ME 496 System Reliability Engineering
School of Engineering and Applied Sciences **Fall 2020**
Western Kentucky University

COURSE HANDOUT

Course: ME 496 System Reliability Engineering, 3 Credit Hour, Lecture
Prerequisite: STAT 301

Instructor: Robert Choate, P.E., CRE, CBST
Professor, SEAS
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Office Hours: TR: 9:30 – 10:30 am and 1:00 – 3:00 pm via ZOOM

Textbook: CRE Primer, Fifth Edition, Dated January 1, 2018, Robert Dovich and Bill Wortman, Quality Council of Indiana, 602 West Paris Avenue, West Terre Haute, IN 47885.

COURSE DESCRIPTION:

This course provides a semi-intensive survey of the complete field of reliability engineering. The course is designed to give a thorough philosophical base for reliability engineering along with frequent examples of applications. Students completing this course will have a good understanding of the actions and goals of a state-of-the-industry reliability program and will become familiar with current techniques and their use in producing robust products and processes. Examples will cover a range of different applications with the objective of helping the student to appreciate the challenges in the varied components of complex products and systems.

COURSE OUTCOMES:

1. Use a variety of methods to assess reliability of components or systems that can be modeled by failure theories, engineering design equations, or other performance functions.
2. Predict reliability as a function of time based on failure-rate models of early-life, useful-life and wear-out, and use life-test data to create Exponential and Weibull models of reliability versus lifetime.
3. Find system reliability characteristics from information on system structure and component performance, for series, parallel, and other system types.
4. Estimate parameters from strength-stress or life test results, and account for the effects of sampling uncertainty via a confidence interval on the reliability estimate.
5. Describe, and qualitatively apply, techniques of failure modes and effects analysis, fault tree analysis.

KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS SHOULD HAVE BEFORE ENTERING THIS COURSE: Communicate technical information accurately and concisely – both orally and in writing, use analysis, computer software, word processors, etc., to define and develop solutions to technical problems in engineering**.**

KNOWLEDGE, SKILLS, AND ABILITIES STUDENTS GAIN FROM THIS COURSE:
This course will give students an initial exposure to the field of reliability engineering as it applies to complex systems. The students will also be exposed to concepts and practices regarding reliability life distributions and models and predictive and testing methods. These topics will be in preparation for your career as an engineering practitioner. They will learn that reliability engineering is iterative and will develop judgment that will allow them to compare and evaluate engineering alternatives. Course provides adequate preparation to sit for the American Society for Quality (ASQ) Certified Reliability Examination (CRE).

CLASS FORMAT:
Course material will be delivered online via our Blackboard Intranet Site (See next Section) asynchronously. However, as I am converting this course from my traditional face-to-face to a fully online class, I will incorporate synchronous meetings delivered by ZOOM sessions. All students must be online at that exact same time in order to participate in these class sessions. I will schedule synchronous ZOOM sessions at least once a week or multiple times a week with the entire class. These segments of the class will be taught during the TopNet designated Day(s) and Time slots.

What does this mean? It means that this is **NOT** exclusively a WEB based course so you are expected to attend and your grade will include participation during our scheduled ZOOM sessions on Mondays and Wednesdays from 1:50 am – 3:10 pm. **Do not schedule other commitments during these TopNet designated days and time slots.**

BLACKBOARD INTRANET SITE:
There is a Blackboard intranet site available for the course, http://blackboard.wku.edu. To login use your username (NetID) and password.

- Blackboard will be used extensively throughout this course.
- Assignments and Performance Measures will be posted in the Announcement Section of the Blackboard site and due dates in the Assignment Feature.
- Course material will be posted in appropriate section and associated folders.
- Student grades will be posted in the Grade Center.

ATTENDANCE:

- Regular attendance is expected at our ZOOM sessions. Note that a portion of your grade is based on participation and self-initiative. Professional contribution is a goal of this course.
- Attendance will be recorded AT THE BEGINNING of each class session.
- Once attendance has been recorded and the session begins, credit WILL NOT be given for late arrival.
- The attendance grade will be calculated as follows:
    - Students are allowed two absences (or tardy) per semester.

- **Students who miss or are late to more than two sessions will be penalized one-half a letter grade for EACH session missed/tardy off their final course grade.**

COURSE GRADE:

Component	*Weight*
Assignments/Case Studies/Projects/Class Participation	70%
Final Exam	30%

Grades on Assignment/Case Studies/Class Participation will be assigned based on a weighted average of the levels of performance demonstrated throughout the semester. Scores for your performance will be based on the following rubric:

Letter Grade	Numeric Equivalent	Qualitative Description (Typical)
A	> 90%	Exemplary; no to minor mistakes.
B	> 80%	Proficient; several minor mistakes; almost no conceptual mistakes.
C	> 70%	Apprentice; several mistakes, some major; conceptual mistakes.
D	> 60%	Novice; many significant mistakes and conceptual errors.
F	< 60%	Non-response or completely incorrect response.

