SIE 408/508: Descriptive Course Title
COURSE SYLLABUS

SEMESTER
Online: Asynchronous

Course Description

This is a three-credit course offered for well-qualified seniors, graduate students, and engineering professionals and practitioners. This is an introductory text and will be supplemented with material on many everyday reliability engineering problems e.g., root cause analysis. The course will make use of Minitab™ software. The scope of this course includes: (1) failure distributions, (2) failure rate models & reliability concepts, (3) reliability systems & state-space models, (4) accelerated testing. (5) Repair process & Availability, (6) Bayesian reliability estimates, (7) Case studies. After successful completion of the course, the students will be able to analyze data related to reliability questions and use the analytical results to predict the reliability of simple and some types of complex systems. This course will introduce probability for continuous and discrete random variables, statistical failure time models, estimation of model parameters, model comparison, and prediction of future failures. Students will practice application of the theoretical techniques with data sets from different engineering disciplines using the commercial software provided in this class.

Units: 3

Instructor and Contact Information

Instructor Name: John Ullrich
Email: ullrich@arizona.edu
Office: Engineering 265
Office Hours:

You are encouraged to reach out to your instructor frequently throughout the semester via email, phone, text, office hours, or a scheduled synchronous meeting (in-person or Zoom). Every attempt will be made to respond to questions and concerns that you may have within 24 hours.

Course Prerequisites

Undergraduate students (SIE 408): Complete SIE 305 or equivalent
Graduate students (SIE 508): SIE 430/530 or its equivalent (useful but not required)

Prior to enrolling in the course, you should be able to complete hypothesis tests: t-stes, Chi square test, F-test, and simple linear regression.

Course Format and Teaching Methods

#Add Teaching Methods.

Course Format and Teaching Methods

This course is structured to blend theoretical foundations with practical application, ensuring a comprehensive understanding of reliability engineering. Instruction will be delivered through a combination of lectures,

interactive discussions, and hands-on activities. Scheduled classes will incorporate multimedia presentations, real-world case studies, and collaborative problem-solving sessions to reinforce key concepts.

Students are encouraged to actively participate in group projects, which are designed to foster teamwork and simulate professional engineering scenarios. Regular assignments and quizzes will help gauge understanding and provide opportunities for self-assessment. Supplemental readings and online resources will be provided to deepen your knowledge beyond the classroom.

Laboratory sessions and computer-based exercises will introduce relevant software tools for reliability prediction and simulation, allowing you to gain practical experience with industry-standard applications. Throughout the semester, guest speakers from the field and peer-to-peer review activities will offer additional perspectives and enrich your learning experience.

Flexible learning is supported by both in-person and virtual options, with recorded lectures available for reference. The course is designed to be inclusive and adaptive, ensuring that all students can engage meaningfully regardless of their backgrounds or schedules.

Course Objectives

During this course, you will:

1) Develop the ability to analyze and model system reliability using probability and statistical methods.
2) Gain proficiency in applying life-data analysis to estimate failure distributions and key reliability metrics.
3) Design and evaluate redundancy strategies and fault-tolerant system architectures.
4) Formulate and assess preventive and corrective maintenance policies for engineering systems.
5) Utilize software tools for reliability prediction and simulation in practical scenarios.
6) Interpret and apply reliability requirements to real-world engineering projects.

Expected Learning Outcomes

Upon completion of this course, you should be able to:

1) Analyze and model system reliability using probability and statistical methods.
2) Apply life-data analysis to estimate failure distributions and key reliability metrics.
3) Design and evaluate redundancy and fault-tolerant architectures.
4) Develop preventive and corrective maintenance policies.
5) Use software tools for reliability prediction and simulation.
6) Interpret reliability requirements for real-world engineering projects.

Textbooks & Software

Required Textbooks

Reliability Engineering (3rd ed.)
by Elsayed A. Elsayed
ISBN: 9781119665908

Required Software

Minitab

Assessments

Assignments (x 7)

Reliability engineering homework assignments are designed to deepen students' understanding of the principles, methods, and practices that ensure the dependable performance and longevity of engineering systems. These tasks challenge learners to apply theoretical concepts to practical problems, fostering analytical and critical thinking skills essential for real-world reliability assessments.

