


ENGI08040 Six Sigma Engineering (Part-time)

Full Title	Six Sigma Engineering (Part-time)		
Status	Uploaded to Banner	Start Term	2020
NFQ Level	08	ECTS Credits	05
Module Code	ENGI08040	Duration	18 weeks - (18 Weeks)
Grading Mode	Numeric	Department	Mechanical & Industrial Eng
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Module Description

This module looks at the application of Six Sigma Quality Management techniques and tools and the "Define, Measure, Analyse, Improve, and Control" (DMAIC) process to solve industry problems. It gives students a toolkit of techniques with which to define a problem, collect data about it, look for trends in the data, design experiments to develop new solutions, and ensure that process improvements are sustained.

Learning Outcomes	
	<i>On completion of this module the learner will/should be able to:</i>
1.	Describe data using statistics and probability distributions, and apply statistics and probability distributions to the conduct of process capability analysis, Gage R&R studies for variables (Xbar/R and ANOVA) and attribute agreement analysis.
2.	Prioritise and filter input variables using Failure Modes and Effects Analysis (FMEA) and XY Diagrams.
3.	Measure and model relationships between variables, perform linear and multiple regression and identify sources of variability, using Multi-vari analysis.
4.	Perform Hypothesis testing, including paired tests, to determine the statistical significance of the result of process changes for mean, variance, goodness of fit and proportions, and construct confidence Intervals for means, variance and proportion.
5.	Design and conduct experiments, by selecting appropriate experimental design (screening, full and fractional factorial, response surface, Taguchi), developing the design, analysing results and residuals and developing prediction equations.
6.	Recommend appropriate strategies to sustain process improvements in an organisation, including developing Control Plans, and identifying relevant variable control charts (Xbar and R, Individual and MR, Median) and attribute control charts to monitor the performance of improved processes.
7.	Use the A3 Problem Solving Methodology and DMAIC Process to solve a case study problem and present the solution and data using graphical methods.

Indicative Syllabus

The Six Sigma Organisation Overview, Six sigma in manufacturing, Lean Six Sigma

Statistics: The statistics behind the six sigma concept: (binomial, Poisson, normal, t, Chi Square, F, exponential, hypergeometric)

The Six Sigma DMAIC Approach & A3 Problem-Solving

Review of Define Phase: project definition, development of problem statements, metrics, Business Case, Project Charter

Measure: Data collection. numerical and statistical description of processes, characterisation of baseline processes. Process capability (Cp, Cpk, Pp, Ppk, Relative Precision Index), Gage R&R, attribute Agreement Analysis.

Analyse: Perform Hypothesis testing, including z and t tests for mean, Chi Square test for variance, F test, Chi Square Goodness of Fit test, Hypothesis tests for proportions, Paired comparison Hypothesis tests, ANOVA; and construct confidence Intervals for means, variation and proportion.

Improve: Design of experiments. Independent and dependent variables. Factors and levels. Full factorial design, fractional factorial design. Screening, response surface, Taguchi.

Control: Advanced Statistical Process Control, Control charts for attributes (p-, np-, c- and c-charts) and variables (Xbar & R, Individual & MR, Median). Control Plans

The Minitab software system will be used in the DMAIC process.

Teaching and Learning Strategy

Learners on the programme will be supported with blended online educational resources and support.

All learners have access to online training delivery tools such as "LearnOnline", Microsoft teams and Microsoft stream. There will be a 1 hour per week live online lecture where students can attend class via a laptop, PC or mobile device. Microsoft Teams will enable this activity. Learner can interact with lecturer through the chat box. The lecture will be of a theory content and will follow the DMAIC sequence. An actual industry case study will be reviewed. Lectures will be uploaded through Microsoft stream onto "LearnOnLine". The advantage of this is learners can plan study around conflicting priorities.

There will be a 2-hour practical/laboratory work in a computer laboratory. The practical work will involve individual problem-solving.. This will mean that learners will have to practice solving Six Sigma problems in a laboratory setting. Students will use MINITAB, or learning games, such as the Statapult, or Glider Launcher. A fictional case study will also be used as a basis for the application of the tools by students.

Assessment Strategy

There will be one 20% in-lab assessment, based on the use of MINITAB to analyse Six Sigma problems, and on a case study.

The theoretical concepts and tools will be assessed in a terminal examination.

Repeat Assessment Strategies

An autumn repeat examination will be provided.

Indicative Coursework and Continuous Assessment:		20 %		
Form	Title	Percent	Week (Indicative)	Learning Outcomes
Practical Evaluation	Class Assessment Laboratory exercises using Excel and Minitab or equivalent software. Case studies.	20 %	OnGoing	2,3,4,5,7

End of Semester / Year Formal Exam:		80 %		
Form	Title	Percent	Week (Indicative)	Learning Outcomes
Closed Book Exam	Final Exam End of Term Exam	80 %	End of Term	1,2,3,4,5,6

Blended Delivery Mode Average Weekly Workload:			3.00 Hours		
Type	Description	Location	Hours	Frequency	Weekly Avg
Online Learning	Online Delivery	Not Specified	1	Weekly	1.00
Practical	Laboratory	Engineering Laboratory	2	Weekly	2.00

Recommended Reading Book List

Benbow, W., (2016). *The Certified Six Sigma Black Belt Handbook*. 3rd Edition. ASQ Quality Press.
ISBN 0873899415 ISBN-13 9780873899413

Michael, D., (2010). *The Memory Jogger 2*. 2nd Edition. Goal Q P C Incorporated.
ISBN 1576811131 ISBN-13 9781576811139

Brook, Q., (2020). *Lean Six Sigma and Minitab: The Complete Toolbox Guide for Business Improvement*. 6th Edition. OPEX Resources Ltd.

Indiana, QC., (2020). *CSSBB Certified Six Sigma Black Belt Primer*. 1st Edition. Quality Council of Indiana.

Sullivan, I., (2017). *Statistics*.
ISBN 1292157119 ISBN-13 9781292157115

Literary Resources

Six sigma and MINITAB : a toolbox guide for managers, black belts and green belts / Quentin Brook. [England] ; QSB Consulting Ltd, 2014
Certified Six Sigma Black Belt Primer, Quality Council of Indiana, 2014

The Certified Six Sigma Green Belt Handbook, Second Edition, American Society of Quality, 2015

Six Sigma fundamentals : a complete guide to the system, methods and tools / by D.H.

Stamatis., New York, N.Y. : Productivity Press, c2004.

Six Sigma : SPC and TQM in manufacturing and services / Geoff Tennant. [Aldershot] : Gower, [2001]

Design of Experiments for Process Improvement and Quality Assurance Robert F. Brewer, Engineering and Management Press, 1996

Online Resources

All notes, resources and laboratory exercises used in the module are on the module's moodle page.

Other Resources

Statpult learning tool.

Glider Launcher learning tool.

MINITAB software package.

One PC per student for lab exercises

Additional Information

None

Programme Membership

GA_EINDG_H08 202000 Bachelor of Engineering (Honours) in Industrial Engineering