Quorum Logistic Support Limited
Quantum House
Hadley Park East
Telford
Shropshire
TF1 6QJ

University College Diploma in Reliability Engineering

Introduction:

Quorum Logistic Support in association with Harper Adams University College is now offering a Reliability Engineering programme aimed at those in industry interested in improving the reliability performance and procedures within their own organisation. The course will suit students from a range of industries and is appropriate for engineers, managers, designers and technicians with or without relevant occupational expertise.

The diploma comprises four modules designed to be studied sequentially. All four modules must be completed to gain the 60 credits necessary to achieve the full award for the University College Diploma in Reliability Engineering. Classroom learning for each module takes place at Quorum over a five day period followed by 120 hours of private study, research and assignments.

Module	Course Title	Level	Credits	Learning Classroom Hrs	Learning On Site Hrs
1	Foundation of Reliability Engineering	5	15	30	120
2	Application of Reliability Engineering	5	15	30	120
3	Verification of Reliability Engineering	5	15	30	120
4	Reliability Engineering & Supportability	5	15	30	120

Pre-Requisites:

Students should have a basic understanding of business processes, the use of standard analytical tools and a sound knowledge and understanding of basic mathematics

Module 1 - Foundations of Reliability Engineering

This module provides insight into the practical and theoretical applications of reliability engineering in the classroom with tutorials and assignments, syndicate exercises and peer discussion. There is particular focus upon the essentials of reliability theory exploring such questions as: What is reliability theory? What are the variables that determine reliability? How does reliability relate to probability? Participants begin to engage with the mathematical underpinnings of the discipline and are introduced to relevant calculations and statistical concepts. Consideration is given to the appreciation of the benefits of reliability engineering.

The implementation of reliability engineering incorporates aspects of cultural change within an organisation and so this module, whilst focussing on the underpinnings of reliability engineering also promotes an appreciation interdisciplinary and inter-team working. The connection of the theory to any individual's own practice is encouraged throughout, particularly through discussion and reflection.

Delegates participating on this module will study and explore:

- Reliability and maintainability requirements in engineering products – an introduction to reliability engineering.

Tel: +44 (0) 1952 671950
Fax: +44 (0) 1952 671951
Web: www.qlsl.com

- The potential influence of product reliability on the need for supportability and specifically upon ownership, usage, maintenance and training.
- The cost of building in reliability and the cost providing supportability.
- Definitions of concepts in reliability engineering e.g. durability, testability, availability, maintainability, supportability.
- Reviewing systems engineering with respect to reliability (case studies or reflections).
- Measures of reliability.
- Concepts in calculating reliability including probability, distributions, statistical confidence, hypothesis testing, goodness of fit, probability plotting, lognormal, Weibull and load-strength interference, confidence levels.
- The impact of variability upon products, systems, components.
- The perceived benefits of reliability engineering drawing from experience and from case studies and the benefits to support provisioning and system safety.
- The roles of reliability engineering within a systems engineering environment/project.
- Team development for reliability engineering performance.
- Introduction to reliability and maintainability case reports.

Module 2 - Application of Reliability Engineering.

This module seeks to enable participants to effectively and successfully implement Reliability and Maintainability (R&M) actions in their industrial setting. The focus is around the design and creation activities that can provide an organisation, customers and suppliers with real improvements in R&M.

Application of Reliability Engineering requires an understanding of the specified R&M requirements to determine the associated engineering risks such that a strategy for compliance and risk mitigation can be planned. Plans for reliability improvements and satisfying reliability requirements with an auditable body of evidence showing compliance are developed with a view to application in a systems engineering team environment. Different tools for predicting reliability are appraised and used as an extended part of the planning process.

The module enables practitioners to develop an understanding of analytical models for use in the reliability improvement process. Participants will be equipped to select and apply appropriate analytical models, tools and techniques for use within a systems engineering team environment. Participants will become familiar and secure with the vocabulary of analysis and confident with the use of software and calculations for analysis.

Delegates participating on this module will study and explore:

- **Requirements of an R&M project** including deliverables, equipment capability and procurement. Through discussion context specific additional requirements can be explored.
- **Influences upon reliability planning**: risk, strategy, integration, trade offs (the role of trade offs in decision making e.g. by suppliers of materials), quality standards,

Tel: +44 (0) 1952 671950
Fax: +44 (0) 1952 671951
Web: www.qlsl.com

progressive assurance, the role of review and strategies for review, targets and contracts. Participants will look at the general influences but also consider how these apply to their setting.

- **Team-working to develop planning:** communications, reviews, meetings.
- **Tools for predictions**: Reliability Block Diagrams (RBD's), Fault Tree Analysis (FTA), RELEX (Software) and prediction models.
- **Review the steps involved in applying an R&M Programme:** in a specific employment context. Steps would include programming activities, review, configuration of activities, re-planning, and updating of plans in the light of earlier experience.
- **Analysis of reliability and maintainability using recognised techniques.** Techniques for analysis would typically include FMEA (Failure Modes and Effects Analysis) and FMECA (Failure Mode, Effects and Criticality Analysis), Functional FMECA, Modelling Maintainability using Maximum Active Corrective Maintenance Time (MACMT) and Mean Time to Repair (MTTR). The module offers an overview of these techniques and encourages application through in-class exercises.
- **The role of evaluation in planning and implementing reliability improvements**: Strategies for evaluating projects are considered across the different stages of a product or process development.

