The University of Arizona
College of Engineering

Course Title: Reliability Engineering Fall 2021 Start: August 2021

Course: SIE 408/508, TBD
Instructor: Allan T. Mense, Ph.D., PE, CRE
Systems and Industrial Engineering Department
University of Arizona
Office:.
Office hour: Tuesday & Thursday 3:30pm to 4:30 pm using Zoom.
Phone Number: (520) 907-7786 **E-mail:** atmense@arizona.edu
GTA: **Mithun Ghosh (mithunghosh@email.arizona.edu)**
Office:
Office hours: Zoom Wednesday & Friday at 5:00pm to 6:00 pm

Text: Ebeling, Charles E., "An Introduction to Reliability and Maintainability Engineering, 3rd Ed.", Waveland Press, Inc., 2019 (ISBN 978-1-4786-3734-9)

Software: **Minitab 18** (Available on SIE department server); MS Excel

Course Description and Goals:
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.

There will be 4 quizzes during the semester that will account for 50% of semester grade.

Undergraduates will be graded separately from grad students.

Graduate students will perform a term project and present results as a paper (10 pages) and a set of ppt slides (10 slides).

The project a review of an assigned topic that will involve reading of published technical papers. Project topics may be chosen from the following options 1) prognostics and the use in reliability, 2) Bayesian techniques applied to reliability analysis. Topic must be approved by the instructor.

Prerequisite:
For undergraduate students: SIE 305 or equivalent; For graduate students: SIE 430/530 would be useful but not required. Students should review stats including hypothesis tests (t-test, Chi square test, F-test) and simple linear regression.

Topics to be covered:
       Basic concepts in Reliability Engineering
       Statistical reliability models
       Accelerated testing.
       System reliability analysis
       Lifetime data analysis & model parameter estimation
       Repairable systems and Availability
       Basic Bayesian reliability analyses

Proctor Information:
This course will have 4 quizzes taken on D2L, DRC students will be accommodated.

Grading (different criteria will be used for Under Grad and Grad students):

SIE 408	
Homework	50%
4 Quizzes	50%
Total	**100%**

SIE 508	
Homework	50%
4 Quizzes	50%
Project (Required)	Extra credit
Total	**100%**

It is expected that grading will be based on a percentage of the total points possible with the following minimums required for each grade: **A = 90%, B = 80%, C = 70%**, and **D = 60%**. Instructor may curve final course grades but that is not guaranteed. Homework will have due dates assigned on each homework **LATE HOMEWORK WILL BE ACCEPTED only with permission of instructor or TA.** Late homework w/o prior notification to TA will have a 10% deduction. **If you want an A or B you must turn in all the homework!**

Suggested References

Additional references:
1. E.A. Elsayed, *Reliability Engineering, 2nd Ed*, Addison Wesley, 2012. (very good but very expensive)

2. Tobias & Trindade, *Applied Reliability* 3rd Ed., Wiley Pub. Best Grad-level text

3. Meeker, W.Q., and L.A. Escobar, *Statistical Methods for Reliability Data*, 3rd Edition. John Wiley & Sons, 2021. Classic but just came out with new edition.

4. O'Connor, Patrick, and Kleyner, Andre. *Practical Reliability Engineering*, 5th Ed., John Wiley & Sons, 2012. A lot of good practical advice and wisdom (paperback)

5. by Leemis, L. *Reliability,* 2nd Ed., , (2009) more mathematical but well written (paperback)