COURSE SYLLABUS AND COURSE REQUIREMENTS
ACADEMIC YEAR 2024-2025 SEMESTER I.

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

COURSE DESCRIPTION

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

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.

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*
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*

PRACTICE LABORATORY PRACTICE

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.	Electromagnetic waves I (Generation, properties) X-ray, Interference, diffraction (two-slit experiment) Prism, gratings, monochromators	…	…	…
2.	Optics (lenses, mirrors, objectives) Spectrometer design The structure of atoms I (Rutherford's experiment, Bohr's model)			
3.	The structure of atoms II (De Broglie, Photoelectric effect, Frank-Hertz experiment) The quantum mechanical model of the atom. Orbitals, molecular orbitals.			
4.	LASER I LASER II			
5.	Absorption spectroscopy Fluorescence spectroscopy 1			
6.	Fluorescence spectroscopy 2 (detectors, lamps, design)			

	Fluorescence spectroscopy 3 (FRET, anisotropy, applications)			
7.	Infrared spectroscopy Raman spectroscopy			
8.	Structure of the atomic nucleus, radioactivity Interaction of radioactive radiations with matter, biological effects			
9.	Gamma-camera, CT NMR, MRI			
10.	Protein structure Protein engineering: plasmids, expression strategies			
11.	Protein purification 1 (Sedimentation) Protein purification 2 (Chromatography)			
12.	Electrostatics, Coulomb force, electric potential. Structure of membranes. Resting membrane potential Types of sensory receptors. Action potential			
13.				
14.				
15.				

PRACTICE, LABORATORY PRACTICE

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

…

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 … %. *(The minimum cannot exceed 40%.)*

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

The mid-term performance accounts for … %, the performance at the exam accounts for … % 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