MORPHOLOGY 2

FIRST YEAR OF STUDIES

year 2023/2024.

BIOPHYSICS

Course:

BIOPHYSICS

The course is evaluated with 3 ECTS. There are 2 hours of active classes per week (2 hours of lectures and 1 hour of work in a small group.)

TEACHERS AND ASSOCIATES:

No	Name and surname	Email address	Title
1.	Vladimir Jakovljevic	drvladakgbg@yahoo.com	full professor
2.	Gvozden Rosic	grosic@medf.kg.ac.rs	full professor
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11.	Valentina Opancina	valentina.opancina@gmail.com	assistant

COURSE STRUCTURE:

Module	**Title of the module**	**Weeks**	**Lectures weekly**	**Work in a small group weekly**	**Teacher-module manager**
1	Basics of biophysical laws of the organism, nuclear physics and radiological physics	5	6	3	Prof. dr Vladimir Zivkovic
					∑ 15+15=30

EVALUATION:

The student masters the coure by modules. The grade is equivalent to the number of points earned (see tables). Points are earned in two ways:

1. ACTIVITY DURING CLASSES: In this way, the student can earn up to 30 points, by answering 2 exam questions from that week of class, and in accordance with the demonstrated knowledge, earns 0-2 points.

2. FINAL EXAM: The final exam is organized as a final test. In this way, the student can earn up to 70 points, according to the attached table. The test consists of 35 questions. Each question is worth 2 points. If the student achieves 36 or more points on the test, the final exam has been passed.
A student has the right to take the final test if he has achieved more than 50% of the points provided for the activity.
Postponed passing of the final test (in subsequent exam periods) does not reduce the number of points used to define the final grade.

MODULE		MAXIMUM POINTS		
		activity during classes	**final test**	**Σ**
1	Basics of biophysical laws of the organism, nuclear physics and radiological physics	30	70	100
Σ		**30**	**70**	**100**

<u>The final grade is formed as follows:</u>

In order to pass the course, the student must obtain a minimum of 51 points.
To pass the course the student must:
1. acquires more than 50% of the points provided for the activity
2. pass the final exam, i.e. have more than 50% correct answers on the final test.

the number of earned points	**grade**
0 - 50	**5**
51 - 60	**6**
61 - 70	**7**
71 - 80	**8**
81 - 90	**9**
91 - 100	**10**

TESTS

FINAL TEST
0-70 POINTS

EVALUATION OF THE FINAL TEST

Test consists of 35 questions
Each question is worth 2 points

LITERATURE:

module	title of the textbook	authors	publisher	library
Basics of biophysical laws of the organism	Ganong's Review of Medical Physiology, first edition in Serbian.	Ganong William. Vladimir Jakovljevic editor.	Faculty of Medical Sciences, Kragujevac, 2015.	Yes
Basics of nuclear physics	Fundamentals of Nuclear Medicine, Second Edition.	Bosnjakovic V. Kostic K.	Faculty of Medicine, Belgrade, 1994.	Yes
	Nuclear medicine	A group of authors.	Faculty of Medicine, Belgrade, 2005.	Yes
Basics of radiological physics	Radiology, textbook for medical students.	Lazic J. Sobic V.	Medical book, 1997.	Yes
	Practicum of radiology.	Bosnjakovic P.	Medical book, 2011.	Yes

All lectures are available on the website of the Faculty of Medical Sciences: www.medf.kg.ac.rs

THE PROGRAM

MODULE: BASICS OF BIOPHYSICAL LAWS OF THE ORGANISM, NUCLEAR PHYSICS AND RADIOLOGICAL PHYSICS

TEACHING UNIT 1 (FIRST WEEK):

TRANSPORT THROUGH THE CELL MEMBRANE

lecture 2 hours	practice 1 hour
Physiological features of the cell membrane. Membrane permeability. Membrane transport proteins. Ion channels. Exocytosis. Endocytosis.	Osmosis.

TEACHING UNIT 2 (SECOND WEEK):

THE HUMAN ORGANISM AS A PHYSIOLOGICAL SOLUTION

lecture 2 hours	practice 1 hour
Body fluids. Distribution and composition of body fluids in different parts of the body. Membrane potentials.	Registration of membrane potentials.

TEACHING UNIT 3 (THIRD WEEK):

BIOMECHANICAL PROPERTIES OF THE LOCOMOTOR SYSTEM

lecture 2 hours	practice 1 hour
Biomechanical properties of the locomotor system.	Functional tests of the locomotor system.

