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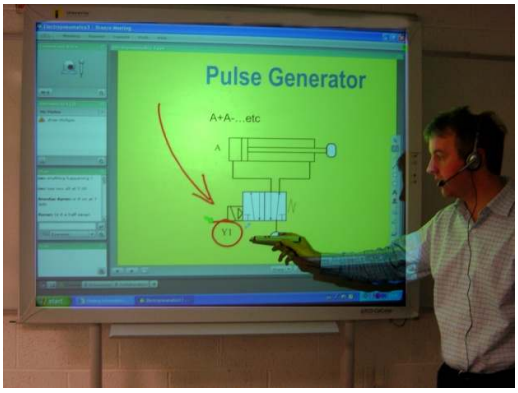
# Six Sigma Green Belt Course

# IT Sligo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$6\sigma$

# Six Sigma Green Belt Course – IT Sligo
# Apply at:www.itsligo.ie/online/sixsigma.htm

The Six Sigma Green Belt course commences in September and January each year (where there is sufficient demand) and runs for one semester. The programme comprises of three modules which are as follows:

- Six Sigma I (Quality Tools)
- Six Sigma II (Statistical Control)
- Six Sigma III (Project)

The delivery of the six sigma modules I & II in parallel with the six sigma project allows the student to use the tools for a real life project thus gaining a better understanding of the six sigma methodology. This 'learning by doing' approach also allows for better integration of the tools into the students workplace. Full details of each module are at the end of the page.
The three modules followed by the 1 day workshop cover the requirements of the Six Sigma Green Belt award. This flexible approach will allow for cost savings and participation at all levels within the organisation from supervisor and technician through to engineering and management level.

Six Sigma Green Belt Course

| Module | Credits | Cost Per Student € | Duration | Dates |
|---|---|---|---|---|
| Six Sigma I (Quality Tools) | 5 | 658 | 16 weeks | Sep & Jan start dates |
| Six Sigma II (Statistical Control) | 5 | 658 | 16 weeks | Sep & Jan start dates |
| Six Sigma III (Project) | 5 | 658 | 16 weeks | Sep & Jan start dates |
| **Total (3 Modules) Green Belt** | **15** | **€1974** | 16 weeks | |
| External Six Sigma Green Belt Exam & Workshop | N/A | €200 | 1 Day | TBD |

For example, students who just want an introduction to Six Sigma at the Green Belt level could take Six Sigma I. If more detailed Six Sigma statistical knowledge is required, students could then take Six Sigma II and Six Sigma III. Students can also attend the IT Sligo induction for online learners in September where they would receive training on the online learning system Moodle and an introduction to their Six Sigma lectures. The costs shown above include course fees, examinations fees, access to the online lectures, access to the Learning Management system Moodle where course notes and reading material are provided. The only additional cost for the student is the cost of textbooks and Minitab software which is estimated to be approx €150 per student.

## *Six Sigma Green Belt Exam*

Successful completion of the three modules satisfies the requirements of the International Quality Federation (http://www.iqfnet.org/), the organisation responsible for Six Sigma Green Belt certification. This certification to Green Belt is organised through an Irish based training company. The Green Belt fee of €200 covers a 1 day workshop for Green Belt exam revision along with the cost of the exam. It includes:

- Set of notes to cover the Green Belt exam material
- Sample Set of Exam Questions
- Access to On Line Study Guide
- Access to On Line Examination
- Green Belt Certification based on successful completion of the examination.

Note that this exam is in addition to the normal HETAC accredited end of semester exams which are held by IT Sligo.

## *Academic Qualification - Courses HETAC Accredited*

The Six Sigma modules are HETAC accredited at Level 7 at 5 credits each. This means that a student can study for an online degree program which is both nationally and internationally recognised. The on-line student sits the same exam as the full time student and is awarded the same qualification.

## *Further Study Options*

As IT Sligo already offer online programs from Levels 7 -9 on the National Qualifications Framework (NQF), there will be a progression path for those students who pass the modules and wish to continue on with a degree in Quality or Manufacturing Management. Students who meet the eligibility criteria to enter the full degree programme can therefore upgrade skills in specific areas while still earning credits towards a final degree award. On successful completion of the three Six Sigma modules, the student will receive 15 credits at Level 7.

