



MEDICAL UNIVERSITY

"PROF. DR. PARASKEV STOYANOV" - VARNA

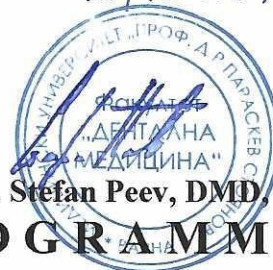
FACULTY OF DENTAL MEDICINE

Approved with a Protocol of FC № 46/16.02.2022г

Approved:

DEAN:

/Prof. Dr. Stefan Peev, DMD, PhD, DSc/



EDUCATIONAL PROGRAMME

OF

"BIOPHYSICS"

Specialty "DENTAL MEDICINE"

Discipline **BIOPHYSICS** compulsory

Educational-qualification degree "MASTER"

Professional qualification "PHYSICIAN IN DENTAL MEDICINE"

	Semester	Horarium weekly	Total horarium
Lectures	II	2	14
Exercises	II	2	16
Total		4	30
Monitoring and evaluation forms	Current control		Exam II semester
Credits (ECTS)	2		
Extracurricular employment	30		

Varna, 2022

ANNOTATION:

This general course on Biophysics concentrates on some of the basic physical processes in living systems on the cellular and molecular level. The lectures, labs and seminars are designed to develop the logical and analytical thinking of students.

The lectures introduce the students to the problems of regulation, self-regulation, and control in living organisms, and the principles of modelling of complex systems. Molecular biophysics topics target the structure of biological membranes and the transport of neutral and charged particles across membranes. The electrical properties of membranes are illustrated by the discussion of the resting and action potentials. The labs and seminars complement and illustrate the material covered on the lectures.

PLAN OF TOPICS OF LECTURES AND PRACTICAL CLASSES

Lectures II semester

№	Topic	Hours
1.	BASICS OF CYBERNETICS. FEEDBACK AND CONTROL. MODELLING BIOLOGICAL SYSTEMS.	2
2.	TYPES OF BIOLOGICAL MEMBRANES. MOLECULAR STRUCTURE OF BIOMEMBRANES. MECHANICAL PROPERTIES OF BIOMEMBRANES.	2
3.	PASSIVE TRANSPORT OF NEUTRAL PARTICLES AND IONS.	2
4.	ACTIVE TRANSPORT SYSTEMS.	2
5.	RESTING POTENTIAL OF BIOMEMBRANES.	2
6.	ACTION POTENTIAL OF EXCITABLE BIOMEMBRANES. PROPAGATION OF THE ACTION POTENTIAL.	2
7.	SURFACE ELECTRIC CHARGE OF CELLS. ELECTROPHORESIS. APPLICATIONS IN MEDICINE.	2
	Total	14

Practical classes II semester

№	Topic	Hours
1.	SUBJECT AND METHODS OF BIOPHYSICS. (SEMINAR)	2
2.	PHYSICAL MODELLING OF THE DIFFUSION PROCESS.	2
3.	IONOPHORETIC PERMEABILITY OF HUMAN SKIN.	2
4.	PERMEABILITY OF CELL MEMBRANES.	2
5.	PASSIVE TRANSPORT OF CHLORIDE IONS THROUGH AN ARTIFICIAL MEMBRANE.	2
6.	ACTION POTENTIAL OF EXCITABLE BIOMEMBRANES. PROPAGATION OF THE ACTION POTENTIAL. (SEMINAR)	2
7.	MODELLING OF TRANSIENT PROCESSES IN AXONS.	2
8.	MEASUREMENT OF THE ELECTROKINETIC POTENTIAL OF CELLS.	2
Total		16

MONITORING AND EVALUATION FORMS:

Student performance is formally evaluated at lab and seminar sessions by brief tests on the current lab topic, and written student reports about the results obtained.

Students who have completed the labs and seminars are admitted to the final examination which consists of written and oral parts.

The final mark consists of: labs and seminars (30%), written part of final exam (60%), and oral part of final exam (10%).

REFERENCES:

1. Lecture Notes available online at <http://elearn.mu-varna.bg/>
2. Leake Mark C, Single-molecule cellular biophysics, Cambridge University Press (www.cambridge.org/9781107005839), 2013
3. Russell K. Hobbie, Bradley J Roth, Intermediate Physics for Medicine and Biology, 5th Edition, Springer, 2015.
4. T.F.Weiss, Cellular Biophysics, v.1: Transport, v.2: Electrical Properties, The MIT Press, 1996.
5. R. Cotterill, Biophysics – An Introduction, Wiley, 2004.
6. R.K.Hobbie, Intermediate Physics for Medicine and Biology, Springer, 2007.
7. P.Davidovits, Physics in Biology and Medicine, Harcourt Academic Press, 2008.
8. <https://en.khanacademy.org/science/physics/>
9. <https://en.khanacademy.org/science/biology/>
10. <https://en.khanacademy.org/science/health-and-medicine/>
11. <https://en.khanacademy.org/science/computing/computer-science/>

Department's council protocol № 130 / 21.12.2021

PREPARED:



prof. Krastena Nikolova, PhD

HEAD OF DEPARTMENT – “PHYSICS AND BIOPHYSICS”



prof. Krastena Nikolova, PhD/

SYLLABUS FOR BIOPHYSICS
(FIRST YEAR STUDENTS OF DENTAL MEDICINE)

1. BASICS OF CYBERNETICS. FEEDBACK AND CONTROL.
MODELLING BIOLOGICAL SYSTEMS.
2. TYPES OF BIOLOGICAL MEMBRANES. THE MOLECULAR
STRUCTURE OF BIOMEMBRANES.
3. MECHANICAL PROPERTIES OF BIOMEMBRANES
4. PASSIVE TRANSPORT OF NEUTRAL PARTICLES. PASSIVE
TRANSPORT OF IONS
5. ACTIVE TRANSPORT SYSTEMS
6. RESTING POTENTIAL OF BIOMEMBRANES. ACTION POTENTIAL OF
EXCITABLE BIOMEMBRANES
7. PROPAGATION OF THE ACTION POTENTIAL
8. SURFACE ELECTRIC CHARGE OF CELLS. ELECTROPHORESIS AND
ITS APPLICATIONS IN MEDICINE.