TRAINING ON
RELIABILITY ENGINEERING

RELIABILITY ENGINEERING

Why QVISE for your Reliability Training?

✓QVISE offers exceptional Reliability Engineering training designed to empower professionals to enhance product performance and durability.

✓Our expert instructors combine in-depth industry knowledge with practical experience to deliver comprehensive and engaging training programs.

✓Benefit from our hands-on approach, real-world case studies, and tailored curriculum to meet your specific reliability objectives.

✓By choosing QVISE, you gain the tools and expertise to optimize product reliability, reduce failures, and improve overall product life cycle performance.

Pre-Requisites

- ❑ Bachelor's degree in electrical / Electronics / Mechanical / Mechatronics Engineering
- ❑ Minimum 3 year of industry experience is recommended
- ❑ Understanding of Technical Documentations i.e., P&ID, BOM and Process Flows
- ❑ Understanding of technical specifications
- ❑ Proficient in algebra, probability & statistics
- ❑ Well-versed in calculus (Integration)

RELIABILITY **ENGINEERING**

TESTIMONIALS

“The trainer's extensive experience was invaluable. Their insights and sharing of examples from personal experience provided practical guidance that I can directly apply to my work. I'm confident that this training will significantly contribute to my professional growth.”

– Reliability Team Member ***(Module – 3)***

"The practical examples and clear explanations of equations and notations were invaluable. This training has equipped me with the tools to confidently apply reliability concepts in my future projects.“

– Subject Matter Expert ***(Module – 4)***

“Compared to previous reliability trainings, this course was exceptional. The content was more relevant, engaging, and practical.”

– Reliability Team Member ***(Module – 4)***

RELIABILITY ENGINEERING

Reliability Engineering Course Details

❑The Reliability Engineering Courses are focused to provide individuals with a complete run-down of all the basics of a Reliability Program, with a solid foundation.

❑The program is structured into **eight (8)** distinct modules designed to be thorough yet concise.

❑Our curriculum is carefully designed to align with Military standards and best practices, ensuring that participants gain a deep understanding of Reliability Engineering principles, processes, and implementation techniques.

❑Upon successful completion of the program, learners will demonstrate a basic level expertise of Reliability Engineering concepts & strategies.

Course Module Distribution

- ✓ **Module 1**: Introduction to ILS/ IPS, Reliability & Supportability Engineering
- ✓ **Module 2**: Reliability Governance & Contractual Management
- ✓ **Module 3**: Reliability Program Reviews & Failure Review Board (**FRB**)
- ✓ **Module 4**: Reliability Modeling & Allocation
- ✓ **Module 5**: Reliability Prediction
- ✓ **Module 6**: Failure Modes, Effects & Criticality Analysis (**FMECA**) and Failure Reporting Analysis & Corrective Action System (**FRACAS**)
- ✓ **Module 7**: Reliability Growth (**RGT**) & Environmental Stress Screening (**ESS**)
- ✓ **Module 8**: Reliability Qualification & Production Reliability Acceptance Testing (**RQT** & **PRAT**)

MODULE 1 INTRODUCTION TO ILS / IPS, RELIABILITY & SUPPORTABILITY ENGINEERING

OBJECTIVES

- ✓ Acquire a comprehensive understanding of IPS elements, their purpose, benefits, and applications
- ✓ Identify key IPS deliverables across the acquisition life cycle phases
- ✓ Develop awareness of PSA (Product Support Analysis), LPD (Logistics Product Data) and grasp the fundamentals of ILS Plan (ILSP) development
- ✓ Understand the fundamental concepts and principles of Reliability Engineering
- ✓ Identify key tasks and activities associated with Reliability program
- ✓ Understand the integration and processes of ILS / IPS and Reliability within the system life cycle phases

Course Outline – 5 Days

1. Introduction to Reliability Engineering
   a) Brief History
   b) What is Reliability Engineering
   c) Overview of Reliability Program Tasks as per MIL-STD-785B
2. Reliability Modeling
   a) Functional Block Diagram (FBD)
   b) Reliability Block Diagram (RBD)
3. Reliability Prediction
   a) Parts Stress Analysis
   b) Live Demo on FALCON software
4. Mean Time Between Failure (MTBF) Calculation Techniques
   a) In-Service MTBF Calculation

