MORPHOLOGY 2

FIRST YEAR OF STUDIES

year 2024/2025.

BIOPHYSICS

Course:

BIOPHYSICS

The course is evaluated with 3 ECTS. There are 3 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	Звање
1.	Radiša Vojinović	rhvojinovic@gmail.com	full professor
2.	Vladimir Vukomanović	vukomanovic@gmail.com	associate professor
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4.	Snežana Lukić	snezanamlukic@gmail.com	associate professor
5.	Vesna Ignjatović	vesnacokanovic@yahoo.com	assistant professor
6.	Valentina Opančina	valentina.opancina@gmail.com	assistant professor
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8.	Neda Milosavljević	neda.milosavljevic@yahoo.com	assistant professor
9.	Biljana Brkić Georgijevski	brkicbiljana15@yahoo.com	assistant professor
10.	Katarina Vuleta	kvuleta87@gmail.com	assistant
11.	Vladan Marković	drjack.vm@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 Vukomanović
					∑ 30+15=45

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 3 exam questions from that week of class (one for each lecture week), and in accordance with the demonstrated knowledge, earns 0-6 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.

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**

TEACHING CONSULTATIONS: Consultations can be scheduled with the head of the department, Assoc. Prof. Dr Vladimir Vukomanović, vukomanovic@gmail.com

The final grade is formed as follows:

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:

title of the textbook	authors	publisher	library
Diagnostic Radiology, Volume one and two	A.Adam, A.K. Dixon, Grainger&Allison's Churchill Livingstone Has	Churchill Livingstone	Has
The Radiology Handbook : A Pocket Guide to Medical Imaging	Benseler, J.S.	Athens, United States: Ohio University Press	Has
Fundamentals of Diagnostic Radiology, Fourth Edition	W.E. Brant, C.A. Helms	Wolters Kluwer Health / Lippincott Williams & Wilkins	Has
Nuclear Medicine: A Core Review. 2nd edition	Shah C, Bradshaw M, Dalal I.	Philadelphia: Wolters Kluver Lippincott Williams&Wilkins; 2021.	Has
Nuclear Medicine and Molecular Imaging: The Requisites.	O'Malley J, Ziessman H. 5th edition.	Elsevier Science; 2020.	Has
Nuclear Medicine Physics. 8th edition.	Chandra R, Rahmim A.	Philadelphia: Wolters Kluwer; 2018.	Has

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 NUCLEAR PHYSICS AND RADIOLOGICAL PHYSICS

TEACHING UNIT 1 (11th WEEK):

INTRODUSTION TO MEDICAL BIOPHYSICS

lecture 2 hours	practice 1 hour
Medical Biophysics for biological processes for development of methods and/or devices for clinical application in diagnosis and therapy. 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. Radioactivity units.	Basics of medical physics. Consolidatio

TEACHING UNIT 2 (11th WEEK):

BASICS OF NUCLEAR PHYSICS 1

lecture 2 hours	practice 1 hour
Radioactive decay: law and statistics. Types of radioactive decay. Alpha decay. Beta decay. Electronic capture. Gamma decay. Internal conversion. Characteristics of gamma radiation.	Basics of nuclear physics 1. Consolidation.

TEACHING UNIT 3 (11th WEEK):

BASICS OF NUCLEAR PHYSICS 2

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 2. Consolidation.

TEACHING UNIT 4 (12th WEEK):

RADIATION DETECTION AND MONITORING SYSTEMS

lecture 2 hours	practice 1 hour
Mechanism of detection of ionizing radiation. Gas detector. Ionization detector. Scintillation detector. Collimators and collimation. Gamma scintillation camera. Computer systems in medicine	Acquire knowledge about the basic principles of detector devices in medicine

TEACHING UNIT 5 (12th WEEK):

APPLICATION OF RADIOACTIVE ISOTOPES IN MEDICINE

lecture 2 hours	practice 1 hour
Nuclear reactions. Radioactive isotopes obtained by reactors, accelerators and cyclotrons. Radionuclide generators. Application of radioactive isotopes in medicine. Radioactive isotopes as markers. Recording of radioactive isotope distribution (scintigraphy).	Acquire knowledge about the radioactive isotopes in medicine. Consolidation.