TEACHING UNIT 4 (FOURTH WEEK):

BIOMECHANICAL PROPERTIES OF THE SKELETAL MUSCLES

lecture 2 hours	practice 1 hour
Functional characteristics of skeletal muscles. Types of muscle contractions. Energetic aspects of muscle contraction.	Functional tests of the sceletal muscles.

TEACHING UNIT 5 (FIFTH WEEK):

BIOMECHANICAL PROPERTIES OF THE CARDIOVASCULAR SYSTEM

lecture 2 hours	practice 1 hour
Physical principles of functioning of the cardiovascular system. The importance of natural laws for the analysis of the function of the cardiovascular system.	Functional tests of the cardiovascular system.

TEACHING UNIT 6 (SIXTH WEEK):

BASICS OF NUCLEAR PHYSICS 1

lecture 2 hours	practice 1 hour
Atom and nucleus structure. Conventional and quantum model of the atom. Atomic mass and nucleus size. Nuclear forces and bond energy. Stability of nuclides. Instability of nuclides. Radioactive nuclides. Radioactive decay: law and statistics. Radioactivity units. Physical half-life. Biological and effective half-life.	Basics of nuclear physics 1. Consolidation.

TEACHING UNIT 7 (SEVENTH WEEK):

BASICS OF NUCLEAR PHYSICS 2

lecture 2 hours	practice 1 hour
Types of radioactive decay. Alpha decay. Energy spectrum of alpha radiation, specific ionization, range and interactions of alpha particles with the material through which they pass. Beta decay. Electronic capture. Energy spectrum of beta radiation, range and interactions of beta particles with the material through which they pass. Gamma decay. Internal conversion. Characteristics of gamma radiation.	Basics of nuclear physics 2. Consolidation.

TEACHING UNIT 8 (EIGHT WEEK):

BASICS OF NUCLEAR PHYSICS 3

lecture 2 hours	practice 1 hour
Basic principles of interaction of gamma radiation with matter. Photoelectric effect, Compton scattering, pair creation, annihilation. X and γ rays: source and characteristics. Neutron radiation. Absorption and interaction of neutrons with matter. Radiation detection mechanism. Types of detectors.	Basics of nuclear physics 3. Consolidation.

TEACHING UNIT 9 (NINTH WEEK):

APPLICATION OF RADIOACTIVE ISOTOPES IN MEDICINE

lecture 2 hours	practice 1 hour
Nuclear reactions. Radioactive isotopes obtained by reactors. Radioactive nuclides produced by accelerators and cyclotrons. Radionuclide generators. Mo-Tc generator. Radionuclides obtained by nuclear fission as fission fragments. Nuclear fusion. Application of radioactive isotopes in medicine. Radioactive isotopes as markers. Radioactive dilution. Recording of radioactive isotope distribution (scintigraphy).	Application of radioactive isotopes in medicine. Consolidation.

TEACHING UNIT 10 (TENTH WEEK):

BIOPHYSICAL EFFECTS OF RADIATION. RADIATION PROTECTION

lecture 2 hours	practice 1 hour
Biological effects of ionizing radiation. Radiosensitivity and radioresistance. Mechanisms of cell damage. Stochastic and deterministic effects of radiation. Dose. Dosimeters. Radiation protection (professionally exposed personnel, patients, other persons). Nuclear accident.	Biophysical effects of radiation. Radiation protection. Consolidation.

TEACHING UNIT 11 (ELEVENTH WEEK):

X-RAY TUBE

lecture 2 hours	practice 1 hour
Principle of X-ray tube functioning. Types of x-ray tubes.	Introducting the technical characteristics of the X-ray tube. Quality and quantity of X-rays.

TEACHING UNIT 12 (TWELFTH WEEK):

X-RAY MACHINE

lecture 2 hours	practice 1 hour
Technical characteristics of the X-ray machine.	Introducting the basic parts of the X-ray machine.

TEACHING UNIT 13 (THIRTEENTH WEEK):

TYPES OF X-RAY MACHINES

lecture 2 hours	practice 1 hour
Types of x-ray machines depending on the purpose. Ro graphing machine. Mammogram. Ro apparatus for scopy and graphy.	Introducting the with basic types of X-ray machines.

TEACHING UNIT 14 (FOURTEENTH WEEK):

MULTIDETECTOR COMPUTERIZED TOMOGRAPHY

lecture 2 hours	practice 1 hour
Basic principles of tomography. Image formation on computerized multidetector tomography.	Introducting the basic types of multidetector computerized tomography machines (scanners).

TEACHING UNIT 15 (FIFTEENTH WEEK):

RADIOLOGICAL INFORMATION SYSTEM, IMAGE ARCHIVING SYSTEM-PAKS

lecture 2 hours	practice 1 hour
Radiological information system - PAKS.	Introducting the functioning of the radiological information system. Significance and application of PAKS.

