1. **Course Number and Name**
   a. **ENGR 3305**: Probability and Risk in Engineering, Spring 2020
   b. Section 010, TR 12:30 – 1:45 pm

2. **Credits and Contact Hours**
   a. **Credits**: 3
   b. **Contact Hours**: 3 hours/week (Classroom) 0/hours/week (Lab)

3. **Instructor Information**
   a. **Course Coordinator**: Aldo R. Pinon-Villarreal
   b. **Instructor**: Aldo R. Pinon-Villarreal, 325-486-5510, apinonvillarreal@angelo.edu, Office: VIN 272. For office hours see faculty homepage.
   c. **Course Materials**
      a. **Required Textbook**:
      b. **Software**
         - *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](http://www.squarecap.com) on your web browser
   c. **Other Supplemental Materials**: Posted on Blackboard® Learning Management System

4. **Specific Course Information**
   **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.
   a. **Prerequisites and Corequisites**: Prerequisites: MATH 3415.
   b. **Required or Elective**: Required (Engineering principles)

5. **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, MATLAB) 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

<table>
<thead>
<tr>
<th>ABET Student Outcomes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Solve Problems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Design</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>3. Communication</td>
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<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4. Ethics &amp; Professionalism</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5. Teamwork</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6. Experimentation</td>
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<td></td>
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<td></td>
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<tr>
<td>7. Acquire New Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

6. 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. Quality Assurance/Control Charts
   Special Topics: Programming and Statistical Projects

7. Course structure and communication

This course has two 75-minute lectures per week. For each lecture, you are expected to have read the assigned textbook material ahead of time, and to be ready to engage with the lesson materials, especially through in-class problems to be answered using squarecap, discussions, and activities.

Classes will be composed of regular lecture and group or individual work sessions. You are expected to complete the assigned reading material before class. We will spend a significant amount of time working alone or in groups to accomplish hands-on learning objectives. We will be using Blackboard (Bb) for announcements and discussion of course materials. Please do not email your instructor with questions about class—instead post your questions on Piazza Discussion Board. One purpose of the discussions is to inform your instructor about any open questions from the reading or other material. It’s important that you provide feedback to your instructor.

7.1 Professionalism

Professional engineering standard 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.

8. Graded Material

8.1 Class Attendance and In-Class Exercises

Attendance and participation in class activities is essential for success in this class. Attendance, timeliness, and participation will be assessed through the squarecap application every time you respond to a exercise or poll. If you are not present for in-class activities, then you will receive no credit. No make-up exercises will be provided. If you must miss a class or lab session due to an excusable reason, notify your instructor, preferably before class, to avoid a zero grade on the graded material covered in class. Your lowest grade from the squarecap exercises will be dropped.

8.2 Online Reading Assignments

Online reading assignments are used to evaluate your comprehension about the assigned reading material. These quizzes will test your conceptual and/or technical understanding of the material with simple calculations or short-answer responses. If you miss a lecture or online reading quiz, then you will receive no credit. Your lowest score in the lecture reading quiz will be dropped.

8.3 Homework

There will be periodic homework assignments through the McGraw Hill Connect Access website. links to the assignments and deadlines will be posted in blackboard. Your lowest homework score will be dropped.

If you miss a homework submission deadline, then you have no more than 24 hours to turn in your late assignment with a 20% late penalty. No late homework is accepted after 24 hours.

8.4 Term Project Reports

There will be three projects assigned in this class. The projects can be completed by group effort but each student will be responsible to prepare an individual technical report for each project. These reports must be completed clearly and legibly for full credit. The reports will be prepared using a word processor (e.g. MS Word). Tables and graphs must also be completed using a software program (e.g. MATLAB, R or MS Excel). 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 that is 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 done – instead, this procedure must explain what you did using full and complete sentences;
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

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.

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.

8.5 Exams

There will be two partial exams and one comprehensive final exam. Each exam will cover lecture material as noted in the tentative course schedule.

