COURSE SYLLABUS AND COURSE REQUIREMENTS
2024-2025 II.

Course title	*Biomedical Measurement Theory*
Course Code	*MSM612ANEG*
Hours/Week: le/pr/lab	2/0/2
Credits	4
Degree Programme	Biomedical Engineering MSc
Study Mode	*Full Time*
Requirements	Exam
Teaching Period	2nd semester
Prerequisites	Mathematics
Department(s)	Informatics and Electrical Engineering
Course Director	Dr. Adam Schiffer
Teaching Staff	Dr. Adam Schiffer, Ahmad Abdalla Mhd Mouayad

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

This course covers the sensing, transformation, visualisation and processing of biomedical information acquired during the operation of technical objects and systems, as well as the sensing, transformation, visualisation and processing of various physical properties in some specific measurement tasks (pressure, temperature, material flow, mechanical vibration, and measurement and computer data acquisition of electrical properties).

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

To familiarise biomedical engineering students with the basics of measurement technology, to learn about the technical solutions for carrying out measurements in various engineering fields, and to systematise and process the information obtained during measurements. The subject provides a foundation for the subject group control engineering, based on the knowledge of electrical networks and electronics.

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

	TOPICS
LECTURE	1. *Basic concepts of measurement theory and measurement techniques. The measurement process, error, documentation.* 2. *Evaluation of measurement data series, calibration, statistical principles* 3. *Analogue to digital signal conversion, discrete time signal processing. Sampling.* 4. *Temperature and pressure measurement* 5. *Sensors* 6. *PC based measurement systems* 7. *Industrial measurement systems* 8. *Measurement with microcomputers*

	9. *Filtering in frequency domain*
PRACTICE	1. *Calibration* 2. *Evaluation of biomedical measurement data series* 3. *Digital biomedical measurements with NI myDAQ* 4. *Measurement in frequency domain* 5. *Sensors, biomedical instrumentation* 6. *Biomedical measurements and documentation*
LABORATORY PRACTICE	

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Introduction	…	…	…
2.	The aim of the subject. Basic concepts of measurement theory and metrology. The measurement process, error, documentation.	Lecture presentation Lecture notes [3] pp. 3-30		
3.	Evaluation of measurement data series, calibration, statistical principles I.	Lecture presentation Lecture notes [3] pp. 3-30		
4.	Evaluation of measurement data series, statistical principles. II.	Lecture presentation Lecture notes [3] pp. 3-30		
5.	Analogue to digital signal conversion, discrete time signal processing. Sampling.	Lecture presentation Lecture notes [3] pp. 247-260		
6.	Principles and instruments for temperature measurement. Contact thermometers. Pirometers, thermography. Strain gauges.	Lecture presentation Lecture notes [3] pp. 150-160 [3] pp. 172-176		
7.	Pressure measurement, instruments, measuring procedures.	Lecture presentation Lecture notes		
8.	Sensors in metrology 1.	Lecture presentation Lecture notes [3] pp. 150-197		
9.	PC based measuring systems.			
10.	Measurement with microcomputers	Lecture presentation Lecture notes		
11.	Filtering basics			
12.	Spring break	Lecture presentation Lecture notes [3] pp. 260-270		
13.	consultancy			
14.	written test			

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Introduction			

2.	Measurement uncertainty and the mean. Calibration of instruments, single and two-point calibration			
3.	Evaluation of measurement data series 1.			
4.	Evaluation of measurement data series 2.		1. homework	End of 5. week
5.	Ironing			
6.	NI DAQmx board and simple resistance measurement			
7.	NI DAQmx: generate, measure and record sine wave		2. homework	End of 9 week
8.	PHOTORESISTOR MEASUREMENT		3. homework	End of 10. week
9.	RC MEASUREMENT (BODE DIAGRAM AND LOW PASS FILTERING)			
10.	Biomedical measurement with iWORKS lab I.			
11.	Biomedical measurement with iWORKS lab II.			
12.	SPRING BREAK			
13.	Biomedical measurement with iWORKS lab III.			
14.	written test			

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

Attendance sheet

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

(The samples in the table to be deleted.)

Type	Assessment	*Weighting as a proportion of the pre-requisite for taking the exam*
1. ***'Passed' rating for all submissions***	*Accepted/ rejected*	*100%*

Requirements for the end-of-semester signature

(Eg.: mid-term assessment of 40%)

'Passed' rating for all submissions

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Submission of homeworks up to the 2nd week of the examination period

Type of examination *(written, oral):* *written*

The exam is successful if the result is minimum ***40*** ***%.*** *(The minimum cannot exceed 40%.)*

Calculation of the grade *(TVSz 47§ (3))*

The mid-term performance accounts for ***0*** %, the performance at the exam accounts for ***100*** % in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

[1] Lecture Presentations (can be downloaded)
[2] Adam Schiffer: Lecture notes for Measurement and DAQ
[3] John P. Bentley: Principles of Measurement Systems, Prentice Hall, 2005 (online)
[4] Intro and VXI - VTI Instruments [online], https://www.vti-instruments.pl/files/All-about-the-VXI-Standard.pdf
[5] John . Webster: Medical Instrumentation, Application and Design, John Wiley & Sons, 2010