BSc in Mechanical Engineering 2N-AG0/2NAAG0,
Process Engineering specialization 2N-AG0-PE

Mechanical Engineering
compulsory subject

SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 10st October 2019

MEASUREMENT TECHNIQUE OF PROCESSES

FOLYAMATTECHNIKAI MÉRÉSEK

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEVGAG03	**5**	**1+0+1**	**p**	**2**	**English**

2. Subject's responsible:

Name:	Position:	Affiliation (Department):
Dr. Ferenc Hegedűs	assistant professor	Dept. of Hydrodynamic Systems

3. Lecturer:

Name:	Position:	Affiliation (Department):
Dr. Gábor Halász	professor emeritus	Dept. of Hydrodynamic Systems
Dr. Ferenc Hegedűs	assistant professor	Dept. of Hydrodynamic Systems
Sára Till	assistant lecturer	Dept. of Hydrodynamic Systems
Dr. Ferenc Hegedűs	contact lecturer	Dept. of Hydrodynamic Systems

4. Thematic background of the subject:

Mathematics: univariate and multivariate analysis, basics of probability theory and mathematical statistics

5. Compulsory / recommended prerequisites:

Compulsory: Analysis of Technical and Economic Data, BMEGEVGAG14
Suggested: -

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

The aim of this subject is to present the fundamental devices and methods of measurement techniques of processes. The course presents the mathematical methods of the measuring techniques and the signal processing; shows the practical usage of them; and points out the achievable results.

7. Method of education:

Contact hours: in the first 7 week of the semester lectures 2 h/w, in the following 7 weeks laboratory practices 2 h/w (where the students will use the previously acquired knowledge). Homework: compulsory laboratory report (1/semester)).

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

Lectures: 7*2h

1. Reviewing the basic concepts of probability theory and mathematical statistics; Error Estimation for indirect measurements; estimating systematic errors
2. Estimating systematic (accuracy class) and random errors ensemble for indirect measurement results; Calibration
3. The fundamentals of measuring time variant signals: Sampling and Quantization Theorems; Theorem's analysis; Consequences in measuring techniques
4. Fourier series and transformation, and their role in signal processing; The Spectrum and it's applications; Recognizing periodic and noise processes
5. Application of spectrum and cepstrum analysis for investigation operating machines
6. The real measurement result; Noise, as the characterization of stochastic processes; Amplitude density function; Autocorrelation and Cross correlation functions
7. Application of Autocorrelation and Cross correlation technique for analyzing periodic and transient signals

Laboratory practices: 4*3,5h

1. Pressure transducer's response to step function
2. Pressure transducer's response to harmonic excitation
3. Measuring transmission characteristics of an impulse line
4. Investigating the effects of sampling parameters

9. Requirements and grading

a) in term-period

mid-terms exam: predicted on the 8th week of the semester mid-term exam, on the extra week the possibility of two other re-take exam; the exam cannot retake in examination period

measurements: written short tests before all the measurements, the results of these will be taken into account at final grading. The laboratory report has to be ready on two weeks after the measurements. Re-taken of one laboratory measurement is possible on the extra week, delayed transmission of the report is possible before the end of the extra week.

requirements for the final grading: at least "pass" classification for the mid-terms exam (> 49 %); and for the laboratory measurements (4x5 points for the short test before the four measurements and additional 10 points for the laboratory report).

grading: the maximum achievable score is 60 points (30 points for the exam, 30 points for the measurements). The final examination mark based on the score:

points	mark	explanation
53-60	5	excellent
45-52	4	good
37-44	3	satisfactory
30-36	2	pass
0-29	1	failed

b) in examination period

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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 at: https://gpk.bme.hu/downloads/en/BME_Code_of_Studies.pdf

10. Retake and repeat

Regulated by Code of Studies and Exams of BME (BME TVSZ)

11. Consulting opportunities:

Consultation hours: By email appointments

12. Reference literature (compulsory, recommended):

- Books
  - **Bendat, J.S. – Piersol, A.G.: Engineering Application of Correlation and Spectral Analysis**
- Downloadable materials: www.hds.bme.hu

13. Home study required to pass the subject:

Contact hours	28	h/semester
Home study for the courses	14	h/semester
Home study for the mid-semester checks	10	h/check
Preparation of mid-semester homework	4	h/homework

Home study of the allotted written notes	4	h/semester
Home study for the exam	0	h/semester
Totally:	**60**	**h/semester**

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

Name:	Title:	Affiliation (Department):
Dr. Gábor Halász	professor emeritus	Dept. of Hydrodynamic Systems
Dr. Ferenc Hegedűs	assistant professor	Dept. of Hydrodynamic Systems

15. Contact person for administrative questions:

Ferenc Hegedűs, PhD, fhegedus@hds.bme.hu