Exams will be closed-book and closed-notes but you are allowed to bring the FE Reference Handbook and one page of handwritten notes. Additionally you are allowed to bring a straight-edge and a calculator. Only calculators that are allowed by the Fundamentals of Engineering (FE) and Professional Engineering (PE) exams will be allowed in our class exams. Please refer to the National Council of Examiners for Engineering and Surveying (NCEES) calculator policy for the list of acceptable calculators.

8.6 Grades

Table 2 presents the grade weighting

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>5</td>
</tr>
<tr>
<td>Homework</td>
<td>12</td>
</tr>
<tr>
<td>Quizzes</td>
<td>8</td>
</tr>
<tr>
<td>Projects</td>
<td>30</td>
</tr>
<tr>
<td>Exams</td>
<td>26</td>
</tr>
<tr>
<td>Final Exam</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

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 (> 89%), B = good work (80-89%), C = average work (70-79%), D = poor work (60-69%), F = failing work (< 60%).
9. Classroom and University Policies and Student Support

9.1 General Policies

All students are required to follow the policies and procedures presented in the Angelo State University Student Handbook and Angelo State University Catalog.

9.2 Student Disability Services

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. For more information about the application process and requirements, visit the Student Disability Services website. The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dallas Swafford
Director of Student Disability Services
Office of Student Affairs
325-942-2047
dallas.swafford@angelo.edu
Houston Harte University Center, Room 112

9.3 Title IX at Angelo State University

The University prohibits discrimination based on sex, which includes pregnancy, sexual orientation, gender identity, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination including: sexual assault, sex-based discrimination, sexual exploitation, sexual harassment, public indecency, interpersonal violence (domestic violence and/or dating violence), and stalking. As a faculty member, I am a Responsible Employee meaning that I am obligated by law and ASU policy to report any allegations I am notified of to the Office of Title IX Compliance.

Students are encouraged to report any incidents of sexual misconduct directly to ASU’s Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator at:

Michelle Boone, J.D.
Director of Title IX Compliance/Title IX Coordinator
Face to face: Mayer Administration Building, Room 210
325-942-2022, michelle.boone@angelo.edu

You may also file a report online 24/7 at www.angelo.edu/incident-form.

If you are wishing to speak to someone about an incident in confidence you may contact the University Health Clinic and Counseling Center at 325-942-2173 or the ASU Crisis Helpline at 325-486-6345.

For more information about Title IX in general you may visit www.angelo.edu/title-ix.
9.4 **Observance of Religious Holy Day**

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](#) for more information.

9.5 **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 Grading Procedures for more information.

9.6 **Student Conduct Policies**

9.6.1 **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.

The College of Science and Engineering adheres to the university’s [Statement of Academic Integrity](#).

9.6.2 **Plagiarism**

Plagiarism is a serious topic covered in ASU’s [Academic Integrity policy](#) 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. Resources to help you understand this policy better are available at the [ASU Writing Center](#).

9.6.3 **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.

10. **Instructor Prerogative**

The instructor reserves the right to change the policies and procedures of this course when he deems it necessary. Any such changes will be implemented fairly and will typically not be a detriment to your grade. The instructor will notify you of any such changes in a timely manner.

11. **Course Outline**

The course outline is presented in Table 3. 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 Lecture Schedules