MODULE 1 INTRODUCTION TO ILS / IPS, RELIABILITY & SUPPORTABILITY ENGINEERING

Course Outline

5. Introduction to ILS / IPS
   a) History and transition from ILS to IPS
   b) Elements of IPS
6. PSA (Product Support Analysis)
   a) Transition from LSA to PSA
   b) PSA Process in different Life cycle Phases
   c) PSA Tailoring + Live Demo on FALCON
7. FMECA (Failure Modes, Effects & Criticality Analysis)
   a) Qualitative FMECA
   b) Quantitative FMECA
   c) Live Demo on FALCON
8. RCM (Reliability Centered Maintenance)
   a) RCM as Failure Management Process
   b) RCM Decision Logic Tree + Workshop

Course Outline

9. Condition Based Maintenance (CBM)
   a) CBM & CBM +
   b) CBM Techniques
   c) CBM + and US DoD Acquisition Life cycle
10. FRACAS (Failure Reporting, Analysis & Corrective Action System)
    a) FRACAS Concept
    b) FRACAS Process
    c) FRACAS vs FMEA / FMECA
    d) Workshop
    e) Live Demo on FALCON
11. MTA (Maintenance Task Analysis)
    a) MTA as Activity 12 of PSA
    b) Live Demo on FALCON

MODULE 1 INTRODUCTION TO ILS / IPS, RELIABILITY & SUPPORTABILITY ENGINEERING

Course Outline

12. LORA (Level Of Repair Analysis)
    a) LORA Process
    b) Factors Affecting LORA
13. Availability
    a) Achieved & Inherent Availability
    b) Operational Availability
    c) Workshop + Activity
14. LCCA (Life Cycle Cost Analysis)
    a) Costing Categories
    b) Life Cycle Cost Methods
    c) Live Demo on FALCON
15. IETM (Interactive Electronic Technical Manual)
    a) Management, Authoring and Publishing using live demo on FALCON

Course Outline

16. Obsolescence Management (OM)
    a) Analysis & Assessment
    b) Mitigation & Resolution
17. CM (Configuration Management)
    a) CM Functions
    b) Configuration Change Management
    c) Live Demo of FALCON for CM
18. LSAR / LPD (Logistics Support Analysis Record / Logistics Product Data)
    a) LPD Entities in Life Cycle Phases
    b) Important LPD DEDs in LPD
    c) Live Demo on FALCON
19. Spare Support
    a) Spare Allowance Computation

MODULE 1 INTRODUCTION TO ILS / IPS, RELIABILITY & SUPPORTABILITY ENGINEERING

Course Outline

19. Spare Support
    - b) Spare Optimization & Procurement Decisions
    - c) Live Demo on FALCON
20. MRO (Maintenance Repair Overhaul) and Shopfloor Management
    - a) Maintenance Planning
    - b) Maintenance Data Collection
    - c) Tools & Techniques for Maintenance Management
    - d) Live Demo on FALCON

MODULE 2 RELIABILITY GOVERNANCE

OBJECTIVES

- ✓ Master the identification and application of relevant reliability standards and reference materials
- ✓ Develop and implement effective reliability programs aligned with industry standards and guidelines
- ✓ Acquire proficiency in various reliability analysis methods and testing procedures
- ✓ Optimize reliability data collection and parts management processes
- ✓ Select appropriate reliability standards based on specific project requirements
- ✓ Compare and contrast different reliability standards in terms of their frameworks, recognition, emphasis, coverage, and applicability

Course Outline – 4 Days

1. Reliability Governance
   a) Standardization, its Need and importance
   b) Governing Bodies for standards
   c) Reliability & Maintainability Categorization
2. Reliability Program management (MIL-STD-785B)
   a) Features & Limitations
   b) Tasks in for Reliability Program
3. Reliability Analysis Methods
   a) MIL-HDBK-217
   b) MIL-STD-756
   c) MIL-STD-1629
   d) MIL-STD-2155

