BSc in Mechatronics
Integrated Engineering spec
2N-AM0-IE training code
compulsory subject

SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 9th of February 2017

LABORATORY

LABORMÉRÉS

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEÁTAM06	**6**	**0+0+4**	**p**	**5**	**English**

2. Subject's responsible:

Name:	Title:	Affiliation (Department):
Dr. Csaba HORVÁTH	assistant professor	Dept. of Fluid Mechanics

3. Lecturer:

Name:	Title:	Affiliation (Department):
Dr. Csaba HORVÁTH	assistant professor	Dept. of Fluid Mechanics
Károly ZABÁN	laboratory engineer	Dept. of Automation and Applied Informatics
Dr. Dániel BACHRATHY	assistant professor	Dept. of Applied Mechanics

4. Thematic background of the subject: fluid mechanics, solid mechanics, mathematics: Fourier transform. mechanics: vibration theory, theory of the electric circuits, theory of the electric machines, analog and digital electronics, power electronics.

5. Compulsory / suggested prerequisites:

Compulsory: Áramlástan BMEGEÁTAM01, vagy új kóddal BMEGEÁTAM11

Suggested: Mechanics Global Exam BMEGEMMAGM0, Basic of Electrical Engineering (in Hungarian: Elektrotecnika alapjai) – BMEVIAUA007, Electromechanics (in Hungarian: Elektromechanika) - BMEVIAUA008, Digital Electronics (in Hungarian: Digitális elektronika) - BMEVIAUA010

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

Fluid Mechanics: Students have already acquired the theoretical knowledge necessary to understand and describe the flow of gaseous and liquid fluids from earlier lectures. Building on this knowledge, the laboratory measurements will show the students how to solve technical problems related to the flow of a medium. An emphasis will be placed on knowledge related to flow measurements, measurement techniques applied in evaluating flow phenomena occurring in fluid machinery, equipment, and ducts. The students will be evaluated on their ability to apply the theory to practical problems. These evaluations will be in the form of laboratory measurements. This subject prepares the students for their engineering careers by teaching them to recognize fluid mechanics related problems, provides them with the knowledge necessary to solve common problems, and gives them a solid foundation on which they can build in taking on complex assignments.

Applied Mechanics: To introduce the most common measurement methods in mechanical systems (e.g.: strain gages, accelerometers). During the measurements the students will understand and experience in practice many phenomena of mechanical systems, such as the critical damping, beating effect, force detection, mode shapes.

Automation and Applied Informatics: Knowledge and self-realization of various electrical measurements: tests used oscilloscopes and other electronic meters, RLC circuits, electric machines, powers electronics, control technology, analog electronics, digital electronics, computer simulations.

