

SIE 408/508: Reliability Engineering

Course Syllabus — Fall 2026

Online: Asynchronous · 3 units

Due dates: This syllabus covers policies, grading, and structure. Any leftover Sunday-deadline language is from a prior term. **Official Fall 2026 due dates are in D2L** (Quizzes and Assignments) and on *Start Here* → *Schedule* | *Fall 2026 due dates (D2L official)*. If anything disagrees with D2L, follow D2L.

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 and reliability concepts, (3) reliability systems and state-space models, (4) accelerated testing, (5) repair process and availability, (6) Bayesian reliability estimates, (7) case studies.

After successful completion of the course, 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 the application of the theoretical techniques with data sets from different engineering disciplines using the commercial software provided in this class.

Instructor and Contact Information

Instructor: John Ullrich

Email: ullrich@arizona.edu

Office: Engineering 265

Office hours: By appointment. Email to request a day/time at least 24 hours in advance.

You are encouraged to reach out frequently throughout the semester via email, office hours, or a scheduled meeting (in person or Zoom). Every attempt will be made to respond within 24 hours.

Course Prerequisites

- **Undergraduate (SIE 408):** SIE 305 or equivalent
- **Graduate (SIE 508):** SIE 430/530 or equivalent (useful but not required)

Prior to enrolling, you should be able to complete hypothesis tests: t-tests, chi-square test, F-test, and simple linear regression.

Course Format and Teaching Methods

This course blends theoretical foundations with practical application. Instruction is delivered through lectures, discussions, and hands-on activities, with multimedia presentations, case studies, and problem-solving to reinforce key concepts.

Students are encouraged to participate in group projects designed to foster teamwork and simulate professional engineering scenarios. Regular assignments and quizzes help gauge understanding. Supplemental readings and online resources are provided to go beyond the classroom. Laboratory sessions and computer-based exercises introduce software tools for reliability prediction and simulation. Guest speakers and peer-to-peer review may offer additional perspectives.

Flexible learning is supported with recorded lectures. The course is designed to be inclusive and adaptive so students can engage regardless of background or schedule.

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 and Software

Required textbook

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

Available for free electronically through the library. Access it through the Pay One Price and Inclusive Access Materials module in this D2L site under Content, or through the library website with your UA NetID.

Required software

Minitab 19, available for free through the University of Arizona's Virtual Computing Access Technology (accessible from anywhere with broadband). The software is also installed in OSCR physical computer labs on the Tucson main campus. Log in with your UA NetID.

Assessments

Assignments (×14) — 20%

Homework is designed to apply reliability principles to practical problems: problem sets (system reliability, critical components, MTBF), simulations, case studies, and related written work. Assessed for accuracy, reasoning, depth of analysis, and practical relevance.

Quizzes (×7) — 15%

Reading quizzes assess comprehension of key concepts and the ability to apply them, and help prepare for class discussion and later assignments.

Project (×5) — 20%

The semester project is an in-depth reliability analysis of an engineering system: identify challenges, apply assessment methods, and propose evidence-based solutions. Phases 1–4 are 50% of the project grade; Phase 5 is 50%.

CH-7 reliability watch — 10%

Separate individual watch. Weekly data files unlock in D2L. Submit one short report when you believe article CH-7 is unsafe and likely to fail within the next week: state that, show the data, and give the rationale. Due Thursday, December 10, 2026 at 11:59 PM Arizona time. Submitting far too early is a false alarm; missing an impending failure earns no detection credit.

Exams (×2) — 35%

Comprehensive assessments of principles, methods, and application. Mid-term is 40% of the exam grade; final is 60%.

Grade Distribution

Component	Weight
Assignments (×14)	20%
Quizzes (×7)	15%
Project (×5)	20%
CH-7 reliability watch	10%
Exams (×2)	35%
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 in writing and may require documentation.

Instructor Grading and Student Appeals

Feedback and grades will typically be provided within 72 hours (excluding weekends) of due dates. Rubrics will be provided for assignments and team projects.

You may dispute a grade within two weeks of when it was awarded. Email the instructor with substantiated claims and any supporting evidence.

Grading Scale

Grade	Range
A	90–100%
B	80–89%
C	70–79%

D	60–69%
E	less than 60%

Incomplete (I) or Withdrawal (W) requests follow University policy: [Incomplete](#) and [Withdrawals](#).

Policy on the Use of Artificial Intelligence

[Green Light] This course embraces critical thinking about generative AI. You are encouraged to use generative AI tools and to critique the quality of the output. You are responsible for all work submitted for grading. Always provide human oversight and evaluation of AI-generated content.

See UA Libraries Guide: How to Cite AI. A lack of disclosure of AI use may be considered a violation of the Code of Academic Integrity. If you are in doubt, contact the instructor.

Course Behavior Policy

Students and instructors share responsibility for a safe, welcoming, and inclusive environment. Focus on the tasks at hand rather than extraneous activities (texting, unrelated browsing, etc.).

University Policies

Links to UA syllabus policies are at <https://catalog.arizona.edu/syllabus-policies>:

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