- Problem Sets: These exercises focus on calculation and modeling, such as determining system reliability, identifying critical components, and computing MTBF using provided data.
- Simulation Assignments: Students use software tools to simulate system behavior under various conditions, analyze outcomes, and propose reliability enhancements.
- Case Study Analysis: Learners examine real or hypothetical engineering systems, identify reliability challenges, and recommend maintenance or design modifications.
- Research Projects: Assignments may require investigation into emerging reliability engineering practices, literature reviews, or the evaluation of novel materials and methods.
- Practical Application: Some tasks involve developing maintenance schedules or reliability plans for actual engineering projects or industry scenarios.

Assignments are assessed for accuracy, clarity of reasoning, depth analysis, and the practical relevance of proposed solutions, preparing students for professional excellence in reliability engineering.

Quizzes (x 7)

Reading quizzes are designed to assess students' comprehension of key concepts and methods presented in the assigned reliability engineering materials. These quizzes test retention, understanding, and the ability to apply theoretical knowledge to practical scenarios, ensuring students are prepared for deeper engagement in class discussions and assignments.

Final Report (x 1)

The final project/report requires students to conduct an in-depth analysis of an engineering system's reliability. Learners will identify key reliability challenges, apply appropriate assessment methods, and propose evidence-based solutions to enhance system performance and longevity. The report should demonstrate practical application of course concepts, clear reasoning, and thorough evaluation of data.

Exams (x 2)

#Description

The exams are comprehensive assessments designed to evaluate students' understanding of reliability engineering principles, methods, and their ability to apply concepts to real-world engineering challenges.

Grade Distribution, Scale & Policies

The grading distribution for course assignments is as follows:

Assignments (x7)	25%
Quizzes (x7)	15%
Project (x1)	20%
Exams (x2)	40%
Total	**100%**

Late Work Policy

All coursework must be submitted by the published deadline. Late work is subject to penalties unless an extension is approved.

- Up to 24 hours late: 10% penalty
- 24–72 hours late: 20% penalty
- More than 72 hours late: Not accepted, except for documented emergencies
- Contact the instructor as soon as possible if you need an extension due to illness or emergency.
- Requests must be made in writing and may require documentation.
- Handled individually; notify the instructor promptly for make-up options if you have a valid reason.

Questions about this policy should be directed at the instructor.

Instructor Grading & Student Appeals Policy

- Instructors will provide feedback and grades within 72 hours of assignment due dates, excluding weekends.
- All assignments and projects will be graded using published rubrics.
- Students may appeal a grade within two weeks of receipt by contacting the instructor via email or in person.
- Appeals must include a clear rationale and supporting evidence for reconsideration.
- The instructor will review appeals individually and communicate the outcome promptly.

Grading Scale

The following scale will be used to award final grades:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
E	less than 60%

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at https://registrar.arizona.edu/faculty-staff-resources/grading/grading-policies/incomplete and https://registrar.arizona.edu/faculty-staff-resources/grading/grading-policies/withdrawals respectively.

Policy on the Use of Artificial Intelligence

In this course you are welcome and expected to use generative artificial intelligence/large language model tools, e.g. ChatGPT, Dall-e, Bard, Perplexity. Using these tools aligns with the course learning goal/s [insert the course learning goal/s that use of AI aligns with]. Be aware that many AI companies collect information; do not enter confidential information as part of a prompt. LLMs may make up or hallucinate information. These tools may reflect misconceptions and biases of the data they were trained on and the human-written prompts used to steer them. You are responsible for checking facts, finding reliable sources for, and making a careful, critical examination of any work that you submit.

Your use of AI tools or content must be acknowledged or cited. If you do not acknowledge or cite your use of an AI tool, what you submit will be considered a form of cheating or plagiarism. Please use the following guidelines for acknowledging/citing generative AI in your assignments <insert link to MLA or APA or your own instructions about citation/acknowledgment>.

Course Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

University Policies

Links to the following UA policies are available at, https://catalog.arizona.edu/syllabus-policies:

- Absence and Class Participation Policies
- Safety on Campus & in the Classroom
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement