

COURSE SYLLABUS AND COURSE REQUIREMENTS

ACADEMIC YEAR 2024-2025 SEMESTER I

<i>Course title</i>	<i>Biophysics</i>
<i>Course Code</i>	MSM605MNEG
<i>Hours/Week: le/pr/lab</i>	2/2/0
<i>Credits</i>	4
<i>Degree Programme</i>	Biomedical Engineering MSc
<i>Study Mode</i>	Full-time
<i>Requirements</i>	exam
<i>Teaching Period</i>	fall
<i>Prerequisites</i>	
<i>Department(s)</i>	Medical School, Department of Biophysics
<i>Course Director</i>	Dr. Lukács András
<i>Teaching Staff</i>	Dr. Lukács András, Dr. Telek Elek, Dr. Újfalusi Zoltán, Dr. Pécsi Ildikó, Dr. Bódis Emőke, Dr. Fekete Zsuzsanna, Dr. Pasitka Jonatán

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).

Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

...

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.

Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

The course addresses the physical basis of the structure and function of biological systems. The main topics include atomic and nuclear physics, thermodynamics, transport processes, molecular and supramolecular systems, bioelectric phenomena, and biological motion.

2. COURSE CONTENT

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

TOPICS

LECTURE

1. Introduction
2. The structure of atoms I (Rutherford's experiment, Bohr's model)
3. The structure of atoms II (De Broglie, Photoelectric effect, Frank-Hertz experiment)
4. The quantum mechanical model of the atom. Orbitals, molecular orbitals.
5. LASER I
6. LASER II
7. Absorption spectroscopy
8. Fluorescence spectroscopy
9. Infrared spectroscopy
10. Raman spectroscopy
11. Thermodynamics 1 (zeroth law, gas laws, work, first law)
12. Thermodynamics 2 (enthalpy, Gibbs free energy, spontaneous processes)
13. Structure of the atomic nucleus, radioactivity
14. Interaction of radioactive radiations with matter, biological effects
15. Gamma-camera, SPECT, PET

**PRACTICE
LABORATORY
PRACTICE**

16. NMR, MRI
17. X-ray diagnostics, CT
18. Protein structure (folding, enzymes)
19. Molecular mechanisms of biological movement: motor proteins, cytoskeletal polymers
20. Molecular mechanisms of muscle functioning
21. Structure of membranes. Resting membrane potential
22. Types of sensory receptors. Action potential
23. Fluid flow
24. Circulation. Work of the heart
25. Vision
26. Hearing
27. Ultrasound
28. DSC, ITC

1. Introduction. Laboratory safety rules
2. Direct current measurements
3. Alternative current measurements
4. Frank-Hertz experiment
5. Raman spectroscopy
6. Spectroscopy and spectrophotometry
7. Fluorescence spectroscopy
8. Polarimetry and refractometry
9. Temperature and basic thermodynamics measurement
10. Conductivity
11. Michelson interferometer
12. Make-up lab
13. Make-up lab
14. Make-up lab and final evaluation

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 The structure of atoms I	LECTURE NOTES
2.	The structure of atoms II The quantum mechanical model of the atom. Orbitals, molecular orbitals	LECTURE NOTES		
3.	LASER I-II	LECTURE NOTES		
4.	Absorption spectroscopy Fluorescence spectroscopy	LECTURE NOTES		
5.	Infrared spectroscopy Raman spectroscopy	LECTURE NOTES		
6.	Thermodynamics 1 -2	LECTURE NOTES		
7.	Structure of the atomic nucleus, radioactivity Interaction of radioactive radiations with matter, biological effects	LECTURE NOTES		
8.	Gamma-camera, SPECT, PET NMR, MRI	LECTURE NOTES		
9.	autumn break			
10.	X-ray diagnostics, CT Protein structure (folding, enzymes)	LECTURE NOTES		

11.	Molecular mechanisms of biological movement: motor proteins, cytoskeletal polymers Molecular mechanisms of muscle functioning	LECTURE NOTES		
12.	Structure of membranes. Resting membrane potential Types of sensory receptors. Action potential	LECTURE NOTES		
13.	Fluid flow Circulation. Work of the heart	LECTURE NOTES		
14.	Vision Hearing Ultrasound DSC, ITC	LECTURE NOTES		

PRACTICE, LABORATORY PRACTICE

<i>week</i>	Topic	Compulsory reading; page number (from ... to ...)	Required tasks (assignments, tests, etc.)	Completion date, due date
1.	<i>Introduction. Laboratory safety rules</i>	LECTURE NOTES		
2.	<i>Direct current measurements</i>	LECTURE NOTES		
3.	<i>Alternative current measurements</i>	LECTURE NOTES		
4.	<i>Frank-Hertz experiment</i>	LECTURE NOTES		
5.	<i>Raman spectroscopy</i>	LECTURE NOTES		
6.	<i>Spectroscopy and spectrophotometry</i>	LECTURE NOTES		
7.	<i>Fluorescence spectroscopy</i>	LECTURE NOTES		
8.	<i>Polarimetry and refractometry</i>	LECTURE NOTES		
9.	<i>Temperature and basic thermodynamics measurement</i>	LECTURE NOTES		
10.	<i>Conductivity</i>	LECTURE NOTES		
11.	<i>Michelson interferometer</i>	LECTURE NOTES		
12.	<i>Make-up lab</i>	LECTURE NOTES		
13.	<i>Make-up lab</i>	LECTURE NOTES		
14.	<i>Make-up lab and final evaluation</i>	LECTURE NOTES		
15.				

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.)

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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. e.g.: Test 1	eg. max 20 points	eg. 20 %
2. e.g.: Test 2	eg. max 30 points	eg. 30 %
3. e.g.: home assignment (project documentation)	eg. max 30 points	eg. 30 %
4. ...	eg. max 15 points	eg. 20 %

Requirements for the end-of-semester signature

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

Performing all the practical labs

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.

There are three make up labs in order to perform the missed labs

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

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.] Medical biophysics (ed. Damjanovich, Fidy, Szöllőssy) Medicina Kiadó

RECOMMENDED LITERATURE AND AVAILABILITY

[3.] P.W. Atkins: Physical Chemistry