DISCIPLINE SHEET

1. Study program:

1.1.	**"CAROL DAVILA" UNIVERSITY OF MEDICINE AND PHARMACY BUCHAREST**
1.2.	**FACULTY OF DENTISTRY**
1.3.	**DEPARTMENT: DENTISTRY I**
1.4.	**DISCIPLINE: Biophysics**
1.5.	**STUDY DOMAIN: Health, sectoral regulated within European Union**
1.6.	**STUDY LEVEL: I (Bachelor's degree) and II (Master's degree)**
1.7.	**STUDY PROGRAMME: DENTAL MEDICINE IN ENGLISH**

2. Discipline:

2.1.	**Discipline name according to the study curriculum: BIOPHYSICS**					
2.2.	**Discipline code: MD01F13EN**					
2.3.	**Discipline type: FD**					
2.4.	**Discipline optionality: COD**					
2.5.	Lectures tenure: **Ion-Octavian DOAGĂ** (MD, PhD) – Lecturer **Claudiu Constantin MANOLE** (PhD) – Lecturer					
2.6.	Practical classes tenure: **Ion-Octavian DOAGĂ** (MD, PhD) – Lecturer **Claudiu Constantin MANOLE** (PhD) – Lecturer					
2.7. Year of study	**I**	**2.8.** Semester	**II**	**2.9.** Evaluation	**E**	

3. Estimated total time (hours/ semester of teaching and training activity /individual study)

1. University training						
3.1.Number of hours per week	**4**	**from which**	**3.2. lecture**	**2**	**3.3. practical class/ seminar**	**2**
3.4. Total hours in the study curriculum	**56**	**from which**	**3.5. lecture**	**28**	**3.6. practical class/ seminar**	**28**
II. Preparation/ individual study						
Time distribution						**hours**
Study of lecture materials, textbooks, books, study of the minimum recommended bibliography						**16**
Additional documentation activity in the library, on online platforms						**8**
Specific preparation activities for projects, practical classes, preparation of assignments, reports						**12**
Preparation for presentations or evaluations, preparation for the final examination						**24**
Tutoring activity						**4**
Other activities						**-**
3.7. Total hours of individual study						**64**

3.8. Total hours per semester (3.4.+3.7.)	**120**
3.9. Number of credits	**4**

4. Prerequisites

4.1. curriculum	Basic knowledge of mathematics, informatics, physics, chemistry and biology on a high school level
4.2. proficiencies	-

5. Conditions

5.1. for lecture activity	Electronic presentations with a digital video projection system
5.2. for practical class	Laboratory equipment and consumables

6. Learning outcomes

Knowledge	Skills	Responsibility and autonomy
K1. Description of the fundamental mechanisms of biological systems functioning and stages of energy transformations	S1. ability to use the concepts of physics and chemistry to explain biological phenomena involving the movement / exchange of matter or energy in living systems	RA1. critical evaluation and scientific curiosity of the physical phenomena underlying the understanding of the mechanisms of normal functioning of biological systems, by formulating pertinent questions and actively seeking answers
K2. Description of the major physical factors and their effects on biological systems	S2. the ability to use the basics of the information theory to explain the processes by which organisms adapt to environmental conditions	RA2. compliance with the scientific rigor in obtaining and interpreting experimental data
K3. Recognizing and explaining the principles of some physical methods of diagnosis and treatment used in general medical practice and dentistry	S3. ability to use the concepts of physics and chemistry to explain the principles of operation of the methods and techniques used in the medical practice and dental practice	RA3. correct management of working protocols and equipment based on understanding their operating principles
	S4. ability to use physics-chemical concepts to explain the effects of physical factors (electromagnetic radiation, ultrasound, etc.) on biological systems	
	S5. the ability to design and carry out a scientific experiment and to process experimental data;	

	S6. the ability to explain and interpret correctly the experimental results	

7. Objectives (correlated with learning outcomes)

7.1. General Objective	Presentation of the general notions necessary to understand the fundamental mechanisms underlying the normal functioning of biological systems
7.2. Specific Objectives	1. presentation of the notions necessary to understand the mechanisms of energy conversion in biological systems 2. presentation of the notions of informatics necessary to understand the mechanisms of adaptation of the organism to the environmental conditions 3. presentation of the notions necessary to understand the properties of the material environment in which biological processes take place 4. studying the effects of some physical factors on biological systems 5. presentation of the principles of operation of some techniques and methods used in medical and dental practice.