MODULE 2 RELIABILITY GOVERNANCE

Course Outline

4. Reference Guides and Handbooks
   a) Overview & Purpose of Handbooks
   b) Applicable Handbooks
      i. DOD RAM Guide
      ii. MIL-HDBK-454
      iii. MIL-HDBK-338
   c) MIL-HDBK-338
      i. RAM (Reliability, Availability & Maintainability) Theory
      ii. Reliability Specification, Allocation, Modeling & Prediction
      iii. Reliability Engineering Design Guidelines
      iv. Reliability Data Collection and Analysis, Demonstration & Growth
      v. Software Reliability
      vi. Systems Reliability Engineering
      vii. Production and Use (Deployment) R&M

Course Outline

5. Maintainability Analysis
   a) Introduction
   b) Applicable & Recommended Documents
   c) Military STD / HDBK
      i. MIL-STD-721
      ii. MIL-STD-470B
      iii. MIL-HDBK-472(Notice 1)
      iv. MIL-STD-471A
      v. MIL-STD-2165
   d) DoD-HDBK-791
   e) BS EN 50126-1
   f) Comparative Analysis
6. Reliability Testing
   a) MIL-STD-781
   b) MIL-STD-810 – Overview

MODULE 2 **RELIABILITY GOVERNANCE**

Course Outline

6. Reliability Testing
    c) MIL-STD-1635 – Overview
    d) MIL-STD-2074
    e) MIL-STD-2164 – Overview
7. System Safety
    a) Introduction
    b) Applicable Standards
    c) MIL-STD-882E
    d) IEC 61508-1:2010
8. Data collection and parts information
    a) Importance of Reliability Data
    b) MIL-STD-690
    c) MIL-STD-790
    d) MIL-STD-883
    e) MIL-STD-965

MODULE 3 RELIABILITY PROGRAM REVIEWS & FAILURE REVIEW BOARD

OBJECTIVES

- ✓ Understand the purpose and timing of program reviews, and their role in preventing project failures.
- ✓ Integrate reliability program management with overall project management principles.
- ✓ Align reliability engineering activities with program and project life cycle stages.
- ✓ Participate effectively in System Engineering Technical Reviews (SETRs) with a focus on reliability and maintainability (RAM) aspects.
- ✓ Identify reliability-related aspects within various SETR
- ✓ Apply Root Cause Analysis (RCA) techniques for failure investigation and prevention.
- ✓ Establish and conduct effective Failure Review Boards in accordance with industry best practices.

Course Outline – 3 Days

1. Introduction to Reliability Program Reviews
   a) What is a Program Review
   b) Relation to Reliability Engineering and Reliability Program Review
   c) Why to conduct Reviews
   d) Project Monitoring & Evaluation
   e) Benefits of Reviews
   f) Review guidelines and processes
   g) Elements of Review
2. Reliability and Systems Engineering
   a) What is Systems Engineering
   b) Relationship with Reliability Engineering
   c) Program / Project Lifecycle
   d) Systems Engineering Technical Reviews
   e) Case Study + Workshop on ASR

MODULE 3 RELIABILITY PROGRAM REVIEWS & FAILURE REVIEW BOARD

Course Outline

3. Reliability Program Reviews Scheduling
   a) Preparation Activities
   b) Execution Activities
   c) Documentation
   d) Review consideration
4. Types of Program Reviews
   a) Informal Reliability Reviews
   b) Formal Design / Program Reviews
   c) Systems Engineering Technical Reviews (SETRs) & Reliability
   d) Case Study + Workshop on PDR
   e) Software Review Categories
5. Failure Review Board (FRB)
   a) Overview
   b) Importance of FRB

Course Outline

5. FRB
   c) Relationship between Reliability & Failure Reporting
6. Root Cause Analysis Methods
   a) Overview
   b) Processes
   c) Techniques + Workshop
      i. Events & Causal Factors (ECF) charting
      ii. The 5 'Whys' method
      iii. Cause Tree method
      iv. Why-Because Analysis (WBA) / Why-Because Graph (WBG)
      v. Fault Tree Analysis (FTA)
      vi. Fishbone / Ishikawa
      vii. KNOT Chart
      viii. PARETO Analysis