Module 3 - Verification of Reliability Engineering.

Verification of Reliability Engineering seeks to demonstrate that a product (component, subsystem or system) meets specific, defined, and in some cases safety critical, requirements. Verification procedures exist to provide the required method and parameters for implementation of incident reporting and corrective action systems which are instrumental in understanding how a product (system or equipment) is actually performing in the field from a reliability and maintainability perspective.

Participants will examine the process and purpose of verification in reliability engineering and develop knowledge and skills for the achievement of validation in their context. Participants will work with verification data, tools and plans and will gain an understanding of the importance of, and means to achieve, a successful corrective action. There is a focus on planning for verification, using techniques for monitoring performance, handling verification data, and monitoring findings to inform future actions.

Special attention is given to *Data Reporting and Corrective Action System* (DRACAS), which is an innovative safety and reliability solution. DRACAS is a database used primarily to enter faults/failures collected from a working system as well as required improvements for procedures and processes. Based on this data DRACAS produces a history of faults/failures of the system components in both textual and graphical formats; the participant will prepare a DRACAS data set and learn to accurately interpret this with reference to their own context. Calculations such as *Duane and Chi-square* are demonstrated and practised to inform the verification process.

Delegates participating on this module will study and explore:

- **Design and negotiation of Reliability and growth test planning** including appraisal of resource requirements (time, resource, cost) against risk mitigation (design improvement) and compliance with specified R&M requirements.

Tel: +44 (0) 1952 671950
Fax: +44 (0) 1952 671951
Web: www.qlsl.com

- **Reliability Qualification Trials (RQT's):** The role of RQT's is explored as a means to formally verify to the purchaser (and customer) the achievement of reliability of a product to satisfy the contract requirements.
- **Data Reporting and Corrective Action System (DRACAS)**: What is DRACAS, understanding and entering data, deconstructing fault/failure records, interpreting and reporting data from DRACAS, calculations using DRACAS data.
- **Product Reliability and Acceptance Testing (PRAT)**: Performing PRAT; PRAT in the context of customers' requirements and/or expectations.
- **Relating monitoring and planning for improvements in product reliability**: case studies.
- **Project scheduling**: Monitoring within constraints, resourcing corrective actions, goal setting for reliability targets and costing the verification process.

Module 4 - Reliability Engineering and Supportability:

This module is designed to provide an introduction to the Reliability Centred Maintenance (RCM) process and introduce the skills necessary to perform RCM analysis. RCM is an analytical process used to determine appropriate failure management strategies to ensure safe and cost-effective operations of a physical asset in a specific operating environment.

RCM can be used to create a cost effective maintenance strategy to address the causes of equipment failure. It is a systematic approach to defining a routine maintenance programme composed of suitable cost effective tasks that preserve user defined functions based on the asset's operating context.

Through a consideration of supportability engineering, a discipline that is applied to integrated logistic support (ILS) methodology amalgamated with systems engineering to achieve the design of an optimised and coherent support solution, the module seeks to explore how early design can be effective in determining whole life costs. Participants learn to identify and develop support resource requirements, gain the confidence to make decisions about appropriate support resources and develop an understanding of the required in-use support for optimum whole life costs. The module also encourages participants to evaluate support activity against a framework of costs, resource availability and standards.

Delegates participating on this module will study and explore:

- **Supportability** as a concept is explained and set in the context of reliability and logistic support. The relationships between the fields are identified.
- **RCM**: Why RCM was developed; the RCM outputs and process, the relationship between reliability and RCM, RCM Algorithms and logic, RCM tools and RCM limitations.
- **RCM 7 Questions**: functions of assets, functional failure, consequences of functional failure, prevention and prediction of failure, contingency and pro-activity.
- **RCM toolkit:** appropriate use, examples, practise.
- **Spares analysis and planning:** Using inputs from the maintenance schedule, frequency of failure (reliability), tools and software for spares planning and usage profile to determine the range and scale of spare parts.

Tel: +44 (0) 1952 671950
Fax: +44 (0) 1952 671951
Web: www.qlsl.com

- **Life cycle cost analysis:** Inputs from the maintenance schedule, frequency of failure (reliability), usage profiles and spares analysis to determine the cost of ownership, trade off and review in relation to different systems options. Learners will analyse *RCM* in relation to a product lifecycle and worked examples will typically be used. Software and other tools are also considered in relation to this area.
- **Methods of integrating and managing RCM** are considered (in some instances this may be with reference to documentation, training and staff support).

Tel: +44 (0) 1952 671950
Fax: +44 (0) 1952 671951
Web: www.qlsl.com