SCUPI
Sichuan University - Pittsburgh Institute

IE Technical Elective – Reliability Engineering

Spring 2022

Course Syllabus

Instructor

Changxi Wang, Ph.D. (email: changxi.wang@scupi.cn)
Office: Zone 4-220
Office Hours: Wednesday 12:30-15:30

Teaching Assistant

Tonya Wu (email: 2018141522062@stu.scu.edu.cn)
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Office Hours: By appointment

Lecture

Wednesday 8:15-11:00; Room: Zone 4-216

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

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 & Assignment:	25%
Project:	20%
Mid-Semester Examination:	20%
Final Examination:	35%
	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

Attendance

There are **13** 165-minute lecture periods in the semester. Attendance may be taken for the lectures. Each student is allowed **two** absences. Each absence, after the second absence, will result in a **1% deduction** from the attendance grade. After the **tenth** absence, the student will not be allowed to take the final exam.

Homework

Homework problems will be assigned periodically and are due as stated. Late submission **will not** be accepted. Submissions must be done on **Blackboard** on electronic edition.

Exams

There will one mid-semester exam and one final exam, all are **OPEN BOOK, OPEN NOTES**. You are allowed to bring any material you need in the exam. Students should take both exams. If you must miss an exam, you should make alternative arrangements with the instructor before the exam is given. If you miss an exam without prior notification, you will receive a score of "zero" for that exam except under extenuating circumstances.

Make-Up Exams

Students who have not taken both mid-semester and final exams are not eligible for make-up exams. Make-up exams can only be taken by students who have attained between 50.00 % and 59.99 % (out of 100 %) of the total score. Only 75 % of the make-up exam grade can be used to replace the final exam grade. Students taking make-up exams can only attain at most a "D" grade.

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Student Opinion of Teaching Surveys

Students in this class will be asked to complete a Student Opinion of Teaching Survey. Surveys will be sent via SCUPI email and appear on your Blackboard landing page during the last three weeks of class meeting days. Your responses are anonymous. Please take time to thoughtfully respond, your feedback is important to me. Read more about Student Opinion of Teaching Surveys.

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.

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Tentative Course Schedule

Lecture	Week	Dates	Topics	Chapter
1	1	Feb 23	Course Introduction and Review of Syllabus, Introduction to Reliability Engineering, Reliability Definition	1
2	2	March 2	Probability Distributions Review, Mean time to failure, Mean residual life, Time of first failure	1
3	3	March 9	Introduction to System Reliability Evaluation, Reliability Block Diagrams	2
4	4	March 16	Series Systems, Parallel Systems, Series-Parallel Systems, Parallel-Series Systems, Mixed Systems	2
5	5	March 23	Reliability Evaluation of k-out-of-n Systems	2
6	6	March 30	Complex System Reliability Analysis	2
7	7	April 6	Redundancy, Importance measures of components	2
	8	April 13	Midterm Exam	1,2
8	9	April 20	Time-Dependent Reliability	3
9	10	April 27	Failure-Dependent Reliability	3
	11	May 4	Holiday for International Worker's Day	
10	12	May 11	Parameters Estimation 1: Method of Moments	4
11	13	May 18	Parameters Estimation 2: The Likelihood Function	4
12	14	May 25	Parameters Estimation 3: Method of Least Squares, Bayesian Approach	4
	15	June 1	Project Presentation	
13	16	June 8	Final Exam Review	1,2,3,4
	17	June 15	Final Exam	1,2,3,4