TEACHING UNIT 6 (12th WEEK):

METHODS OF SPECTROSCOPY AND SPECTROMETRY

lecture 2 hours	practice 1 hour
In vitro diagnostics methods: transluminescence, UV luminescence and others. Basic principles of RIA. Alternatives to radioimmunology and analysis (FIA, IFMA, EIA, LIA...) Measuring devices in In vitro diagnostics (Gamma counter with pitted crystal. Fluorometer. Luminometer). Quality control of measuring devices	Acquire knowledge wide array of techniques, and highly specialized equipment

TEACHING UNIT 7 (13th WEEK):

PRINCIPLES OF WORK OF RADIOLOGY MACHINES. X RAY TUBE

lecture 2 hours	practice 1 hour
Basic principles of physics in radiology, diagnostic devices used in radiology. X-ray tube, origin and spectrum of X-radiation; interaction of X-ray photons with biological tissues. Principle of X-ray tube operation.	Acquire knowledge about diagnostic devices used in radiology. Introducting the technical characteristics of the X-ray tube.

TEACHING UNIT 8 (13th WEEK):

X-RAY DEVICE. TYPES OF X-RAY DEVICES

lecture 2 hours	practice 1 hour
Technical characteristics of the X-ray machine. Application of radiological methods in medicine - establishing a diagnosis, planning therapeutic procedures and monitoring the development of the disease. Types of x-ray machines depending on the purpose.	Acquire knowledge about the basic parts of the X-ray machine and the basic types of X-ray machines

TEACHING UNIT 9 (13th WEEK):

BASIC PRINCIPLES OF ULTRASOUND

lecture 2 hours	practice 1 hour
Physics of ultrasound diagnostics, echogram resolution	Acquire knowledge about the basic principles of ultrasound diagnostics

TEACHING UNIT 10 (14th WEEK):

MULTIDETECTOR COMPUTERIZED TOMOGRAPHY

lecture 2 hours	practice 1 hour
Basic principles of tomography. Creation of a computerized image multidetector tomography.	Acquire knowledge about the basic types of multidetector computerized devices for tomography

TEACHING UNIT 11 (14th WEEK):

MAGNETIC RESONANCE IN MEDICINE

lecture 2 hours	practice 1 hour
Basic principles of magnetic resonance in medicine, basics of spectroscopy.	Acquire knowledge about the Basic principles of magnetic resonance in medicine, basics of spectroscopy.

TEACHING UNIT 12 (14th WEEK):

RADIOLOGICAL INFORMATION SYSTEM RIS, IMAGE ARCHIVING SYSTEM-PACS

lecture 2 hours	practice 1 hour
A radiological information system (RIS). Picture archiving and communication system (PACS)	Acquire knowledge about the RIS and PACS systems.

TEACHING UNIT 13 (15th WEEK):

THE PHYSICAL BASIS OF RADIATION THERAPY

lecture 2 hours	practice 1 hour
Dosimetric principles, sizes and units. Radiotherapy devices with external beams - teletherapy devices. Passage of the photon beam through the medium, brachytherapy.	The physical basis of radiation therapy. Consolidation.

TEACHING UNIT 14 (15th WEEK):

RADIATION BIOLOGY

lecture 2 hours	practice 1 hour
A Natural sources of radiation; artificial radiation sources; DNA damage caused by ionizing radiation; types of ionizing radiation; effects of radiation on the human population; cell survival curves clinical; radiobiology.	Radiation biology. Consolidation.

TEACHING UNIT 15 (15th 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. Radiation protection (professionally exposed personnel, patients, other persons).	Biological effects of ionizing radiation. Consolidation.