7. Method of education: lecture 0h/w, seminar 0h/w, laboratory 4h/w

8. Detailed thematic description of the subject:

week 1	Fluid Mechanics lab I:	Preparatory class: introduction of measurement techniques and instruments
	Aut. and Applied Inf.:	Courses: A, B, C.: Introduction to the measurements
week 2	Aut. and Applied Inf. lab:	Courses: B, C: 1st measurement - Use of the oscilloscope, 2nd measurement - Application of electronic meters, 3rd measurement - Measurements with electromechanical meters, 4th measurement - Linear passive elements
week 3	Fluid Mechanics lab II:	8:15-10:00 "A" measurement, 10:15-12:00 "B" measurement
	Aut. and Applied Inf. lab:	Courses: A: 1st measurement - Use of the oscilloscope, 2nd measurement - Application of electronic meters, 3rd measurement - Measurements with electromechanical meters, 4th measurement - Linear passive elements
week 4	Aut. and Applied Inf. lab:	Courses: B, C: 5th measurement - Investigation of relays and contactors, 6th measurement - Investigation of a three-phase slip-ring induction motor, 7th measurement - Computer based measurement of induction motors, 8th measurement - Investigation of controlled and uncontrolled rectifier circuits
	Fluid Mechanics:	Submission of reports by Sunday at midnight.
week 5	Fluid Mechanics lab III:	8:15-10:00 "A" makeup measurement, 10:15-12:00 "B" makeup measurement
	Aut. and Applied Inf. lab:	Courses: A: 5th measurement - Investigation of relays and contactors, 6th measurement - Investigation of a three-phase slip-ring induction motor, 7th measurement - Computer based measurement of induction motors, 8th measurement - Investigation of controlled and uncontrolled rectifier circuits
	Fluid Mechanics:	Resubmission of corrected reports by Sunday at midnight.
week 6	Aut. and Applied Inf. lab:	Courses: B, C: Practice (1st, 2nd, 3rd, 4th and 5th, 6th, 7th, 8th measurements), mid-term exam 1 (1st, 2nd measurements), mid-term exam 2 (3rd, 4th measurements), mid-term exam 3 (5th, 6th, 7th , 8th measurements)
	Fluid Mechanics:	Submission of makeup measurement reports by Sunday at midnight
week 7	Fluid Mechanics lab IV:	Presentation of the "+A" and "+B" measurements
	Aut. and Applied Inf. lab:	Courses: A: Practice (1st, 2nd, 3rd, 4th and 5th, 6th, 7th, 8th measurements), mid-term exam 1 (1st, 2nd measurements), mid-term exam 2 (3rd, 4th measurements), mid-term exam 3 (5th, 6th, 7th , 8th measurements)
week 8	Aut. and Applied Inf. lab:	Courses: B, C: 9th measurement - Investigation of digital combination networks, 10th measurement - Computer simulations of digital combination networks, 11th measurement - Investigation of digital sequential networks, 12th measurement - Computer simulations of digital sequential networks
week 9	Mechanical. meas. lab I:	Force and position measurements based on strain gages.
	Aut. and Applied Inf. lab:	Courses: A: 9th measurement - Investigation of digital combination networks, 10th measurement - Computer simulations of digital combination networks, 11th measurement - Investigation of digital sequential networks, 12th measurement - Computer simulations of digital sequential networks
week 10	Aut. and Applied Inf. lab:	Courses: B, C: 13th measurement - Investigation of semiconductor devices, 14th measurement - Computer simulations of semiconductor devices, 15th measurement - Integrated operational amplifiers, 16th measurement - Computer simulations of integrated operational amplifiers
	Mechanics:	Submission of the Mech. meas. lab I report.
week 11	Mechanical meas. lab II:	Measurement of a damping and natural frequency of a one degree-of-freedom system
	Aut. and Applied Inf. lab:	Courses: A: 13th measurement - Investigation of semiconductor devices, 14th measurement - Computer simulations of semiconductor devices, 15th measurement - Integrated operational amplifiers, 16th measurement - Computer simulations of integrated operational amplifiers
week 12	Aut. and Applied Inf. lab:	Courses: B, C: Practice (9th, 10th, 11th, 12th and 13th, 14th, 15th, 16th measurements), mid-term exam 4 (9th, 11th measurements), mid-term exam 5 (13th, 15th measurements), mid-term exam 6 (10th, 12th, 14th, 16th measurements)
	Mechanics:	Submission of the Mech. meas. lab II report.
week 13	Aut. and Applied Inf. lab:	Courses: A: Practice (9th, 10th, 11th, 12th and 13th, 14th, 15th, 16th measurements), mid-term exam 4 (9th, 11th measurements), mid-term exam 5 (13th, 15th measurements), mid-term exam 6 (10th, 12th, 14th, 16th measurements)
	Mechanical meas. lab III:	Detection of the natural frequencies and mode shapes of a multi-degree-of-freedom system.
week 14	Aut. and Applied Inf. lab:	Courses: A, B, C: Other electronic meters, Make up for tests
	Mechanics:	Submission of the Mech. meas. lab III report.

9. Requirements and grading

9.1. Participation: Participation in the laboratory measurements, submission of reports, and holding presentations is compulsory. Absence without leave is not acceptable, and laboratory measurements which are missed cannot be made up. Any additional questions regarding participation should be dealt with according to the current TVSz.

