SUBJECT DATA SHEET AND REQUIREMENTS

last modified: October 2019

Analysis of Technical and Economical Data

(Műszaki és gazdasági adatok elemzése)

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEVGAG14	**3**	**2+1+0**	**p**	**3**	**English**

2. Subject's responsible:

Name:	Position:	Affiliation (Department):
Dr. György Paál	Professor	Dept. of Hydrodynamic Systems

3. Lecturer:

Name:	Position:	Affiliation (Department):
Dr. György Paál	Professor	Dept. of Hydrodynamic Systems
	contact person	

4. Thematic background of the subject:

The course requires some basic established understanding in mathematics to help in acquiring the essence of the presented new methods. For the application of these methods some technological understanding is necessary.

5. Compulsory / recommended prerequisites:

Compulsory: Mechanical Engineers: Mathematics A2, Introduction to Mechanical Engineering
Mechatronics: Mathematics A2, Introduction to Mechatronics
Suggested: Micro- and Macro economics

6. Main aims and objectives, learning outcomes of the subject:

Processing and analysis of technical data is often part of engineering tasks. The data can originate from measurements of economical processes and results or from some technological tests but the main methods of the analysis are basically independent from the data source. Utilizing these methods, the valuable information can be extracted from

complex data sets through measurements of possible correlations, hypothesis testing and quality assurance tests.

7. Method of education:

Lectures: 2hrs/week
Seminar: 1hr/week
Laboratory: -

To be able to practice the course material, the usage of computers (MS Excel) is necessary.

8. Detailed thematic description of the subject (by topic, min. 800 character):

1.	Probability theory basic review: relative frequency, probability, probability density and distribution, expected value, standard deviation.
2.	Basic definition in statistics: average, empirical variance, empirical density and distribution functions. Application: quality control, histogram, Pareto-Lorenz diagram.
3.	Data acquisition with sampling: sampling techniques. Sampling in quality control. Application: calculation of the required dataset sizes for analysis.
4	Operation characteristics curve: product acceptance using statistical sampling. Application: calculation of economically justifiable fallout rate.
5.	Quality and reliability. Upper- and lower control bounds. Control capability index. Application: Machine settings verification.
6.	Data acquisition with measurement: measurement principles (comparability, equality, disparity). Direct and indirect measurements. Propagation of measurement errors. Application: evaluation of acceptance measurements, error bounds.
7.	Point and interval estimation: properties of the estimations. Confidence interval for expected value and variance. Application: Analysis of technical and economic data with the help of confidence interval.
8.	Correlation coefficient, empirical correlation coefficient. Main properties. Application: correlation diagram, use of correlation in quality control.
9.	Regression analysis based on generalization of Gauss-Markov theorem. Application: linear and polynomial regression between the variables of the data of technical processes.
10.	Regression models: Estimation of degree-index. Coefficient of determination. Forecasting economic trends with moving average and exponential smoothing. Application: prognosis of capacities, production and utilization.
11.	Statistical tests: parametric and non-parametric test. Detailed discussion of the U-test. Critical domain. First and second type errors. Application: verification of change in consumption trends.
12.	Parametric tests: T-test, F-test, etc. Application: Quality and production control with parametric tests.
13.	Non-parametric tests: $\chi 2$ and Wilcoxon tests. Application: verification of fittings in production and quality control.
14.	Introduction to variance analysis: hypothesis testing with F-test, ANOVA test. Application: analysis of production quality.

9. Requirements and grading

a) in term-period

Attending minimum 70% of the classes.

The students are required to achieve at least 50% from the summed results of three in-term tests that are planned on weeks 6, 10 and 14.

Type	**Share of the grade**
1. Mid-term test (multiple-choice test)	20 %
2. Mid-term test (statistical problem's solving on paper)	40 %
3. Mid-term test (statistical problem's solving in MS Excel)	40 %
Sum	100%

b) in examination period

-

c) Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework

According to the Code of Studies (Rector's Order № 7 of 2017 (6 November 2017) with the amendments of Rector's Order № 3 of 2018 (30 August 2018), available: https://gpk.bme.hu/downloads/en/BME_Code_of_Studies.pdf

d) grade

The mid-term grade is based on the sum of the mid-term tests scores as shown in the table below.

grade ● [ECTS]	**points**
jeles(5) ● Excellent [5]	above 85%
jó(4) ● Good [4]	72,5–85%
közepes(3) ● Satisfactory [3]	65–72,5%
elégséges(2) ● Pass [2]	50–65%
elégtelen(1) ● Fail [1]	under 50%

10. Retake and repeat

According to the Code of Studies

11. Consulting opportunities:

Consultation hours: by email appointments

12. Reference literature (compulsory, recommended):

- Scanned lecture notes downloaded from the department website along with practice examples.
- Recommended additional literature:
  - Morris H. DeGroot, Mark J. Schervish – Probability and Statistics
  - John A. Rice – Mathematical Statistics and Data Analysis

- Robert Piché – Introduction to Statistical Data Analysis for Engineers and Scientists

13. Home study required to pass the subject:

Contact hours	42	h/semester
Home study for the courses	42	h/semester
Home study for the mid-semester checks	6	h/check
Preparation of mid-semester homework	0	h/homework
Home study of the allotted written notes	0	h/semester
Home study for the exam	0	h/semester
Totally:	**90**	**h/semester**

14. The data sheet and the requirements are prepared by:

Name:	Title:	Affiliation (Department):
Dr. György Paál	Professor Emeritus	Dept. of Hydrodynamic Systems

15. Contact person for administrative questions:

…., ...@hds.bme.hu