FINAL EXAM:

The final exam date and time is established by the university and is shown below on our schedule. It will be comprehensive and two-hours in length. **No makeup finals will be given. No early finals will be given. No late finals will be given.**

ASSIGNMENT RULES:

The following rules apply to all submitted assignments (case studies and projects). You may discuss alternatives and methods for assignments with instructor and peers, but you must create your own work, which reflects your own independent thought process and efforts:

- Work must be neat. Presentation will affect your grade!
- No late assignments be accepted. Students will be given ample time to complete assignments and ask questions prior to submission date. DO NOT BEGIN your assignment the night before it is due!!!!!
- Students will be instructed on the format of the assignment.
- Assignments will be weighted (i.e., some assignments will count more than others).
- Assignments must be submitted according to the format provided and file type required. Assignments submitted not according to instructions will not be graded.
- **DO NOT EMAIL ASSIGNMENTS TO INSTRUCTOR.**
- ***ONLY ASSIGNMENTS THAT ARE SUBMITTED ACCORDING TO INSTRUCTIONS WILL BE GRADED!!!!!!***

PROFESSIONAL CONDUCT:

It is expected that all students be present in each synchronous ZOOM session, will be courteous of others' ideas, and otherwise will conduct themselves in a professional manner in accordance with the WKU Student Handbook. Conduct determined to be unacceptable may result in the loss of points. **Notify the instructor in advance of any absence and provide a professional rationale.**

ACADEMIC DISHONESTY:

As an engineering student at WKU, you are expected to refrain from any form of academic dishonesty or deception such as cheating, stealing, plagiarism or lying on assignments, homework, quizzes, tests or exams. Furthermore, you understand and accept the potential consequences of punishable behavior, as stated in the WKU Catalog under Academic Dishonesty.

WKU Covid-19 Mask Statement:

Out of respect for the health and safety of the WKU community and in adherence with the CDC guidelines, the University requires that a cloth face covering (reusable or disposable) that covers both the nose and mouth must be worn at all times when in public areas within all buildings. Students must properly wear masks face coverings while in class regardless of the room size or the nature of the classroom activities. Students who fail to wear a face covering mask as required will be in violation of the WKU Student Code of Conduct and will be asked to comply or will face disciplinary action, including possible dismissal from the University. Accommodations to masks face coverings must be determined by the Student Accessibility Resource Center and documented before a student may attend class.

Title IX Misconduct/Assault Statement:

Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) at https://wku.edu/eoo/documents/titleix/wkutitleixpolicyandgrievanceprocedure.pdf and Discrimination and Harassment Policy (#0.2040) at https://wku.edu/policies/hr_policies/2040_discrimination_harassment_policy.pdf.

Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121.

Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and MUST report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

Ogden Student Course Attendance Statement:
The faculty and staff of Ogden College of Science and Engineering are committed to providing you with learning experiences and opportunities. You must assume ownership of your education and be an active participant in the classroom and laboratory to take advantage of these opportunities. **Active participation requires you to attend.** Scientific studies have shown that attendance during scheduled classroom and laboratory meetings is directly correlated to your performance on assignments and exams and the potential to earn higher grades. Additionally, if you do not regularly attend class, you are missing important information about course topics, due dates, and assignment details that are crucial to your success in the course. Therefore, as a student enrolled in an Ogden course, you are expected to attend every class meeting and to inform your instructor regarding the reasons for any absences as soon as practical. **Your instructor may incorporate class attendance/participation as part of the grading criteria.**

ADA Accommodation Statement:
In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu. Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.

KEY 2020 FALL SEMESTER ACADEMIC CALENDAR DATES:
August 31: Last day to add a class. Last day to drop a class without a grade. Last day to receive 100% refund for a class.

November 2: Last day to drop a class with a W. Last day to change a class from credit to audit.