## *Module Syllabi*

The following is an overview of each module on the Six Sigma Course which follows the internationally recognised Green belt body of knowledge.

| **Module Title** | **Six Sigma I – Quality Tools** |
|---|---|

### Overview: Six Sigma and the Organisation

**A. Six sigma and organizational goals**

- Value of six sigma
- Recognize why organizations use six sigma, how they apply its philosophy and goals, and the origins of six sigma (Juran, Deming, Shewhart, etc.). Describe how process inputs, outputs, and feedback impact the larger organization.
- Organizational drivers and metrics
- Recognize key drivers for business (profit, market share, customer satisfaction, efficiency, product differentiation) and how key metrics and scorecards are developed and impact the entire organization.
- Organizational goals and six sigma projects
- Describe the project selection process including knowing when to use six sigma improvement methodology (DMAIC) as opposed to other problem-solving tools, and confirm that the project supports and is linked to organizational goals.

**B. Lean principles in the organization**

- Lean concepts and tools
- Define and describe concepts such as value chain, flow, pull, perfection, etc., and tools commonly used to eliminate waste, including kaizen, 5S, error-proofing, value-stream mapping, etc.
- Value-added and non-value-added activities
- Identify waste in terms of excess inventory, space, test inspection, rework, transportation, storage, etc., and reduce cycle time to improve throughput.
- Theory of constraints
- Describe the theory of constraints.

**C. Design for Six Sigma (DFSS) in the organization**

- Quality function deployment (QFD)
- Describe how QFD fits into the overall DFSS process.
- Design and process failure mode and effects analysis (DFMEA & PFMEA)
- Define and distinguish between design FMEA (DFMEA) and process (PFMEA) and interpret associated data.
- Road maps for DFSS
- Describe and distinguish between DMADV (define, measure, analyze, design, verify) and IDOV (identify, design, optimize, verify), identify how they relate to DMAIC and how they help close the loop on improving the end product/process during the design (DFSS) phase.

### II. Six Sigma – Define

**A. Process Management for Projects**

- Process elements

- Define and describe process components and boundaries. Recognize how processes cross various functional areas and the challenges that result for process improvement efforts.
- Owners and stakeholders
- Identify process owners, internal and external customers, and other stakeholders in a project.
- Identify customers
- Identify and classify internal and external customers as applicable to a particular project, and show how projects impact customers.
- Collect customer data
- Use various methods to collect customer feedback (e.g., surveys, focus groups, interviews, observation) and identify the key elements that make these tools effective. Review survey questions to eliminate bias, vagueness, etc.
- Analyze customer data
- Use graphical, statistical, and qualitative tools to analyze customer feedback.
- Translate customer requirements
- Assist in translating customer feedback into project goals and objectives, including critical to quality (CTQ) attributes and requirements statements. Use voice of the customer analysis tools such as quality function deployment (QFD) to translate customer requirements into performance measures.

**C. Management and planning tools**

- Define, select, and use 1) affinity diagrams, 2) interrelationship digraphs, 3) tree diagrams, 4) prioritization matrices, 5) matrix diagrams, 6) process decision program (PDPC) charts, and 7) activity network diagrams.

**D. Business results for projects**

- Process performance
- Calculate process performance metrics such as defects per unit (DPU), rolled throughput yield (RTY), cost of poor quality (COPQ), defects per million opportunities (DPMO) sigma levels and process capability indices. Track process performance measures to drive project decisions.
- Failure mode and effects analysis (FMEA)
- Define and describe failure mode and effects analysis (FMEA). Describe the purpose and use of scale criteria and calculate the risk priority number (RPN).

## III. Six Sigma – Measure

**A. Process analysis and documentation**

- Process modeling
- Develop and review process maps, written procedures, work instructions, flowcharts, etc.
- Process inputs and outputs
- Identify process input variables and process output variables (SIPOC), and document their relationships through cause and effect diagrams, relational matrices, etc.

