GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Quality Engineering and Industrial Statistics (E060240)

Course size (nominal values; actual values may depend on programme)

Credits 6.0	Study time 180 h	Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch	seminar: practical PC room classes	20.0 h
		guided self-study	40.0 h
B (semester 2)	English	seminar: practical PC room classes	20.0 h
		demonstration	40.0 h

Lecturers in academic year 2018-2019

De Vuyst, Stijn	TW18	lecturer-in-charge
Aghezzaf, El-Houssaine	TW18	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Master of Science in Electrical Engineering (main subject Communication and Information Technology)	6	B
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	B
Master of Science in Business Engineering (main subject Data Analytics)	6	B
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	6	B
Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)	6	B
Master of Science in Business Engineering (main subject Finance)	6	B
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	B
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	6	B
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	B
Master of Science in Business Engineering (main subject Operations Management)	6	B
Master of Science in Industrial Engineering and Operations Research	6	A
Master of Science in Chemical Engineering	6	B
Master of Science in Civil Engineering	6	B
Master of Science in Computer Science Engineering	6	B
Master of Science in Computer Science Engineering	6	B
Master of Science in Industrial Engineering and Operations Research	6	B
Master of Science in Sustainable Materials Engineering	6	B
Master of Science in Chemical Engineering	6	B
Postgraduate programme in Innovation and Entrepreneurship in Engineering	6	B

Teaching languages

Dutch, English

Keywords

Data Analysis, Production Process Characterization, Modeling, Improvement, Monitoring, Quality Control, Design of Experiments, Linear regression, Control Charts,

measurement and process capability

Position of the course

Place of this course in the curriculum: this course is an advanced course in applied industrial statistics. A primary course in probability and statistics is required.
Goal: To teach the students a profound knowledge of industrial statistcs and familiarize them with common statistical tools for quality control, process monitoring and process improvement; to activate the knowledge through cases, projects and exercises - with pen & paper as well as with statistical software.

Contents

- Introduction to quality systems: quality concepts, philosophies and systems
- Multidimensional data: Exploratory Data Analysis and Principal Component Analysis.
- Overview of preliminaries (industrial) statistics: random samples, statistical inference, tests of hypotheses, point estimation of quality parameters, confidence intervals for quality parameters
- Simple and multiple linear regression, nonparametric tests and Bayesian inference
- Statistical process control: methods and philosophy of statistical process control, control charts for variables, control charts for attributes
- Other process monitoring techniques and capability analysis: Cumulative Sum and Exponentially Weighted Moving Average control charts, other statistical process monitoring and control techniques, process and measurement system capability analysis
- Acceptance sampling plan systems: acceptance sampling for attributes and variables
- Design and analysis of experiments: designed experiments, experiments with a single factor, analysis of variance (ANOVA), randomized blocks, latin squares, and related designs
- Design and analysis of experiments: designed experiments with multiple factors, 2^k factorial design, blocking and confounding
- Design and analysis of experiments: fractional factorial designs, 2^{k-p} designs, two-level, three-level and mixed-level factorial designs, fitting, regression models
- Process optimization with designed experiments: response surface methods and other approaches to process optimization, experiments with random facts, Taguchi approach to quality and robust designs
- Introduction to reliability engineering: basic reliability models and the failure distribution, constant and time-dependent failure rate model, reliability, maintainability and availability of complex systems

Implementation of all these aspects using software for statistical computing, in casu R.

Initial competences

Basic Statistics Course and basic knowledge of probability theory

Final competences

1 Being able to describe and quantify variability in quality data
2 Being able to select, execute and interpret the results of suitable hypothesis tests for quality data
3 Being able to build suitable models from measurement data using linear regression and interpret them correctly
4 Being able to perform one- and two-way ANOVA and analyse the results
5 Being able to select, design, interpret and assess the performance of suitable control charts
6 Being able to calculate and interprete process and measurement capability
7 Being able to set up suitable and effective experiments
8 Being able to select suitable techniques of acceptance sampling, dimension their parameters and reflect on the benefits and advantages of other techniques
9 Being able to critically reflect on the objectivity, validity and relevance of statistical results
10 Possess sufficient working knowledge of R in order to correctly perform and interpret the discussed methods of industrial statistics and quality control
11 Have sufficient theoretical insight into the fundamental assumptions and objectives of statistical methods to asses their range of applicability and limitiations

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, demonstration, seminar: practical PC room classes

Extra information on the teaching methods

The course is split up in a number of well-determined parts. Students must study the theory of each part by themselves, **before** a specific date, based on particular sections in the textbook, slides and other given references. After that, there is first a practical session with PC exercises and then a Questions & Answers session (Q&A) on the theory with further demonstrations concerning the study material. Students must submit their questions for the Q&A beforehand to the Minerva forum.

Learning materials and price

- Engelstalig handboek (prijs ca. 50 euro): Statistical Quality Control: A Modern Introduction, International Student Version, 7th Edition Douglas C. Montgomery
- Additional course notes free of charge the Minerva digital leaning platform

References

- http://www.itl.nist.gov/div898/handbook/index.htm
- http://www.r-project.org/
- Kennett R.S., Zacks S., Modern Industrial Statistics - Design and Control of Quality and Reliability, 1998, Thomson Publishing Inc.
- Cano E.L., Moguerza J.M., Redchuk A.,Six Sigma with R, 2012, Springer.

Course content-related study coaching

- e-mail
- Minerva (forums)
- appointment tutoring

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, open book examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Calculation of the examination mark