

Design for Reliability (DfR) Across the Product Lifecycle Course Outline

Lesson 1 | Role of Design for Reliability (DfR) in the Product Lifecycle

- Understand why Design for Reliability is crucial to business viability.
- Become familiar with core DfR concepts.
- Recognize reliability as a measurable engineering attribute that must be designed, tested, and managed across the product lifecycle.

Lesson 2 | Prediction, Modeling, and Prototyping

- Estimate failure rates using part stress methods, MIL-HDBK-217 concepts, and Physics-of-Failure methods.
- Evaluate system reliability across series, parallel, standby, and load-sharing configurations.
- Use Monte Carlo simulation to explore dynamic reliability problems.
- Understand how prototyping helps identify weaknesses before production.

Lesson 3 | Risk Analysis and Failure Analysis Tools

- Explain how risk is defined and assessed in reliability engineering.
- Apply structured tools such as Fault Tree Analysis, Success Tree Analysis, FMEA, FMECA, Common Mode Failure Analysis, risk matrices, hazard analysis, and system safety.
- Use Risk Priority Number and percent RPN reduction concepts to rank and track risk reduction actions.

Lesson 4 | Robust and Tolerant Design for Reliability

- Understand probability concepts and reliability-related distributions.
- Apply Taguchi methods to reduce sensitivity to variation and noise.
- Evaluate failure risks using Stress-Strength analysis and Design of Experiments.
- Use DfR strategies such as DfX, redundancy, and fault tolerance to improve reliability.

Lesson 5 | Reliability Testing and Accelerated Testing

- Understand the different types of reliability tests and how they are used.
- Explain why accelerated testing is essential in product development.
- Apply Accelerated Life Testing concepts using Arrhenius and Inverse-Power Law models.
- Differentiate discovery tests, measurement tests, acceptance tests, verification, and validation.

Lesson 6 | Reliability Growth and Continuous Improvement

- Improve product performance through structured testing and corrective action using Test, Analyze, and Fix cycles.
- Prioritize risks using failure severity and FMEA criteria.
- Evaluate failures based on environmental stresses and real-world use profiles.
- Support Go/No-Go decisions using a Reliability Dashboard that summarizes MTBF goals, residual risks, and manufacturing yields.

Challenge

- A self-assessment that helps learners test their comprehension of the topics covered in this course.