

DfRSoft Modular Classes List

(Select any or all Modules, We will Quote the Cost and Time Requirements)

Module 1

- **Basic Reliability Mathematics (4 Exercises, 36 Slides) (Using DfRSoft Tools)**
 - MTBF/Failure Rate Basics
 - Failure Rate Conversion (FITs, FMH, MTBF, PPM, AFR, %Failure)
 - System Reliability Analysis & Block Diagrams (Series, Parallel, Redundancy for K of N, Active/Standbys)
 - Allocation (equal apportionment and by complexity)
 - Reliability Predictions (Parts Count, Detailed Stress, Telcordia, Mil Std 217...)

Module 2

- **Advanced Reliability Mathematics (Using DfRSoft Tools) (3 Exercises, 48 Slides)**
 - Time Dependent Failure Rate
 - Main Distribution of the Bathtub Curve, Weibull, Exponential, and Lognormal
 - Reliability Plotting (life data analysis, censored data)
 - Key Reliability Functions (CDF, PDF, Hazard Rate)

Module 3

- **Basic Quality Test Engineering (3 Exercises, 70 Slides) (Using DfRSoft Tools)**
 - Cpk, Yield, Normal/Lognormal, & Six Sigma Analysis
 - SPC Charts
 - Lot Sampling (Hypergeometric, Binomial, Risks, OC) & double sampling.
 - Visual Inspection/Design Release

Module 4

- **Design of Experiment with Multiple Regression**

Module 5

- **Stack Up & Monte Carlo Analysis Methods**
 - Stack up
 - Worst case stack up analysis
 - Stack up Example
 - Monte Carlo Methods for stack up

Module 6

- **Failure Modes Effects Analysis (FMEA) (2 Exercises, 33 Slides)**
 - FMEA Terms
 - Top Down FMEA for Program Planning
 - DFMEA (focus on design controls & actions)
 - DFMEA (streamline with an environmental approach)
 - Keys to a good FMEA (without wasting everyone's time)
 - Value of Derating (Derating Specs - DfRSoft Guideline)

Module 7

- **Accelerated Life Testing, Environmental Profiling & Chi-squared Confidence Testing**
 - Acceleration Factors & Models (Temperature-Arrhenius, Peck Temperature-Humidity, Coffin-Manson Temperature Cycle, Modified Frequency Temperature Cycle, Vibration Accelerated Models, General Power Law Model)
 - Chi-squared confidence method for accelerated testing
 - Environmental Profiling (CALT like model for environments with varying stress profiles)
 - Statistical Qualification Planning

Module 8

- **Design Maturity Chi-Squared Demonstration Testing (4 Exercises, 17 Slides) (Using DfRSoft Tools)**
 - Will Your Product Meet its Reliability Objective?

- DMT Test Plans
- Statistical Confidence

Module 9

- **Design Assessment Reliability Testing & Reliability Growth (DART - HALT)** (3 Exercises, 38 Slides) (DfRSoft Tools)
 - Finding Failure Modes – Test to Fail Not to Pass
 - Accelerated Reliability Growth
 - Multi-Test Reliability Growth Assessment Methods (new Chi-Squared Reliability Growth analysis method)
 - Test Design by Failure Modes
 - HALT & HASS (Basics)
 - Design Margin – Load-Stress Reliability Interference Assessment
 - Safety Factors & Derating (mechanical & electrical stress assurance)

Module 10

- **Field Returns Analysis**
 - Field Returns and Device Hours (3 Exercises, 31 Slides) (DfRSoft Tools)
 - Device Hours – Multiple Test Uses and Field Returns
 - AFR – Most common company metric
 - Field Return– Raw Data Analysis
 - Field Return– Weibull Analysis, Mixed FM, (two populations)
 - Mixed Modes Analysis (field returns)

Module 11

- **Availability & Sparing (DfRSoft Tools)** (1 Exercise, 6 Slides)

Module 12

- **Advanced ESD Concepts** (Numerous Exercises, 128 Slides)
 - ESD Protection Methods (68 Slides)
 - ESD Protection Devices, Design Protection Methods
 - ESD Advanced CDM Issues (61 Slides)
 - Advanced Audits/Investigation, Test Fixtures

Module 13

- **Shock & Vibration** (Numerous Exercises, 90 Slides)
 - Understanding Gs & gs
 - Drop Shock and Specifications
 - Sine Vibration & Analysis
 - Random Vibration and PSD Analysis
 - HALT - ED Shaker: how they differ and advantages of each

Module 14

- **Physics of Failure Analysis Tools** (29 Slides) -Detail Analysis Pictures Showing Strengths of Instruments
 - SEM (FE-SEM, EDS)
 - Digital Microscopy
 - Focused Ion Beam
 - Real Time Radiology, X-Ray Maps
 - C-SAM
 - Thermal Imaging
 - FTIR
 - Scanning Auger
 - Atomic Force Microscopy
 - SIMS
 - Other Tools Including ESD Simulator
 - Sample Preparations

Module 15

- **Physics of Failure 7 Step Problem Solving** (15 Slides)
- **Physics of Failure** (*Numerous Exercises*, 134 Slides) (Numerous FA Pictures, Industry Lessons Learned and Design Rules to Avoid Issues)
 - Diffusion - Substitutional, Kirkendall
 - Intermetallics - Au Embrittlement, Purple Plague
 - Bond wire failures - non stick, intermetallic
 - Eight Types of Corrosion - Area effect, and Prevention
 - Dendritic Growth, Ag Migration & Electromigration
 - RoHS Issues
 - Contamination – Solder non-wetting, Epoxy non-stick
 - Stress-Strain – Vibration, CTE's
 - Wear
 - Fatigue Failure
 - Popcorn Cracking, Voiding Delamination
 - ESD & EOS - Dielectric Breakdown
 - Solder Failures (non wetting, grain size, leaching, coverage)
 - BGA, Tin Whiskers
 - Current Density & Fusing of Bond wires and wires
 - Junction Temperature Issues

Module 16

- **RoHS Challenges** (27 Slides)
 - Making RoHS Work, What you need to know

Module 17

- **Parametric Reliability** (*Numerous Exercises*, 15 Slides)
 - -Component Drift Analysis Methods & Sample Size Advantages

Module 17

- **The Stage Gate approach for successful design assurance**
 - The design process flow
 - Understanding each gate – the tools for your program

Module 18

- **Material selection stress considerations in design**
 - Elastic deformation, yielding and ductile rupture material considerations
 - Creep & cumulative creep fatigue material considerations
 - Excessive wear; friction & lubrication – material selection
 - Cyclic fatigue SN curves – material selection
 - PCB fatigue life
 - Circuit board component fatigue life model analysis –Steinberg Method (sine and random)
 - Thermal cycle fatigue
 - Engelmaier model - solder component selection & underfill effects on thermal fatigue life
 - Four step approach for material selection

Module 19

- **Design Margin Methods**
 - Design safety factors
 - Reliability Design Safety Margin - load/strength interference
 - Electrical derating

Module 20

- **Isolation & Damping - Designing for Vibration & Shock Suppression**
 - Vibration Isolation
 - Shock Isolation/Absorption
 - Packaging guidelines - foam thickness
 - Vibration Absorption