MODULE 3 RELIABILITY PROGRAM REVIEWS & FAILURE REVIEW BOARD

Course Outline

7. FRB Guidance
    a) Purpose and Scope
    b) FRB Requirements
    c) FRB Organization
    d) FRB Process
8. FRB as Contractor & Customer
    a) Detailed Requirements
    b) FRB Capability Levels

MODULE 4 RELIABILITY ALLOCATION & MODELING

OBJECTIVES

- ✓ Master the concepts and applications of reliability modeling.
- ✓ Construct Failure Breakdown Diagrams (FBDs) and Reliability Block Diagrams (RBDs) to model system behavior.
- ✓ Calculate mission reliability and system reliability metrics.
- ✓ Utilize various probability distributions to model component and system behavior.
- ✓ Allocate system reliability to subsystems using appropriate methods.
- ✓ Employ advanced modeling techniques for complex system analysis.
- ✓ Analyze failure data and project it to appropriate probability distributions.

Course Outline – 5 Days

1. Reliability Modeling
   a) Introduction
   b) Methodology
   c) Requirements
   d) Output Parameters
2. Reliability Allocation
   a) Introduction
   b) Methodology
   c) Requirements
   d) Output Parameters
3. Functional Block Diagram (FBD)
   a) Introduction
   b) Methodology
   c) Requirements
   d) Output Parameters + Workshop

MODULE 4 RELIABILITY ALLOCATION & MODELING

Course Outline

4. Reliability Block Diagram (RBD)
   a) Introduction
   b) Methodology
   c) Requirements
   d) Activity + Workshop
5. Mission and Basic Reliability
   a) Introduction
   b) Requirements
   c) System Definition
   d) Calculation Procedure + Workshop
6. Reliability Metrices + Workshop
   a) Reliability
   b) Failure Rate & Hazard Rate
   c) MTTF, MTBF & MRL
   d) Demonstrated Reliability

Course Outline

7. RBD Models + Workshop
   a) Series System
   b) Parallel System
      i. K/N Redundant system
      ii. Active redundancy or hot standby
      iii. Passive redundancy or cold standby
      iv. Warm standby
   c) Complex Series-Parallel System
   d) Failure Rate Relationship
8. Probability 101
   a) Definition, formula & examples
   b) Rules of Probability + Workshop
      i. Joint Probability, conditional Probability
      ii. Complement probability, dependent / independent probabilities
      iii. Mutually exclusive

MODULE 4 RELIABILITY ALLOCATION & MODELING

Course Outline

9. Probability Functions
   a) Probability Density Function (PDF)
   b) Cumulative Density Function (CDF)
   c) Relationship between PDF & CDF
   d) Reliability Function
   e) Failure Rate Function
   f) MTTF Function
10. Life Distributions
   a) Exponential + Workshop
   b) Weibull + Workshop
   c) Normal + Workshop
   d) Lognormal + Workshop
   e) Gamma
11. Reliability Allocation Methods
   a) Equal Apportionment + Workshop

Course Outline

11. Reliability Allocation Methods
   b) ARINC + Workshop
   c) AGREE + Workshop
   d) Feasibility of Objectives (FOB) + Workshop
   e) Modified FOB + Workshop
12. Modelling methods & Calculation
   a) Conventional Probability + Workshop
   b) Boolean Truth Table + Workshop
   c) Logic Diagram + Workshop
   d) Monte Carlos Simulation + Workshop
13. Probability Plotting – Nonparametric (for in-service MTBF calculation of System)
   a) Overview & Model + Workshop
   b) Nongroup Data / Kimbal Estimator
   c) Group Data / Statistical Estimator

MODULE 4 RELIABILITY ALLOCATION & MODELING

Course Outline

14. Probability Plotting – Exponential Distribution
    a) Overview & Model
    b) Fitting of data on exponential distribution
15. Computing system Reliability of a complex series-parallel combination system with different Life Distribution on each component

MODULE 5 RELIABILITY PREDICTION

OBJECTIVES

- ✓ Integrate reliability prediction into various product life cycle phases.
- ✓ Distinguish between different types of reliability predictions based on design stages.
- ✓ Apply life testing techniques for reliability prediction and utilize Physics of Failure (PoF) models for reliability assessment.
- ✓ Leverage the MIL-HDBK-217F-N2, IEEE 1413 standard for reliability prediction evaluation.
- ✓ Apply NSWC methodologies for mechanical item reliability prediction.
- ✓ Utilize the NPRD database for reliability prediction and adjustment.
- ✓ Evaluate the effectiveness of different reliability prediction methods through case studies.