WEEKLY COURSE SCHEDULE

COURSE	WEDNESDAY	THURSDAY	FRIDAY
BIOPHYSICS from 17.01. to 16.02. (2+1)	LECTURES **08:00 - 11:45** **14:10 - 14:55** (H44) **PRACTICE** **15:00 - 18:00** (H44)	**PRACTICE** **08:00 - 11:00** (H44)	**PRACTICE** **08:00 - 11:00** (H44)

LESSON SCHEDULE FOR THE COURSE OF BIOPHYSICS

week	type	title of method unit	teacher
11	**L**	Physiological features of the cell membrane. Membrane permeability. Membrane transport proteins. Ion channels. Exocytosis. Endocytosis.	Prof. dr Vladimir Jakovljevic
		Body fluids. Distribution and composition of body fluids in different parts of the body. Membrane potentials.	Prof. dr Gvozden Rosic
		Biomechanical properties of the locomotor system.	Prof. dr Vladimir Zivkovic
11	**P**	Osmosis.	Prof. dr Jasmina Sretenovic Ass. Marina Rankovic
		Registration of membrane potentials.	Prof. dr Jasmina Sretenovic Ass. Marina Rankovic
		Functional tests of the locomotor system.	Prof. dr Jasmina Sretenovic Ass. Marina Rankovic
12	**L**	Functional characteristics of skeletal muscles. Types of muscle contractions. Energetic aspects of muscle contraction.	Prof. dr Ivan Srejovic
		Physical principles of functioning of the cardiovascular system. The importance of natural laws for the analysis of the function of the cardiovascular system.	Prof. dr Gvozden Rosic
		Basics of nuclear physics 1.	Prof. dr Vladimir Vukomanovic
12	**P**	Functional tests of the sceletal muscles.	Prof. dr Jasmina Sretenović Ass. Marina Ranković
		Functional tests of the cardiovascular system.	Prof. dr Jasmina Sretenovic Ass. Marina Rankovic
		Basics of nuclear physics 1. Consolidation.	Prof. dr Vesna Ignjatovic Prof. dr Vladimir Vukomanovic
13	**L**	Basics of nuclear physics 2.	Prof. dr Vladimir Vukomanovic
		Basics of nuclear physics 3.	Prof. dr Vladimir Vukomanovic

LESSON SCHEDULE FOR THE COURSE OF BIOPHYSICS

week	type	title of method unit	teacher
		Application of radioactive isotopes in medicine.	Prof. dr Vesna Ignjatovic
13	**P**	Basics of nuclear physics 2. Consolidation.	Prof. dr Vesna Ignjatovic Prof. dr Vladimir Vukomanovic
		Basics of nuclear physics 3. Consolidation.	Prof. dr Vesna Ignjatovic Prof. dr Vladimir Vukomanovic
		Application of radioactive isotopes in medicine. Consolidation.	Prof. dr Vesna Ignjatovic Prof. dr Vladimir Vukomanovic
14	**L**	Biophysical effects of radiation. Radiation protection.	Prof. dr Vesna Ignjatovic
		X-ray tube.	Prof. dr Radisa Vojinovic
		X-ray machine.	Prof. dr Radisa Vojinovic
14	**P**	Biophysical effects of radiation. Radiation protection. Consolidation.	Prof. dr Vesna Ignjatovic Prof. dr Vladimir Vukomanovic
		Introducting the technical characteristics of the X-ray tube. Quality and quantity of X-rays.	Prof. dr Radida Vojinovic Ass. dr Valentina Opancina
		Introducting the basic parts of the X-ray machine.	Prof. dr Radida Vojinovic Ass. dr Valentina Opancina
15	**L**	Types of X-ray machines.	Prof. dr Radisa Vojinovic
		Multidetector computerized tomography.	Prof. dr Radisa Vojinovic
		Radiological information system, image archiving system-PAKS	Prof. dr Radisa Vojinovic
15	**P**	Introducting the with basic types of X-ray machines.	Prof. dr Radisa Vojinovic Ass. dr Valentina Opancina

LESSON SCHEDULE FOR THE COURSE OF BIOPHYSICS

week	type	title of method unit	teacher
		Introducting the basic types of multidetector computerized tomography machines (scanners).	Prof. dr Radisa Vojinovic Ass. dr Valentina Opancina
		Introducting the functioning of the radiological information system. Significance and application of PAKS.	Prof. dr Radisa Vojinovic Ass. dr Valentina Opancina
	E	**FINAL EXAM** (January-February term)	