20	Propagation of Error	3.2
	9	21	Bernoulli Distribution	4.1
	11	22	Bernoulli Distribution (2)	4.1
SB	14			
	16			
	18			
9	21	23	Poisson Distribution	4.3
	23	24	Normal Distribution	4.5
	25	25	Log-Normal Distribution	4.6
10	28	26	PPlots & Central Limit Theorem	4.10, 4.11
	30	27	Confidence Intervals. Large Sample	5.1
	April 1	28	Confidence Intervals. Small Sample	5.3

11	4		Review	
	6		Exam 2	
	8	29	Hypothesis Testing: large sample tests	6.1
12	11	30	Hypothesis Testing: Drawing Conclusions	6.2
	13	31	Hypothesis Testing: Drawing Conclusions	6.2
	15	32	correlation (2)	7.1
13	18	33	Correlation	7.1
	20	34	Least Square Line	7.2
	22	35	Quality Control	10.1
14	25	36	Quality Control	10.2
	27	37	Computer-Based Numerical and Simulation Methods	
	29		Exam 3	
15	May 2	38	Final Project	
	4	39	Final Project	
	6	40	Final Project	
16			Final Exam	

## 14: End Notes

<sup>1</sup> Kaleta, Robert, and Tanya Joosten. "Student response systems." Research Bulletin 10.1 (2007): 1-12. [PDF Link](#).

<sup>2</sup> <https://www.angelo.edu/content/files/14197-op-1011-grading-procedures>

<sup>3</sup> <http://www.angelo.edu/student-handbook/>

<sup>4</sup> <https://www.angelo.edu/academics/catalog/>

<sup>5</sup> <https://www.angelo.edu/current-students/disability-services/>

<sup>6</sup> <https://www.angelo.edu/incident-form>

<sup>7</sup> <https://www.angelo.edu/title-ix>

<sup>8</sup> <http://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of>

<sup>9</sup> <https://www.angelo.edu/covid-19/>

<sup>10</sup> <http://www.angelo.edu/student-handbook/community-policies/academic-integrity.php>

<sup>11</sup> [http://www.angelo.edu/dept/writing\\_center/academic\\_honesty.php](http://www.angelo.edu/dept/writing_center/academic_honesty.php)