Course Outline – 5 Days

1. Reliability Prediction
   a) Introduction
   b) Application and benefits
   c) Important considerations
   d) Core concepts required
   e) General Procedure
2. Reliability Prediction in System Lifecycle
3. Classification based on Design Phase
   a) Type I – Feasibility Prediction
   b) Type II – Preliminary Design Prediction
   c) Type III – Detailed Design Prediction
4. Prediction Technique – Life Testing
   a) Overview & purpose
   b) Advantages & disadvantages

MODULE 5 RELIABILITY PREDICTION

Course Outline

4. Prediction Technique – Life Testing
   - c) Requirements & Procedure
   - d) Workshop
5. Prediction Technique – Physics of Failure (POF)
   - a) Overview & POF models
   - b) Advantages & Disadvantages
   - c) Requirements and Procedure
   - d) Workshop
6. Prediction Technique – Empirical Method
   - a) Similar Item Method
   - b) Similar Circuit Method
   - c) Active Element Method
   - d) Parts Count Method
   - e) Parts Stress Method

Course Outline

7. Comparison of Prediction Techniques
   - a) IEEE 1413 Overview
   - b) Assessment Criteria
   - c) Comparison
8. Parts Count Analysis using MIL-HDBK-217FN2
   - a) Activity + Workshop
9. Parts Stress Analysis using MIL-HDBK-217FN2 + Workshop
   - a) Microcircuits
   - b) Diodes
   - c) Transistors
   - d) Resistors
   - e) Capacitors
10. Reliability Prediction using NSWC
    - a) Bearing

MODULE 5 RELIABILITY PREDICTION

Course Outline

10. Reliability Prediction using NSWC
    - b) Poppet Valve
    - c) Seals (O-rings)
    - d) Springs
11. Reliability Prediction using NPRD
    - a) Overview of NPRD sections (1 – 8)
    - b) Workshop for failure rate estimation
12. Other Failure Rate Prediction standards
    - a) Bellcore / Telcordia
    - b) RDF 2000
    - c) IEC 62380
    - d) PRISM
    - e) Practical Demonstration
    - f) 217PLUS
    - g) China GJB/z 299C, FIDES, OREDA

Course Outline

13. Case Study + Workshop
    - a) Comparison of Reliability Prediction Methods
    - b) Comparison of Reliability Prediction Handbooks
    - c) The Merits and limitations of Reliability Predictions
    - d) Predicted MTBFs to Field and Test Data
    - e) Case Study: Plastic Parts in the US DoD

MODULE 6 FMECA & FRACAS

OBJECTIVES

- ✓ Learn FMEA and FMECA, in accordance with industry standards as per MIL-STD-1629A, IEC, TM 5-698-4, AIAG-VDA
- ✓ Construct FTA and ETA models to identify potential failure scenarios and their consequences.
- ✓ Integrate FTA, ETA, and FMEA for comprehensive risk assessment.
- ✓ Implement a robust Failure Reporting, Analysis, and Corrective Action System (FRACAS).
- ✓ Conduct effective Root Cause Analysis (RCA) to identify and eliminate failure root causes.
- ✓ Develop and implement a comprehensive parts management plan.
- ✓ Establish and manage a Reliability Critical Items List (RCIL).