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Date</th>
<th>Lecture</th>
<th>Reading on Ebook</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>T, 01/14</td>
<td>Sampling</td>
<td>1.1</td>
</tr>
<tr>
<td>02</td>
<td>R, 01/16</td>
<td>Summary Statistics</td>
<td>1.2</td>
</tr>
<tr>
<td>03</td>
<td>T, 01/21</td>
<td>Graphical Summaries</td>
<td>1.3</td>
</tr>
<tr>
<td>04</td>
<td>R, 01/23</td>
<td>Probability: Basic ideas; Project 1 Assigned</td>
<td>2.1</td>
</tr>
<tr>
<td>05</td>
<td>T, 01/28</td>
<td>Probability: Counting Methods</td>
<td>2.2</td>
</tr>
<tr>
<td>06</td>
<td>R, 01/30</td>
<td>Probability: Conditional Probability and Independence</td>
<td>2.3</td>
</tr>
<tr>
<td>07</td>
<td>T, 02/04</td>
<td>Probability: Random Variables(RV)</td>
<td>2.4</td>
</tr>
<tr>
<td>08</td>
<td>R, 02/06</td>
<td>Probability: RV Cont’d</td>
<td>2.4</td>
</tr>
<tr>
<td>09</td>
<td>T, 02/11</td>
<td>Probability: Linear functions of RV</td>
<td>2.5</td>
</tr>
<tr>
<td>10</td>
<td>R, 02/13</td>
<td>Probability: Jointly distributed RV</td>
<td>2.6</td>
</tr>
<tr>
<td>11</td>
<td>T, 02/18</td>
<td>Exam 1 review;</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>R, 02/20</td>
<td><strong>Exam 1 (L01-10)</strong></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>T, 02/25</td>
<td>Propagation of Error: Measurement error; Project 1 Due</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>R, 02/26</td>
<td>Propagation of Error: Linear comb. of Measurements; Project 2 Assigned</td>
<td>3.2</td>
</tr>
<tr>
<td>14</td>
<td>T, 03/03</td>
<td>Probability Distribution: Bernoulli Distribution</td>
<td>4.1</td>
</tr>
<tr>
<td>15</td>
<td>R, 03/05</td>
<td>Probability Distribution: Binomial Distribution</td>
<td>4.2</td>
</tr>
<tr>
<td>03/10-12</td>
<td></td>
<td><strong>Spring Break</strong></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>T, 03/17</td>
<td>Probability Distribution: Poisson Distribution</td>
<td>4.3</td>
</tr>
<tr>
<td>17</td>
<td>R, 03/19</td>
<td>Probability Distribution: Normal Distribution</td>
<td>4.5</td>
</tr>
<tr>
<td>18</td>
<td>T, 03/24</td>
<td>Probability Distribution: Lognormal Distribution</td>
<td>4.6</td>
</tr>
<tr>
<td>19</td>
<td>R, 03/26</td>
<td>Probability Distribution: the Central Limit Theorem</td>
<td>4.11</td>
</tr>
<tr>
<td>20</td>
<td>T, 03/31</td>
<td>Large sample Confidence Intervals; Project 2 Due</td>
<td>5.1</td>
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<tr>
<td>21</td>
<td>R, 04/02</td>
<td>Confidence intervals for Proportions and for small populations; Project 3 Assigned</td>
<td>5.2-5.3</td>
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<tr>
<td>22</td>
<td>R, 04/07</td>
<td><strong>Exam 2 (L14-20)</strong></td>
<td></td>
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<tr>
<td>23</td>
<td>T, 04/14</td>
<td>Hypothesis Testing: large sample tests</td>
<td>6.1</td>
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<tr>
<td>24</td>
<td>R, 04/16</td>
<td>Hypothesis Testing: drawing conclusions</td>
<td>6.2</td>
</tr>
<tr>
<td>25</td>
<td>T, 04/21</td>
<td>Correlation</td>
<td>7.1</td>
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<tr>
<td>26</td>
<td>R, 04/23</td>
<td>Simple Linear Regression</td>
<td>7.2</td>
</tr>
<tr>
<td>27</td>
<td>T, 04/28</td>
<td>Quality Control: Basic ideas</td>
<td>10.1</td>
</tr>
<tr>
<td>28</td>
<td>R, 04/30</td>
<td>Quality Control: Control charts for attributes</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project 3 Due</td>
<td></td>
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<tr>
<td>T 05/05</td>
<td></td>
<td><strong>Final Exam (comprehensive with emphasis on L22-</strong></td>
<td></td>
</tr>
</tbody>
</table>

End Notes

3. [http://www.angelo.edu/catalogs/](http://www.angelo.edu/catalogs/)
4. [http://www.angelo.edu/services/disability-services/](http://www.angelo.edu/services/disability-services/)
5. [http://www.angelo.edu/incident-form](http://www.angelo.edu/incident-form)
6. [http://www.angelo.edu/title-ix](http://www.angelo.edu/title-ix)
7. [http://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of](http://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of)