Fall 2020 Tentative (and VERY FULL) Course Outline (August 10, 2020 version)

Week	Date	Sections	Topics
1	8/24	Section I and II	ZOOM Session: Lesson 1 Certification Overview, Lesson 2A Course Information and Lesson 2B Reliability Fundamentals
	8/26	Section III	ZOOM Session: Risk Management – Lesson 3 Overview and Risk Matrix, Lesson 4 Fault Tree Analysis (FTA) and Lesson 5 Failure Modes and Effects Analysis (FMEA)
2	8/31	Section III	ZOOM Session: Risk Management – Lesson 3 Overview and Risk Matrix, Lesson 4 Fault Tree Analysis (FTA) and Lesson 5 Failure Modes and Effects Analysis (FMEA)
	9/2	Section III	ZOOM Session: Risk Management – Lesson 3 Overview and Risk Matrix, Lesson 4 Fault Tree Analysis (FTA) and Lesson 5 Failure Modes and Effects Analysis (FMEA)
3	9/7	Section IV	ZOOM Session: Statistical Concepts – Lesson 6 Basic Statistics and Probability and Lesson 7 Probability Textbook Examples
	9/9	Section IV	ZOOM Session: Statistical Concepts – Lesson 6 Basic Statistics and Probability and Lesson 7 Probability Textbook Examples
4	9/14	Section IV	ZOOM Session: Statistical Concepts – Lesson 8 Probability "Reliability" Distributions and Lesson 9 Probability Distributions
	9/16	Section IV	ZOOM Session: Statistical Concepts – Lesson 8 Probability "Reliability" Distributions and Lesson 9 Probability Distributions
5	9/21	Section IV	ZOOM Session: Statistical Concepts – Lesson 10 Exponential and Weibull Distributions and Lesson 11 Weibull Distributions and Plotting
	9/23	Section IV	ZOOM Session: Statistical Concepts – Lesson 10 Exponential and Weibull Distributions and Lesson 11 Weibull Distributions and Plotting
6	9/28	Section IV	ZOOM Session: Statistical Concepts – Lesson 12 Ranking Methods and Plotting and Lesson 13 Ranking Methods and Exponential Distribution
	9/30	Section IV	ZOOM Session: Statistical Concepts – Lesson 12 Ranking Methods and Plotting and Lesson 13 Ranking Methods and Exponential Distribution

7	10/5	Section IV	ZOOM Session: Statistical Concepts – Lesson 14 Point and Interval Estimates, Lesson 15 Sampling Distributions and Lesson 16 More Point and Interval Estimates
	10/7	Section IV	ZOOM Session: Statistical Concepts – Lesson 14 Point and Interval Estimates, Lesson 15 Sampling Distributions and Lesson 16 More Point and Interval Estimates
8	10/12	Section IV 4th Edition	ZOOM Session: Statistical Concepts – Lesson 17 Hypothesis Testing Approach and Lesson 18 Hypothesis Testing Examples
	10/14	Section IV 4th Edition	ZOOM Session: Statistical Concepts – Lesson 17 Hypothesis Testing Approach and Lesson 18 Hypothesis Testing Examples
9	10/19	Section V	ZOOM Session: Data Management – Lesson 19 Sources of Reliability Data
	10/21	Section V	ZOOM Session: Data Management – Lesson 19 Sources of Reliability Data
10	10/26	Section VI	ZOOM Session: Reliability Planning – Lesson 20 Vibration Testing and Lesson 21 Reliability Growth
	10/28	Section VI	ZOOM Session: Reliability Planning – Lesson 20 Vibration Testing and Lesson 21 Reliability Growth
11	11/2	Section VII	ZOOM Session: Testing & Modeling – Lesson 22 Reliability Block Diagrams, Lesson 23 Reliability Testing and HASA, Lesson 24 Failure Models and Lesson 25 Accelerated Life Testing
	11/4	Section VII	ZOOM Session: Testing & Modeling – Lesson 22 Reliability Block Diagrams, Lesson 23 Reliability Testing and HASA, Lesson 24 Failure Models and Lesson 25 Accelerated Life Testing
12	11/9	Section VIII	ZOOM Session: Reliability Designs – Lesson 26 Vibration Testing Methods and Lesson 27 Stress – Strength Analysis
	11/11	Section VIII	ZOOM Session: Reliability Designs – Lesson 26 Vibration Testing Methods and Lesson 27 Stress – Strength Analysis
13	11/16	Section VIII	ZOOM Session: Reliability Designs – Lesson 28 Robust Design, QFD and DFX
	11/18	Section VIII	ZOOM Session: Reliability Designs – Lesson 28 Robust Design, QFD and DFX
14	**11/23**		**NO CLASS – Fall Break**
	11/28		**NO CLASS- Thanksgiving Break**
15	11/30		Final Review
	12/2		Final Review; Course Assessment

16	**12/8**		*****Final Exam, Tuesday, December 8th @ 10:30 am – 12:30 pm**

*****Final Exam is cumulative (know your stuff).**