

Reliability, Maintainability, and Quality Management

Course Syllabus - 2018

MTWHF 0900-1200 USAF Expeditionary Center, Ft Dix, NJ (3.0 Credit Hours)

Course Description

Creating and sustaining military capability is the purpose of military leadership and management. Reliability and maintainability (R&M) are component characteristics, which define the ability of a product to perform its specified functions throughout its operational life. Component R&M of the military system are primary determinants of military capability. This course teaches fundamental R&M concepts. Additionally, probability theory is discussed and employed as a tool to quantitatively define these concepts. Topics to be discussed include the measures, which quantitatively define component R&M, the relationship between R&M, and the prediction of R&M measures.

Course Objectives

Upon completion of this course each student shall be able to:

- Understand and apply the fundamentals of the concepts of reliability, maintainability, and availability.
- Understand the use of probability theory to quantify R&M concepts.
- Understand and apply the measures which quantitatively define component R&M.

Pre-requisites & Co-requisites

None

Instructor and Contact Information

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Resources

Required resources

The required text for this course is

- Charles E. Ebeling
An Introduction to Reliability and Maintainability Engineering
2nd ed., Waveland Press, Long Grove, IL 2010.

Optional resources

The following list includes references to more reliability-related resources that can be accessed online. While not required, these references contain content that complements the material presented during this course.

- William Meeker and Luis Escobar
Statistical Methods for Reliability Data
1st Ed., Wiley-Interscience, 1998
- Marvin. Rausand and Arlnot Hoyland
System Reliability Theory: Models, Statistical Methods & Applications
2nd ed., Wiley-Interscience, Hoboken, NJ 2004
- DOD Guide for Achieving Reliability, Availability, and Maintainability, 3 Aug 2005
- **Bill Meeker's Homepage**
- **Weibull.com - Reliability Engineering Resource Website**
- **Reliasoft Corporation Homepage**
- **NIST/SEMATECH e-Handbook of Statistical Methods**
- **Defense Systems Information Analysis Center**
- **Army Material Systems Analysis Activity**

Course Schedule (Tentative)

Week	Chapter	Topics Presented	Notes
1	1, 2	Course Overview Math/Stat Review Reliability Introduction Distribution Functions	HW 1 Assigned
2	2, 3	Distribution Functions Conditional Reliability Constant Failure Rate Model	
3	3, 4	Constant Failure Rate Model Time Dependent Failure Models	HW 1 Due HW 2 Assigned
4	4, 5	Time Dependent Failure Models Reliability of Systems	
5	5 - 7	Reliability of Systems State Dependent Systems Physical Reliability Models	HW 2 Due HW 3 Assigned Project Topics Due
6	8, 9	Design for Reliability Maintainability	HW 3 Due HW 4 Assigned
7	9, 10	Maintainability Design for Maintainability	
8	12, 13	Data Collection Reliability Testing	HW 4 Due HW 5 Assigned
9	13, 14	Reliability Testing Reliability Growth Testing	
10	N/A	Student Presentations	HW 5 Due

Course Format

Class material is primarily presented in lecture format.

Performance Evaluation

Your grade in this course will be calculated according to the following requirements and their respective weights.

- **HOMEWORK (60%):**

Homework is due by 'close of business' (1700) on the day listed in the class schedule. Each student must turn in their own solutions for each problem assigned - Unless other arrangements are approved by the instructor. Solutions will be provided at the beginning of the next class.

- **PROJECT (40%):**

Students, in teams of two, will prepare a class presentation on a topic relevant to reliability, maintainability, and availability. Presentations should be about 30 minutes long. Students may choose a relevant DoD topic or their own topic, approved by the professor. Topics and teams are "first-come, first-served" Topic presentations will include the topic's background and why it is important or relevant, a brief literature review of the research on this topic, a description and assessment of any quantitative reliability tools used, and a managerial assessment of why USAF leaders should know and care about it.

Project examples: Evaluation of the C-5 re-engining and reliability improvement program, a B-52 life extension program, F-35 software reliability, GM ignition switch failures, automotive air bag failures, the Samsung Galaxy Note 7 failures, or electric car battery failures.

A student's final letter grade will be parsed out according to the table below. This grading profile follows the the standard grading profile established by the institution.

- (1.00 - 0.93]: A
- (0.93 - 0.90]: A-
- (0.90 - 0.87]: B+
- (0.87 - 0.83]: B
- (0.83 - 0.80]: B-
- (0.80 - 0.77]: C

Important Policy Statements

Academic Integrity Policy Statement

All students must adhere to the highest standards of academic integrity. Students are prohibited from engaging in plagiarism, cheating, misrepresentation, or any other act constituting a lack of academic integrity. Failure on the part of any individual to practice academic integrity is not condoned and will not be tolerated. Individuals who violate this policy are subject to adverse administrative action including disenrollment from school and disciplinary action. Individuals subject to the Uniform Code of Military Justice may be prosecuted under the UCMJ. Violations by government civilian employees may result in administrative disciplinary action without regard to otherwise applicable criminal or civil sanctions for violations of related laws. (References: AFIT Student Handbook, ENOI 36-107 - *Academic Integrity*)

Attendance Policy Statement

Attendance at all class sessions and exams is mandatory for military and civilians assigned to AFIT as full-time students except for extenuating circumstances. Part-time students are expected to attend scheduled classes, and absences should be explained to the instructor. The student should provide advance notice, if

possible. Scheduled classes and exams are defined by the instructor and they are documented in the course schedule. (References: AFIT Student Handbook, AFIT Graduate School Catalog)

Academic Grievance Policy Statement

AFIT and the Graduate School of Engineering and Management affirm the right of each student to resolve grievances with the Institution. Students are guaranteed the right of fair hearing and appeal in all matters of judgment of academic performance. Procedures are detailed in ENOI 36-138 - *Student Academic Performance Appeals*.