

# IE Technical Elective – Reliability Engineering

## Spring 2023

### Course Syllabus

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**Instructor**

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Office: Zone 4-220

Office Hours: Wednesday 8:15-11:45

**Teaching Assistant**

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**Lecture**

Wednesday 13:50-17:30; Room: Zone 4-203

**Course Description**

Reliability introduction, System Reliability Evaluation, Time and Failure dependent Reliability, Estimation Methods of the parameters, 3 credit hours.

**Course Prerequisites**

IE 1070, MATH 0220, MATH 0235, MATH 0240

**Course Objectives**

1. Learn the basic definitions of reliability, basics of failure-time distributions, reliability metrics and methods for its calculations.
2. Learn to estimate the reliability of a variety of engineering systems using mathematical models.
3. Learn to use programming languages such as MATLAB to fit the failure data and estimate the parameters of the failure-time distributions.
4. Learn to understand failure causes and properly determine the optimal maintenance schedules in the real applications.

**Applicable ABET Outcomes**

Students will build

1. An understanding of the concept of reliability engineering and its applications.
2. An overview of simple failure-time distributions and the basics of reliability statistics such as mean time to failure (MTTF), mean residual life, median life, etc.
3. An understanding of good practices of reliability, and conversely recognizing failures and why.
4. Skills in the use of tools such as MATLAB to fit the data and estimate parameters of real cases in Industrial Engineering.

**Textbook**

[Elsayed A. Elsayed](#), Reliability Engineering, Third Edition. Wiley, (Wiley Series in Systems Engineering and Management), 2021, ISBN: 978-1-119-66592-2

[Dhillon B S.](#), Engineering systems reliability, safety, and maintenance: an integrated approach [M]. CRC Press, 2017. ISBN 9781498781633

## References

[Elsayed, A. Elsayed](#), 可靠性工程(第 2 版), 出版社: 电子工业出版社, 2013 年 8 月, ISBN:9787121210211

## Grading

Attendance, Quizzes & Assignment, projects, and exam questions related specifically to the objectives above.

Attendance, Quizzes	20%
Assignment:	30%
Project:	25%
Final Examination:	<u>25%</u>
	100%

Score	Letter Grade
90.00-100.00	A
85.00-89.99	A-
80.00-84.99	B+
76.00-79.99	B
73.00-75.99	B-
70.00-72.99	C+
66.00-69.99	C
63.00-65.99	C-
61.00-62.99	D+
60.00-60.99	D
0.00-59.99	F

## Exams

There will be one final exam. The exam is OPEN BOOK, OPEN NOTES. You are allowed to bring any material you need in the exam.

## Assignments and Quizzes

Homework will be assigned weekly and needed to be finished before the next class. You are encouraged to work on these assignments with your classmates. Late submission will not be accepted. Homework solutions must be submitted to the Blackboard system.

Quizzes may be assigned during the classes. There is a time limit on the quiz. Late submissions will not be accepted. No make-up quizzes or in-class activities are allowable except under extenuating circumstances.

**Course Project**

The project topic will be given later in the course.

**Avoiding Plagiarism**

1. Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called plagiarism and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.
2. Paraphrasing, when the original statement is still identifiable and has no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

**Course Schedule**

Week	Dates	Topics	Chapter
1	Feb 22	Course Introduction and Review of Syllabus, Introduction to Reliability Engineering, Reliability Definition	1
2	March 1	Probability Distributions Review, Mean time to failure, Mean residual life, Time of first failure, Introduction to System Reliability Evaluation	1
3	March 8	Reliability Block Diagrams, Series Systems, Parallel Systems, Series-Parallel Systems, Parallel-Series Systems	2
4	March 15	Mixed Systems, Reliability Evaluation of k-out-of-n Systems	2
5	March 22	Complex System Reliability Analysis	2
6	March 29	Redundancy, Importance measures of components	2
7	April 5	Tomb Sweeping Holiday. No class.	
8	April 12	Time-Dependent Reliability	1,2
9	April 19	Degradation Models, Failure-Dependent Reliability	3
10	April 26	Parameters Estimation 1: Method of Moments, Parameters Estimation 2: The Likelihood Function Parameters Estimation 3: Method of Least Squares, Bayesian Approach	3
11	May 3	Fault Tree Analysis, Markov Method, Probability Tree Analysis	4
12	May 10	Project Final Presentation, Final Exam	