8. Content

8.1. Lectures	**Teaching method**	**Observations**
1. Fundamental concepts of thermodynamics (part 1)	Oral presentation with PPT support – whiteboard or electronic board	2 h
2. Fundamental concepts of thermodynamics (part 2)		2 h
3. Basic notions of Biocybernetics		2 h
4. Dispersion systems - solutions		2 h
5. Dispersion systems – physical phenomena		2 h
6. Dispersion systems – molecular transport		2 h
7. Fluids biomechanics		2 h
8. Biophysics of cell membranes		2 h
9. Biophysics of cellular excitability		2 h
10. Biophysics of the locomotor system		2 h
11. Interaction of physical factors with biological systems (part 1)		2 h
12. Interaction of physical factors with biological systems (part 2)		2 h
13. Interaction of physical factors with biological systems (part 3)		2 h
14. Basic knowledge of medical radiology and imaging technology		2 h

8.2 Practical classes/ seminar	**Teaching method**	**Observations**
1. reviewing general notions of physics (thermodynamics and electricity)	Oral presentation and practical demonstration	2 h
2. presentation of standard methods for experimental data processing		2 h
3. Determination of the viscosity of biological liquids		2 h
4. Determination of the surface tension of the solutions		2 h

5. Optical microscopy. Measurement of the red blood cell diameter		2 h
6. Polarimetric method. Measurement of the concentration of a glucose solution		2 h
7. Refractometric method. Measurement of the concentration of a glycerin solution		2 h
8. Spectrophotometric analysis. Measurement of concentrations and marking of the absorption spectra.		2 h
9. The eye lenses as a centered optical system. Study of convergence defects		2 h
10. Oscilloscope study - visualization and measurement of electrical signals		2 h
11. Determination of background radiation level		2 h
12. ECG - principles and standard interpretation		2 h
13. Recap seminar		2 h
14. Final evaluation		2 h

8.3. Bibliography for lectures and laboratory/practical sessions

1. Ramona M. Babeş, Irina Băran, Diana Ionescu, Biophysics: practical sessions and seminars, Ed. "Carol Davila", Bucharest, 2018
2. Popescu I. Aurel, Biophysics – Current status and future trends, Ed. Romanian Academy, 2016
3. Roland Glaser, Biophysics: An Introduction, 2nd ed., Springer-Verlag, 2012
4. William C. Parke, A Student's Guide to the Physics of the Life Sciences and Medicine, Springer Nature Switzerland AG, 2020
5. Philip Nelson, Biological Physics, Energy, Information, Life – Student edition, Chiliagon Science, Philadelphia PA USA, 2021

9. Assessment

Activity type	9.1. Evaluation Criteria	9.2. Methods of evaluation	9.3. Percentage of final grade
9.4. Lecture	- Correct solving the grid questions - Ability to distinguish wrong statements from correct ones - Correct identification of the terms and notions presented	Written examination by grid test – 40 questions – working time 45 minutes	80%
9.5. Practical classes	- Knowledge of the operating principles of the methods used - Accuracy and precision in the execution of techniques - Manual dexterity, - Correct interpretation of results	Practical assessment by oral examination – 15 min subject preparation and 15 min oral exam and practical test	20%

Minimum performance standards

For the written examination: proven knowledge of the principles of thermodynamic, cybernetic model of the neuronal channel, diffusion and osmosis laws, muscular contraction mechanism and bone remodeling, ionizing radiations effects on biological systems (minimum 13 correct answers in the multiple-choice exam)

For the practical exam: to identify the equipment and to know the working principle for the respective method