9.2. Mid-semester evaluation of laboratory measurements:

Hungary, 1111 Budapest, Bertalan L. u. 4-6.
Telefon: (36-1) 463-4072 Fax: (36-1) 463-3464
http://www.ara.bme.hu

Measurement groups of 3-4 students will participate in laboratory measurements to be held in the laboratory of the Department of Fluid Mechanics (AE building), Department of Applied Mechanics (MM building), and Automation and Applied Informatics (QBP106). Prior to participating in the measurements, the students will participate in preparatory classes. Upon completion of the laboratory measurements, measurement reports must be submitted, measurement presentations need to be presented, and mid-term exams have to be written.

9.3. Grade improvement and retake opportunities: In the circumstance of an excused absence, the makeup shall be held in a time period and in a manner agreed upon with the faculty member leading the measurements. In the circumstance of an unexcused absence, no makeup opportunity shall be provided. Laboratory reports cannot be submitted during the repeat exam period.

9.4. Requirements for attaining and mode of calculation of the mid-semester grade

9.4.1. Requirements for attaining a mid-semester grade

- Passing grade (minimum of 40%) attained on each laboratory report and passing grade (minimum of 40%) attained on each laboratory presentation.

9.4.2. Calculation of the mid-semester grade:

Mid-semester performance evaluations count toward the mid-semester grade according to the following percentages:

Fluid Mechanics report min. 40 percentile/max. 100 percentile
Fluid Mechanics presentation min. 40 percentile/max. 100 percentile
Fluid Mechanics grade (1/2) × Fluid Mechanics report + (1/2) × Fluid Mechanics presentation in percentile
Applied Mechanics reports min. 40 percentile/max. 100 percentile
Applied Mechanics grade (1/3) × Mech. meas. lab I report + (1/3) × Mech. meas. lab II report + (1/3) × Mech. meas. lab III report in percentile
Aut. and Applied Inf. measurement reports measurement reports must be made at the end of each measurement
Aut. and Applied Inf. mid-term exams in percentile
Aut. and Applied Inf. grade (1/6) × mid-term exam 1 + (1/6) × mid-term exam 2 + (1/6) × mid-term exam 3 + (1/6) × mid-term exam 4 + (1/6) × mid-term exam 5 + (1/6) × mid-term exam 6 in percentile

How to calculate grade: GRADE[%]=(4/14)×Fluid Mechanics grade + (3/14)×Applied Mechanics grade + (7/14)×Aut. and Applied Inf. grade

Table of mid-semester GRADE [%]:

$0\% \leq$ fail(1) $< 40\%$ $40\% \leq$ pass(2) $< 55\%$
$55\% \leq$ satisfactory(3) $< 70\%$ $70\% \leq$ good(4) $< 85\%$
$85\% \leq$ excellent(5) $\leq 100\%$

9.5 The students are subject to disciplinary measures against the application of unauthorized means at mid-terms, term-end exams and homework and the application of the 1/2013. (I.30.) Dean's Order must be followed.

10. Retake and repeat

See above as well as the Code of Studies and Exams of BME.

11. Consulting opportunities:

Consultation hours: by email appointments and as it is indicated on the department's website. Weekly consultation hours will be provided.

12. Reference literature (compulsory, recommended):

- Vad, J. Advanced Flow Measurements, Műegyetemi Kiadó, Ref. No. 45085.
- Lajos T.: Az áramlástan alapjai, tankönyv, Budapest, 2015, ISBN 978 963 12 2885 4 + DVD annex (in Hungarian)
- The web page of the subject: http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATAM06
- The web page of the subject: https://www.get.bme.hu/index.php?mid=labdown&lang=en
- Zoltán István: Méréstechnika, 55029, Műegyetemi Kiadó (in Hungarian)
- Charles Fraser – John Milne: Integrated electrical and electronic engineering for Mechanical Engineers, McGraw-Hill Book Company, 1994.
- N. Mohan, T. M. Undeland and W. P. Robbins: Power Electronics, John Wiley & Sons, 1994
- D. Barnaal: Analog and Digital Electronics for Scientific Application, Breton Publishers, 1982, OMK.

13. Home study required to pass the subject:

Contact hours	56	h/semester
Preparation for the measurements	31	h/semester
Preparation of the measurement reports and presentations	63	h/semester
Totally (5cr × 30h) =	**150**	**h/semester**

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

Name:	Title:	Affiliation (Department):
Dr. Csaba HORVÁTH	assistant professor	Dept. of Fluid Mechanics