Mechanical Design Reliability Training Course

This Mechanical Design Reliability Training Course is a practical application of fundamental mechanical engineering to system and component reliability. Designed for the practitioner, this course covers the theories of mechanical reliability and demonstrates the supporting mathematical theory. For the beginner, the essential tools of reliability analysis are presented and demonstrated. These applications are further solidified by practical problem solving and open discussion. The objective of this extensive application of reliability principles is to leave the participants prepared to address reliability related to mechanical equipment and to provide competency in the predominant tools of mechanical system reliability analysis. Course handouts include a course manual and RAC's publication "Reliability Toolkit: Commercial Practices Edition."

Course Instructor

Ned H. Criscimagna is a Senior Engineer with 40 years experience in engineering, maintenance, and system acquisition. He routinely serves as Project Manager for projects involving reliability and maintainability (R&M) and life cycle cost concerns. In his 20 years as an officer in the US Air Force, he served in a variety of engineering, maintenance, and acquisition positions. He brings to the classroom practical project experience, an appropriate educational background, and an understanding of the product development process. Mr. Criscimagna is the author of many R&M publications and developed a RAC training course on implementing reliability under Defense Acquisition Reform. He received his BSME from the University of Nebraska-Lincoln and his MS in Systems Engineering from the Air Force Institute of Technology. He is an ASQ Certified Reliability Engineer and a SOLE Certified Professional Logistician.

Course Contents

Introduction to Reliability of Mechanical Equipment

1. The RAC
2. Life cycle cost considerations
3. Need for reliability engineering
4. Basic definitions in reliability theory
5. Elements of a comprehensive reliability program

Mathematical Foundations of Reliability Engineering

1. Part versus system reliability issues
2. Probability functions
3. General rules of probability
4. Sampling

Setting Reliability Requirements

1. Determining customer needs
2. Understanding customer performance reliability requirements
3. Deriving product design reliability requirements
4. Developing a system reliability model
5. Allocating system reliability requirements to lower levels

Design for Reliability

1. Understanding the total environment
2. Understanding how things fail
3. Taking proactive action to address "high-risk" items
4. Robust design/fault tolerance
5. Designing for simplicity

6. Integration
7. Reliability program elements and correct timing of tasks
8. Design reviews
9. Overview of common reliability design tools

Mechanical Reliability Assessment – Parts and Systems

1. Definition and purposes
2. Steps in making an assessment
3. Assessment techniques for parts
    A. Failure data analysis
    B. Empirical models
    C. Mechanical stress/strength interference method
    D. Surrogate data
4. System-level assessment
    A. RBDs
    B. Simulation
    C. Parts count

Failure Modes and Effects Analysis

1. What is a Failure Mode and Effects Analysis (FMEA)?
2. What are the benefits of performing an FMEA?
3. When is an FMEA conducted?
4. Who should perform an FMEA?
5. What are the prerequisites, procedures & data elements?
6. The summary report

Fault Tree Analysis

1. What is a Fault Tree Analysis (FTA)
2. Benefits of performing an FTA
3. Appropriate applications of an FTA
4. FTA procedures
5. Analyzing the fault tree
6. Related analyses
    A. Ishakawa diagram
    B. Other

Reliability Testing

1. Development (discovery) Testing
2. Reliability Qualification Testing
3. Accelerated Life Testing
4. Manufacturing/Production

Trending System Reliability During Operation

1. Trend analysis
2. Point process
3. Confidence interval determination

Maintaining Reliability Through Production and Operation

1. Effect of production and operation on reliability
2. Production considerations

3. Quality of production
4. Supplier selection and management
5. Designing for maintainability
6. Reliability information systems
7. Developing a maintenance program of corrective and preventive tasks

Review and Wrap-Up

1. Have a strategy
2. Include the "right" reliability program elements
3. Implement tasks at the correct time
4. Have an effective data system
5. Key points
6. Where do you go from here