Unit T16: Quality Management in Engineering

Unit code:	Y/503/7414
QCF level:	6
Credit value:	15

Aim

The aim of this unit is to develop learners' understanding of, and their ability to apply suitable tools and techniques in the implementation of continuous quality improvement in engineering.

Unit abstract

The unit will enable learners to help an organisation to adopt a high quality assurance culture. 'Total Quality' is a description of the culture, attitude and organisation of a company that strives to provide customers with products and services that satisfy their needs. The culture requires quality in all aspects of the company's operations, with processes carried out right the first time and defects and waste eradicated from operations.

Learning outcome 1 deals with fundamental statistical principles and the common quality tools. Learning outcome 2 covers the main developments in quality and quality management systems, including the systematic use of six sigma tools in continuous quality improvement and ISO 9000. Learning outcome 3 deals with the main methods used in statistical quality control.

Learning outcomes

On successful completion of this unit a learner will:

1 understand statistical principles and tools used in engineering quality management

2 understand quality and quality management systems in engineering

3 be able to apply and manage process capability and statistical quality control techniques in engineering.

Unit content

1 Understand statistical principles and tools used in engineering quality management

Principles: standard normal distribution; sampling and sample statistics; testing of distribution hypotheses; data correlation; stratification; regression analysis

Tools: process flowcharts; scatter diagrams; process control charts; cause and effect diagrams; Pareto analysis; check sheets; histograms

2 Understand quality and quality management systems in engineering

Total quality management (TQM) and five sigma: TQM principles; developing a quality culture; process improvement and problem-solving sequence; cost; lean five sigma definitions; implementation

The six sigma quality process: define-measure-analyse-improve-control (DMAIC); quality function deployment (QFD); design of experiments (DOE); cause and effect matrix; failure mode and effect analysis [FMEA]; t-test: statistical process control (SPC) chart

ISO 9000: quality management system (QMS); ISO 9000 registration; opportunities; costs; procedures for audits

3 Be able to apply and manage process capability and statistical quality control techniques in engineering

Process capability: process capability components (assumptions, conditions, precautions); calculation and interpretation of process capability indices (taking account of off-centred processes)

Control charts: where to use control charts; choice of statistical process control (SPC) chart type; sampling strategies; introducing and evaluating SPC; development and use of control charts for attributes involving discrete/countable data measures (p chart, np chart, c chart, u chart); development and use of control charts for variables involving continuous data measures (X (bar) chart, R chart, combined X(bar) and R charts)

Acceptance sampling: critical evaluation of system requirements; producers' and consumers' risk; single-sample attribute plan; the operating characteristic (OC) curve; average outgoing quality; double and multiple sampling plans

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria for pass
On successful completion of this unit a learner will:	The learner can:
LO1 Understand statistical principles and tools used in engineering quality management	1.1 Critically evaluate statistical methods used in engineering quality management 1.2 Explain the quality tools used in engineering quality management
LO2 Understand quality and quality management systems in engineering	2.1 Critically appraise the structure of a quality management system 2.2 Describe how to implement a lean five sigma programme in engineering applications 2.3 Describe the six sigma quality process 2.4 Explain how to carry out an ISO 9000 quality audit
LO3 Be able to apply and manage process capability and statistical quality control techniques in engineering	3.1 Summarise aspects of process capability for statistical quality control techniques 3.2 Create and interpret control charts for SPC 3.3 Design appropriate sampling plans to meet particular conditions in given engineering applications.

Guidance

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 5
Unit 30: Quality Assurance and Management
Unit 36: Statistical Process Control

The content of this unit has been designed and mapped against the Engineering Council's current Learning Outcomes for IEng Accreditation. The completion of the learning outcomes for this unit will contribute knowledge, understanding and skills towards the evidence requirements for IEng Registration.

See *Annexe B* for summary of mapping information for IEng Accreditation.

Essential requirements

There are no special requirements needed for this unit.

Delivery

In this unit learners need to become familiar with manipulating and interpreting data. It is suggested that extensive use is made of Excel and/or statistical software such as MINITAB (if available). If necessary help and guidance in more advanced use of Excel should be incorporated.

As far as possible, realistic data and case study examples should be used, ideally sourced from local companies.

Assessment

A suitable form of assessment would be an assignment aimed at giving learners the opportunity to demonstrate their ability to apply statistical tools and understand principles. A formal examination to assess their understanding and application of principles.

Typically, the assignment could also be used data sets being given to learners being given data sets, ideally with variants between students or groups to avoid plagiarism. A set of tasks might be: analyse data and test hypothesis for normal distribution; estimate process capability and % rejects given tolerance; test if statistical requirements for six sigma have been achieved and if necessary suggest changes; identify and prepare appropriate control charts.

The formal examination should cover all the learning outcomes.

Resources

Books

Foster T – *Managing Quality* (Pearson, 2009) ISBN 978-0135078198

Mitra A – *Fundamentals of Quality Control and Improvement* (Wiley-Blackwell, 2008) ISBN 978-0470226537

Montgomery D – *Introduction to Statistical Quality Control* (Wiley, 2009) ISBN 978-0470169926

Oakland J S – *Statistical Process Control* (Butterworth-Heinemann, 2008) ISBN 978-0750669627

Prajapati D R and Mahapatra P B – 'Control charts for variables to monitor the process mean and dispersion: a literature review,' in *International Journal of Productivity and Quality Management*, Vol. 4, Number 4, pp 476–520

Website

www.tpmonline.com/articles_on_total_productive_maintenance/leanmfg/5sphilosophy.htm – gives useful definitions of 5S and an outline to its philosophy.

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