Course Outline – 5 Days

1. Introduction to FMEA / FMECA
   a) Need for FMEA / FMECA
   b) Terminologies
   c) Types of FMEA / FMECA
   d) Basic concepts
2. FMEA / FMECA Detailed Process
   a) System Scope and planning
   b) Failure Modes, Effects & Criticality Analysis as per MIL-STD-1629A
   c) Compensating Provisions
   d) Documentation
   e) Workshop + Case Study
3. IEC Process for FMEA
   a) Planning FMECA
   b) Performing FMECA

MODULE 6 FMECA & FRACAS

Course Outline

3. IEC Process for FMEA
   - c) Documentation
4. FMECA for C4ISR (TM 5-698-4)
   - a) FMEA methodology / steps
   - b) Criticality ranking for qualitative and quantitative
   - c) Representation of results of FMECA
5. Process FMEA as per AIAG-VDA
   - a) Scope Definition of PFMEA
   - b) Structure and Function analysis
   - c) Failure and risk Analysis
   - d) Examples + Workshop
6. Fault Tree Analysis (FTA)
   - a) Overview & Application
   - b) Classification & Key Concepts

Course Outline

6. Fault Tree Analysis (FTA)
   - c) Symbols and procedure
   - d) Requirements & considerations
   - e) Qualitative & Quantitative
7. Event Tree Analysis (ETA)
   - a) Overview & Objectives
   - b) Key concepts
   - c) Limitations
   - d) Procedure
8. Combination of FTA with other techniques
   - a) Failure Modes and Effects Analysis (FMEA)
   - b) Event Tree Analysis (ETA)
   - c) Reliability Block Diagram (RBD)

MODULE 6 FMECA & FRACAS

Course Outline

9. FRACAS (Failure Reporting, Analysis & Corrective Action System)
    a) Terminologies
    b) Typical FRACAS Process
    c) FRACAS vs FMECA
10. Root Cause Analysis (RCA)
    a) Introduction to RCA
    b) Types of problems solved during RCA
11. Data Collection
    a) RAM Data
    b) Data Categories
12. Parts Management
    a) Introduction
    b) Policy and Contract Management
    c) Costs and Benefits

Course Outline

12. Parts Management
    d) Parts Management Plan
    e) Responsibilities and Tools
13. Reliability Critical Items List
    a) Introduction
    b) Purpose
    c) FMECA as a driver

MODULE 7 RELIABILITY GROWTH & ENVIRONMENTAL STRESS SCREENING

OBJECTIVES

- ✓ Understand the fundamentals of Reliability Growth Testing (RGT), including core concepts, failure classification, and testing procedures.
- ✓ Assess and monitor reliability growth using various growth curves and test programs.
- ✓ Construct reliability growth curves using models such as Duane Plot and AMSA Model.
- ✓ Apply accelerated testing methods like HALT and HASS to expedite reliability improvement.
- ✓ Understand the principles of Environmental Stress Screening (ESS) and its role in reliability enhancement.
- ✓ Apply MIL-STD-810H standards to reliability testing and product qualification.
- ✓ Analyze the impact of environmental factors and operational conditions on product reliability.

Course Outline – 5 Days

1. Introduction to Reliability Testing
   a) Overview and objectives
   b) Key Concepts
   c) Test Program
   d) Test Data Types
2. Failure Categories and Types
   a) Failure definition and classification
   b) Relevant vs Non relevant failures
   c) Types of Failures
3. Reliability Testing Classification
   a) Classification paradigm
   b) Management aspects of reliability tests
   c) Reliability test classification workshop
4. Introduction to Reliability Growth Testing
   a) Overview

MODULE 7 RELIABILITY GROWTH & ENVIRONMENTAL STRESS SCREENING

Course Outline

4. Introduction to Reliability Growth Testing (RGT)
   - b) Terminologies
   - c) Reliability Growth and Management control process
   - d) Reliability Growth Planning, Tracking and Projection Concepts
5. Reliability Growth Curves Types
   - a) Idealized Growth curve
   - b) Planned Growth curve
   - c) Growth Tracking curve
6. DUANE Plot
   - a) Overview
   - b) Time Terminated Testing
   - c) Failure Terminated Testing
   - d) Grouped Data Testing

Course Outline

7. AMSAA Model (US Army Materiel Systems Analysis Activity)
   - a) Time Terminated Testing
   - b) Failure Terminated Testing
8. Environmental Test Conditions (MIL-STD-810)
   - a) Test Survey
   - b) Combined Stresses
   - c) Single Stress
9. Accelerated Testing
   - a) Overview, Purpose and Classification
   - b) Qualitative Accelerated Testing
   - c) Quantitative Accelerated Testing
10. Introduction to Environmental Stress Screening (ESS)
    - a) Overview & Purpose

