



# HÖGSKOLAN I GÄVLE

## Industrial Statistics 7.5 cr

*Industriell statistik 7,5 hp*

Set by Faculty of Engineering and Sustainable Development

**Version**

**Set at**

**Valid from**

10/11/13

**HT2014**

<b>Level</b>	G2F
<b>Education level</b>	First cycle
<b>Course identifier</b>	IEG501
<b>Credits</b>	7.5 cr
<b>Main field of study</b>	Industrial Economics
<b>Subject group</b>	Industrial Engineering and Management
<b>Disciplinary domain</b>	Technology 100.0 %

**Learning outcomes** This course focuses on the application of Statistics in industrial fields. After completion of the course the student shall be able to

1. state the importance of the concepts, theory and methods in statistics
2. apply statistical methods in engineering problems
3. apply statistical tools such as Excel, SPSS and MatLab for data analysis
4. analyze a practical operational problem with statistical thinking.

**Course content**

Introduction

- Objectives and Typical Applications of Statistical Modeling
- Statistical Thinking
- Collecting and Presenting Engineering Data
- Measurement system/Repeatability & Reproducibility
- Total lifecycle costs of products Overview of Statistics

Overview of statistics

- Variables, discrete and continuous distributions, stochastic process
- Population parameters and sample statistics
- Normal distribution and its engineering interpretation
- Descriptive statistics

- Estimation and confidence intervals
- Linear regression modeling

#### Statistical Uncertainty: Concepts and Measures

- Sources of Uncertainty
- Statistical Uncertainty
- Decisions and Errors
- Statistical Significance, Power and Sample Size
- When Normality Assumptions Fail

#### Statistical Problems in product total lifecycle

- Material Collection (Multivariate statistics analysis, Random Variables and Probability Distributions, forecasting)
- Product Design (Signal process, design of experiments)
- Manufacture (Mechanistic and empirical models, data visualization and environmental statistics, , statistical quality control)
- Product Testing (Mean and variance, sampling theory, quality improvement)
- Weibull analysis
- Storage (Measurement systems capability, analysis of variance)
- Sale and Transportation (Time series plots, histograms, stochastic processes, analysis of variance, data visualization)
- Maintainability (Data mining and analysis, survival analysis)

#### Graphical techniques in Statistics

- Model identification
- Probability plots

#### Design of Engineering Experiments

- The Strategy of Experimentation
- Factorial Experiments
- 2k Factorial Design
- Product/System Robust Design
- Response Surface Methods and Designs
- Uniform Design and Its Industrial Applications
- Six Sigma in manufacturing

#### Advanced statistical analysis in Excel, MatLab and SPSS

- Data file input/output
- Data Organization, Data arrays and groups
- Multivariate Methods
- Visualization and reduction
- Stochastic data models
- Design of Experiments
- Statist process control
- Simulation of random processes

#### Building empirical models

- Simple linear models
- Exploratory Data Analysis (EDA)
- Some Techniques of Nonstandard Data Analysis
- Models of Growth and Decay
- Simulation-Based Techniques for Dealing with Problems Usually Approached via Differential Equation Modeling

#### Time Series Analysis, Forecasting and Control

- Example of time series
- Descriptive Methods
- Box-Jenkins Methodology
- Forecasting
- Design of Feedforward and Feedback Control Schemes

- Stationary processes and autocovariance functions
- Stationary ARMA processes and their spectral representation
- Prediction of Stationary ARMA processes
- Estimation for ARMA models

<b>Teaching</b>	Lectures Lab exercises												
<b>Prerequisites</b>	BSc in Engineering and Mathematical Statistics 7.5hp or equivalent.												
<b>Examination</b>	Written examination, Assignment and Project work.												
<b>Grade</b>	A, B, C, D, E, Fx, F												
<b>Limitations</b>	The course is only given once a year and based on the project nature of the course with only one examination every year. Students that fail are welcome to join a new project the next time the course is given.  Each time the course is given there is one regular written examination and one re-examination.												
<b>Other regulations</b>	Criteria for final grade will be given at the beginning of the course.												
<b>Sustainable environment</b>	Content with sustainable development is not relevant to this course.												
<b>Module</b>	<table> <tr> <td>0010</td> <td>Written examination</td> <td>3 cr</td> <td>Grade: AF</td> </tr> <tr> <td>0020</td> <td>Assignment</td> <td>1.5 cr</td> <td>Grade: AF</td> </tr> <tr> <td>0030</td> <td>Project work</td> <td>3 cr</td> <td>Grade: AF</td> </tr> </table>	0010	Written examination	3 cr	Grade: AF	0020	Assignment	1.5 cr	Grade: AF	0030	Project work	3 cr	Grade: AF
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