**B. Collecting and summarizing data**

- Types of data and measurement scales
- Identify and classify continuous (variables) and discrete (attributes) data. Describe and define nominal,
- ordinal, interval, and ratio measurement scales.
- Data collection methods
- Define and apply methods for collecting data such as check sheets, coded data, etc.
- Techniques for assuring data accuracy and integrity
- Define and apply techniques such as random sampling, stratified sampling, sample homogeneity, etc.
- Descriptive statistics
- Define, compute, and interpret measures of dispersion and central tendency, and construct and interpret
- frequency distributions and cumulative frequency distributions.
- Graphical methods
- Depict relationships by constructing, applying and interpreting diagrams and charts such as stem-and-leaf plots, box-and-whisker plots, run charts, scatter diagrams, Pareto charts, etc.
- Depict distributions by constructing, applying and interpreting diagrams such as histograms, normal probability plots, etc.

## Mandatory Green Belt Textbook

| Authors | Title | Publishers | Year |
|---|---|---|---|
| Paul A. Keller | *Six Sigma Demystified*<br>450 pages<br>ISBN:0071445447 | McGraw-Hill Professional | 2004 |

| Module Title | Six Sigma II - Statistical Control |
|---|---|

## Indicative Syllabus

## I. Six Sigma – Measure

**A. Probability and statistics**

- Drawing valid statistical conclusions
- Distinguish between enumerative (descriptive) and analytical (inferential) studies, and distinguish between a population parameter and a sample statistic.
- Central limit theorem and sampling distribution of the mean
- Define the central limit theorem and describe its significance in the application of inferential statistics for confidence intervals, control charts, etc.
- Basic probability concepts
- Describe and apply concepts such as independence, mutually exclusive, multiplication rules, etc.

**B. Probability distributions**

- Describe and interpret normal, binomial, and Poisson, chi square, Student's t, and F distributions.

**C. Measurement system analysis**

- Calculate, analyze, and interpret measurement system capability using repeatability and reproducibility (GR&R), measurement correlation, bias, linearity, percent agreement, and precision/tolerance (P/T).

**E. Process capability and performance**

- Process capability studies
- Identify, describe, and apply the elements of designing and conducting process capability studies, including identifying characteristics, identifying specifications and tolerances, developing sampling plans, and verifying stability and normality.
- Process performance vs. specification
- Distinguish between natural process limits and specification limits, and calculate process performance metrics such as percent defective.
- Process capability indices
- Define, select, and calculate $C_p$ and $C_{pk}$, and assess process capability.
- Process performance indices
- Define, select, and calculate $P_p$, $P_{pk}$, $C_{pm}$, and assess process performance.
- Short-term vs. long-term capability
- Describe the assumptions and conventions that are appropriate when only short-term data are collected and when only attributes data are available. Describe the changes in relationships that occur when long-term data are used, and interpret the relationship between long- and short-term capability as it relates to a 1.5 sigma shift.
- Process capability for attributes data
- Compute the sigma level for a process and describe its relationship to $P_{pk}$.

## II. Six Sigma – Analyze

**A. Exploratory data analysis**

- Multi-vari studies
- Create and interpret multi-vari studies to interpret the difference between positional, cyclical, and temporal variation; apply sampling plans to investigate the largest sources of variation.
- Simple linear correlation and regression
- Interpret the correlation coefficient and determine its statistical significance (p-value); recognize the difference between correlation and causation. Interpret the linear regression equation and determine its statistical significance (p-value). Use regression models for estimation and prediction.

**B. Hypothesis testing**

- Basics
- Define and distinguish between statistical and practical significance and apply tests for significance level, power, type I and type II errors. Determine appropriate sample size for various test. .
- Tests for means, variances, and proportions
- Define, compare, and contrast statistical and practical significance.
- Paired-comparison tests
- Define and describe paired-comparison parametric hypothesis tests.
- Single-factor analysis of variance (ANOVA)
- Define terms related to one-way ANOVAs and interpret their results and data plots.
- Chi square
- Define and interpret chi square and use it to determine statistical significance.

## III. Six Sigma – Improve & Control

**Design of experiments (DOE)**

- Basic terms
- Define and describe basic DOE terms such as independent and dependent variables, factors and levels, response, treatment, error, repetition, and replication.
- Main effects
- Interpret main effects and interaction plots.