MODULE 7 RELIABILITY GROWTH & ENVIRONMENTAL STRESS SCREENING

Course Outline

10. Introduction to Environmental Stress Screening (ESS)
    b) Key Concepts
    c) Application of ESS in Product Lifecycle
    d) ESS environment types and factors
11. ESS Program Elements
    a) Planning guidelines
    b) Implementation procedures guidelines
    c) ESS monitoring and performance reports
12. ESS Detailed Procedure
    a) Procedure A till F
13. Non operating Reliability
    a) Introduction
    b) Terminologies
    c) Examples and workshop

Course Outline

14. Assessing Non operating Reliability
    a) RADC Method
    b) MIL-HDBK-217 “ZERO Electrical Stress Approach”
    c) “K” Factor Approach
15. Martin-Marietta Test Program
    a) Introduction
    b) Methodology and findings
    c) Analysis and methods
    d) Workshop
16. Test and Maintenance
    a) Introduction
    b) Types of Tests
    c) Maintenance Approaches

MODULE 8 RELIABILITY QUALIFICATION & PRODUCTION RELIABILITY ACCEPTANCE TESTING (RQT & PRAT)

OBJECTIVES

- ✓ Understand the concept of qualification and its role in ensuring product reliability.
- ✓ Differentiate between various qualification types (Virtual, Product, and Quality Assurance Testing).
- ✓ Define the requirements for Reliability Qualification Test (RQT) and Product Reliability Acceptance Test (PRAT).
- ✓ Master the methodologies, procedures, and challenges associated with product qualification.
- ✓ Implement production reliability acceptance testing (PRAT) concepts and procedures.
- ✓ Develop statistical test plans, including MTBF Assurance Tests, Fixed-Duration Test Plans, Probability Ratio Sequential Test Plans (PRST), and All-Equipment Reliability Test Plans.

Course Outline – 4 Days

1. Introduction to RQT (Reliability Qualification Testing)
   a) Objectives & Key Concepts
   b) Requirements for Qualification
   c) RQT in Product Lifecycle
   d) Quality Management System (QMS) and Reliability
2. Virtual Qualification
   a) Overview and objectives
   b) Important aspects of Reliability Qualification
3. Product Qualification
   a) Process for product qualification
   b) Qualification of electronic components
   c) Reliability Tests for Qualification

MODULE 8 RELIABILITY QUALIFICATION & PRODUCTION RELIABILITY ACCEPTANCE TESTING (RQT & PRAT)

Course Outline

4. Quality Assurance
   a) Quality Assurance and Reliability
   b) Quality Control and Reliability
5. Introduction to PRAT (Production Reliability Acceptance Testing)
   a) Overview and Objectives
   b) Key concepts
   c) Methodology
   d) Classification
6. MTBF Assurance Test
   a) Overview
   b) Model
   c) Procedure
   d) Example + Workshop

Course Outline

7. Sequential Test Plan
   a) Overview and Purpose
   b) Model
   c) Test Plans
   d) Examples and Workshop
8. Fixed Duration Test Plan
   a) Overview, Purpose and classification
   b) Model
   c) Test Plan
   d) MTBF Estimation
   e) Examples and Workshop
9. All Equipment Test Plan
   a) Overview & Purpose
   b) Model
   c) Test Plans

MODULE 8 RELIABILITY QUALIFICATION & PRODUCTION RELIABILITY ACCEPTANCE TESTING (RQT & PRAT)

Course Outline

9. Quality Assurance
   - d) Example and Workshop
10. Sampling Methods for Acceptance of Product
    - a) Overview & Terminologies
    - b) Acceptance by Contractor-Proposed Provisions
11. Acceptance by Standard Sampling Tables
    - a) Attributes Sampling + Workshop
    - b) Variables Sampling + Workshop
    - c) Continuous Sampling + Workshop
12. Statistical Process Control (SPC)
    - a) Overview
    - b) Key Characteristics to Control
    - c) Rational for Subgroup Size

Course Outline

13. SPC Control Chart
    - a) Overview
    - b) Variable Control Charts
    - c) Attribute Control Charts