WEEKLY COURSE SCHEDULE

COURSE	WEDNESDAY	THURSDAY	FRIDAY
BIOPHYSICS from 06.11. to 06.12. (2+1)	**LECTURES** **13:00 – 16:00** (H3)	**PRACTICE** **08:00 - 11:00** (H44)	**PRACTICE** **08:00 - 12:55** Dissection room 2 (R8)

LESSON SCHEDULE FOR THE COURSE OF BIOPHYSICS

week	type	title of method unit	teacher
11	**L**	Introdustion to medical biophysics	Prof. Dr Vladimir Vukomanović
		Basics of nuclear physics 1	Prof. Dr Vladimir Vukomanović
		Basics of nuclear physics 2	Prof. Dr Vladimir Vukomanović
11	**P**	Introdustion to medical biophysics. Consolidation	Prof. Dr Vladimir Vukomanović Dr Katarina Vuleta Nedić
		Basics of nuclear physics 1. Consolidation	Prof. Dr Vladimir Vukomanović Dr Katarina Vuleta Nedić
		Basics of nuclear physics 2. Consolidation	Prof. Dr Vladimir Vukomanović Dr Katarina Vuleta Nedić
12	**L**	Radiation detection and monitoring systems.	Prof. dr Vesna Ignjatovic
		Application of radioactive isotopes in medicine	Prof. dr Vesna Ignjatovic
		Methods of spectroscopy and spectrometry Consolidation	Prof. dr Vesna Ignjatovic
12	**P**	Radiation detection and monitoring systems. Consolidation	Prof. dr Vesna Ignjatovic Dr Katarina Vuleta Nedić
		Application of radioactive isotopes in medicine. Consolidation	Prof. dr Vesna Ignjatovic Dr Katarina Vuleta Nedić
		Methods of spectroscopy and spectrometry	Prof. dr Vesna Ignjatovic Dr Katarina Vuleta Nedić
13	**L**	Principles of work of radiology machines. x ray tube	Prof. dr Valentina Opančina
		X-ray device. types of x-ray devices	Prof. dr Valentina Opančina

LESSON SCHEDULE FOR THE COURSE OF BIOPHYSICS

week	type	title of method unit	teacher
		Basic principles of ultrasound	Prof. dr Valentina Opančina
13	**P**	Principles of work of radiology machines. x ray tube. Consolidation	Prof. dr Valentina Opančina
		X-ray device. types of x-ray devices. Consolidation	Prof. dr Valentina Opančina Dr Vladan Marković
		Basic principles of ultrasound. Consolidation	Prof. dr Valentina Opančina Dr Vladan Marković
14	**L**	Multidetector computerized tomography.	Prof. dr Radiša Vojinović Dr Vladan Marković
		Magnetic resonance in medicine	Prof dr Biljana Brkić Georgijevski
		Radiological information system, image archiving system-PACS	Prof. dr Valentina Opančina
14	**P**	Multidetector computerized tomography. Consolidation	Prof. dr Radiša Vojinović Dr Vladan Marković
		Magnetic resonance in medicine. Consolidation	Prof dr Biljana Brkić Georgijevski Dr Vladan Marković
		Radiological information system, image archiving system-PACS. Consolidation	Prof. dr Valentina Opančina Dr Vladan Marković
15	**L**	The physical basis of radiation therapy	Prof. dr Marija Živković Radojević
		Radiation biology	Prof. dr Neda Milosavljević
		Biophysical effects of radiation. Radiation protection	Prof. dr Marija Živković Radojević Prof. dr Neda Milosavljević
15	**P**	The physical basis of radiation therapy. Consolidation	Prof. dr Marija Živković Radojević Prof. dr Neda Milosavljević

LESSON SCHEDULE FOR THE COURSE OF BIOPHYSICS

week	type	title of method unit	teacher
		Radiation biology. Consolidation	Prof. dr Marija Živković Radojević Prof. dr Neda Milosavljević
		Biophysical effects of radiation. Radiation protection. Consolidation	Prof. dr Marija Živković Radojević Prof. dr Neda Milosavljević
	E	**FINAL EXAM** (January-February term)	