**Statistical process control (SPC)**

- Objectives and benefits
- Describe the objectives and benefits of SPC, including controlling process performance, identifying
- special and common causes, etc.
- Rational subgrouping
- Define and describe how rational subgrouping is used.
- Selection and application of control charts
- Identify, select, construct, and apply the following types of control charts: −R, −s, individuals and moving range (ImR / XmR), median ( ), p, np, c, and u.
- Analysis of control charts
- Interpret control charts and distinguish between common and special causes using rules for determining statistical control.

**Implement and validate solutions**

- Use various improvement methods such as brainstorming, main effects analysis, multi-vari studies, FMEA, measurement system capability re-analysis, and post-improvement capability analysis to identify, implement, and validate solutions through F-test, t-test, etc .

**Control plan**

- Assist in developing a control plan to document and hold the gains, and assist in implementing controls and
- monitoring systems.

## Indicative Practicals/Projects

Entering data into Minitab. Copying and pasting from and to Excel
Plotting and editing graphs in Minitab
Generating reports with Minitab.
Use of Minitab to plot data eg. Scatter diagrams, Histograms
Use of Minitab to plot $\bar{x}$ and R Control chart data
Plotting attribute Control charts with Minitab

| Module Title | Six Sigma III – Project |
|---|---|

**Subject Aims:**
The work-based project aims to provide students with the opportunity to apply and integrate the Six Sigma skills and knowledge they have gained on the programme. The project(s) will be undertaken by the student and should address a substantive issue in the workplace. The project(s) will test the student's ability to define a real-life problem of concern to the organisation, design a strategy for addressing the problem (DMAIC), gather data, formulate and evaluate options and make recommendations. While it is recommended that the problem is addressed as part of a cross-functional team, it is important that the student makes a significant contribution to the success of the project. Students will be given the opportunity to reflect on the strengths and weaknesses of their own leadership and communication skills, and those of the organisation with recommendations for change identified.

**Syllabus Content**
The student should bring the learning from the subjects covered in the course to conceive, define and agree a project which is work based and relevant to the subject matter. A mentor will be assigned to each project, which may be individual or group projects. The mentor will act as a guide in agreeing the relevance, and scope of the project, and monitor the progress on a regular basis. Updates will be sent to the mentor on an agreed basis. There will be a final presentation on the project to which marks will be awarded.

The lectures on this module will address the following elements of the Six Sigma Green Belt body of knowledge.

**A. Project management basics**
- Project charter and problem statement
- Define and describe elements of a project charter and develop a problem statement, including baseline and improvement goals.
- Project scope
- Assist with the development of project definition/scope using Pareto charts, process maps, etc.
- Project metrics
- Assist with the development of primary and consequential metrics (e.g., quality, cycle time, cost) and establish key project metrics that relate to the voice of the customer.
- Project planning tools
- Use project tools such as Gantt charts, critical path method (CPM), and program evaluation and review technique (PERT) charts, etc.
- Project documentation
- Provide input and select the proper vehicle for presenting project documentation (e.g., spreadsheet output, storyboards, etc.) at phase reviews, management reviews and other presentations.
- Project risk analysis
- Describe the purpose and benefit of project risk analysis, including resources, financials, impact on customers and other stakeholders, etc.
- Project closure
- Describe the objectives achieved and apply the lessons learned to identify additional opportunities.

**B. Team dynamics and performance**
- Team stages and dynamics
- Define and describe the stages of team evolution, including forming, storming, norming, performing, adjourning, and recognition. Identify and help resolve negative dynamics such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, groupthink, feuding, floundering, the rush to accomplishment, attribution, discounts, plops, digressions, tangents,
- Six sigma and other team roles and responsibilities
- Describe and define the roles and responsibilities of participants on six sigma and other teams, including black belt, master black belt, green belt, champion, executive, coach, facilitator, team member, sponsor, process owner, etc.
- Team tools
- Define and apply team tools such as brainstorming, nominal group technique, multi-voting, etc.
- Communication
- Use effective and appropriate communication techniques for different situations to overcome barriers to project success.